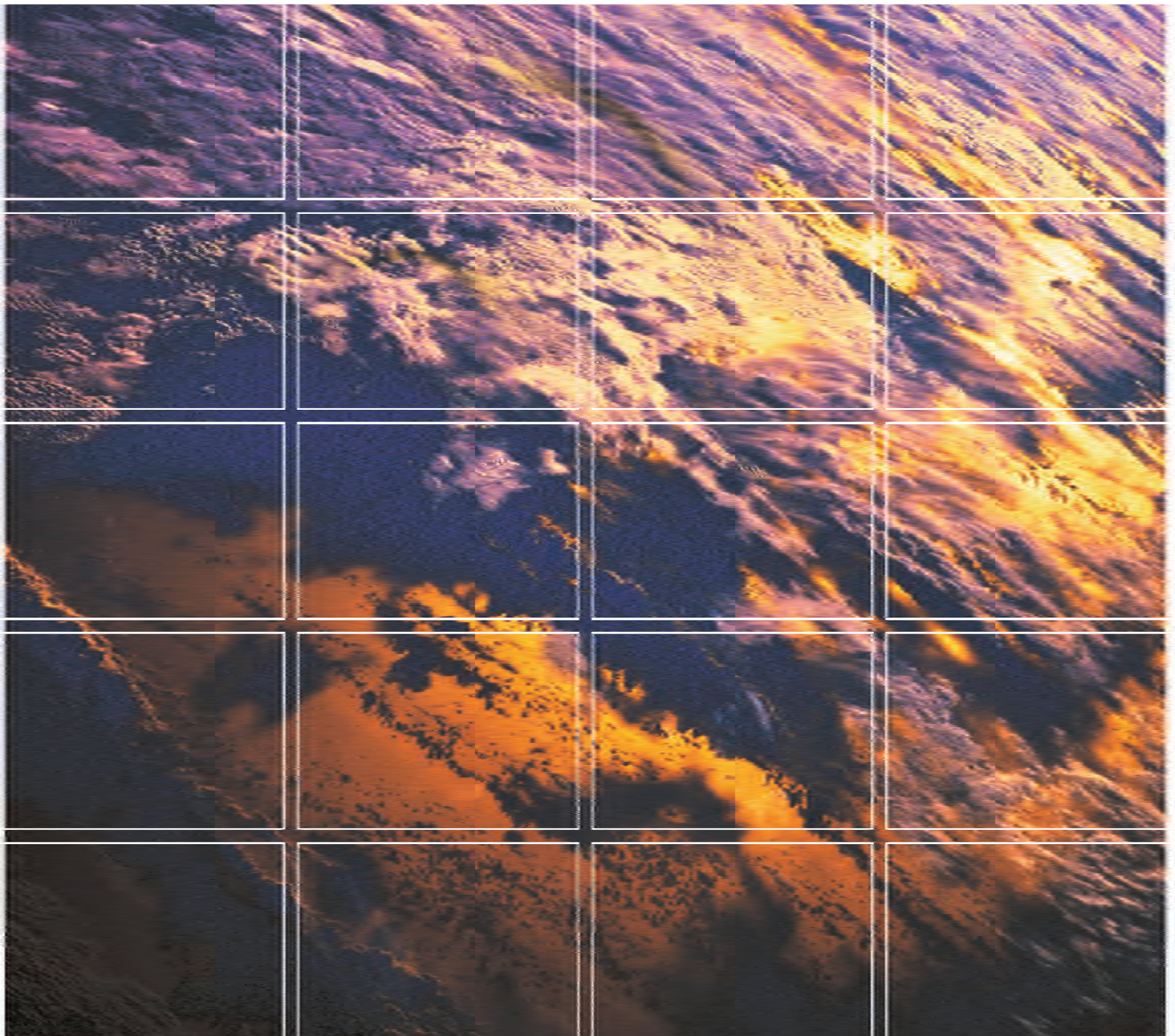


Appendix E

**Environmental Assessment for NNP1  
Access Road from Ban Nonsomboun to  
the Main Dam**

*(Originally Prepared by ERIC and Amended  
by ERM)*



# Nam Ngiep 1 Hydropower Project

**Environmental Assessment (EA) for NNP1  
Access Road from Ban Nonsomboun to the  
Main Dam**

NAM NGIEP 1 POWER COMPANY LIMITED

May 2014

0210549

[www.erm.com](http://www.erm.com)



NAM NGIEP 1 POWER COMPANY LIMITED

## Environmental Assessment (EA) for NNP1 Access Road from Ban Nonsomboun to the Main Dam

Prepared by Environmental Research Institute,  
Chulalongkorn University (ERIC,  
March 2012)

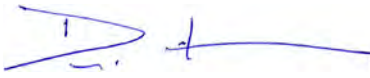
Updated by ERM-Siam Co., Ltd. (May 2014)

Reference 0210549

For and on behalf of  
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## **EXECUTIVE SUMMARY**

*The Nam Ngiep 1 Hydropower Project (NNP1) is the construction of a hydropower dam and other main elements developed by the Nam Ngiep 1 Power Company (NNP1PC). NNP1 is situated on the Nam Ngiep River which is on a left bank tributary of the Mekong River. NNP1PC plans to construct a 148m high concrete gravity dam on the Nam Ngiep River, serving as a main power station of 272 MW and annual power generation of 1,546 GWh at the substation. Once in operation, the main dam will utilize 66.9km<sup>2</sup> of reservoir area, covering parts of Xiang Khouang and Vientiane Provinces. An effective storage of 1,192 million m<sup>3</sup> from the reservoir is designed to drop around 130m to a power station downstream from the main dam.*

*NNP1 will be funded predominantly by the private sector. The owners of Nam Ngiep Power Co. Ltd. include The Kansai Electric Power Co. Inc. (Kansai Electric) from Japan, EGAT International Co. Ltd. (EGATi) from Thailand, and Lao Holding State Enterprise (LHSE) from the Lao PDR.*

*The purpose of the access road project is to allow for the transport of construction materials and equipment from outside the Nam Ngiep 1 Hydropower Project to support the construction of NNP1. The existing roads from Ban Nomsomboun to the Dam Site are dirt roads prone to flooding with pot holes, eroded areas and standing water. Currently, these roads are not suitable to support project activities. To facilitate safe and efficient transport during construction of NNP1 and avoid further deterioration of the existing roads it is proposed to upgrade the existing road surfaces as well as construct new roads.*

*The proposed roadworks extend from Ban Nomsomboun to the Dam Site; with a total length of 58.42km . Road works include the following components:*

- An existing road from Ban Nonsomboun to Ban Hat Gniun to be upgraded (21.2km);*
- JICA road: an existing road from Ban Hat Gniun to Dam Site to be upgraded (9.25km);*
- P1 and P2: permanent roads from Ban Hat Gniun to Dam site to be constructed (11.16km);*
- Temporary Roads: a network of temporary roads (numbered T1 to T13) from Ban Hat Gniun to the Dam Site to be constructed (16.81km);*
- Bridges and culverts, at four locations; and*
- Associated infrastructure including a worker's camp, batching plants and quarries.*

*Temporary roads and associated infrastructure will be removed and rehabilitated following completion of construction of NNP1.*



*This Environmental Assessment (EA) is updated and revised by ERM-Siam to reflect comments provided by the Asian Development Bank (ADB) on November 2013 regarding the original EA developed by the Environmental Research Institute, Chulalongkorn University (ERIC) in 2008. This updated EA aims to provide an initial examination of the potential environmental impacts of the Project's conceptual designs based on a review of the most recently available data to illustrate the current conditions along the access road. This updated EA also provides a series of management and mitigations measures to be implemented.*

*The content of the EA is laid out according to the ADB's Safeguard Policy Statement (June 2009) (SPS) format and provides the updated information for each chapter. To ensure accuracy and comprehensiveness of the updated EA, the following steps were implemented as part of the EA methodology.*

- *Desktop data collection and review: secondary data sources were identified and reviewed to allow collation of relevant information on the Project details and provide current environmental and social conditions in the Project area. The data sources included recently produced or revised reports such as the Biodiversity Studies, Resettlement and Ethics Development Plan, Social Development Plan, Social Impact Assessment as well as Consultation meeting minutes.*
- *Field surveys: field surveys for both social and biodiversity studies were carried out to observe road conditions in the Project area and to collect baseline data for the key issues identified, including social data and land use patterns.*

*The EA consists of nine main chapters. The following paragraphs briefly highlight the main content of each chapter:*

### *1. Introduction*

*The development of the EA takes into account applicable Lao environmental laws, GOL guidelines as well as international standards and conventions, including: the ADB SPS (June 2009); the Equator Principles III (June 2013); and the Convention on Biological Diversity.*

### *2. Description of the Project*

*The access road project consists of four main activities including (1) upgrading road conditions from Ban Nonsomboun to Ban Hat Gniun and JICA, (2) construction of permanent road (3) construction of temporary road and (4) construction and operation of ancillary infrastructure. Details of the access road types and proposed road designs are disclosed in this chapter.*

### *3. Description of the Environment (Baseline Data)*

*This chapter describes the existing environmental context in terms of physical resources, biological resources, and social and cultural resources. The proposed road passes through both natural and modified habitat areas including the Huay Ngua Provincial Preserved Area (PPA). Results of desktop and field survey identified an estimated 19 IUCN-listed (critically endangered, endangered or*

vulnerable) fauna species and 12 flora species that have been reported within proposed corridor. A survey of the road corridor identified 29 individual *Dipterocarpus alatus* stems within the disturbance area. Consultation with species specialists to determine if critical habitat for these and other species with the potential to occur within the road corridor, was undertaken and is summarised in this chapter.

#### 4. Anticipated Environmental Impacts and Mitigation Measures

Under this chapter, anticipated impacts as a result of the proposed road upgrade and construction is identified along with specific mitigation measures for each impact. Identified impacts include physical, biological, social and cultural resources. These potential impacts are further categorized according to construction stage, operational stage, bridge construction and temporary infrastructure.

#### 5. Analysis of Alternatives

As for the analysis of alternatives, after consideration and planning, the Project proposes to undertake activities in 1) road to construction area (Ban Nonsomboun – Ban Hat Gniun) and 2) road within construction area (Ban Hat Gniun – Dam Site). The road from Ban Nonsomboun will be upgraded while the road from Ban Hat Gniun to Dam site will be upgraded and constructed.

#### 6. Information Disclosure Consultation and Participation

A consultation meeting was held with affected people (residents along access roads) on 9<sup>th</sup> April 2013. Participants' concerns were responded to and clearly documented. These concerns were also considered during the assessment of potential impacts and the formulation of the mitigation measures. The affected people's main concerns relate to environmental issues, road safety and resettlement process.

#### 7. Grievance Redress Mechanism

For NNP1, the Grievance Redress Mechanism is a working committee consisting of representatives from provincial authorities, district authorities, village headman, project affected people, mass organization, non-profit organizations and from the NNP1PC. Village Grievance Committee will be established in each village.

#### 8. Environmental Management Plan

The chapter provides a preliminary Environmental Management Plan (EMP) and is described in terms of institutional framework, environmental mitigation measures and monitoring program. The EMP has been developed to manage and minimize the negative impacts of access road construction while enhance the positive impacts.

#### 9. Indicative Budget for Implementation

*The budget provided in Chapter 9 covers the implementation of, and compliance with, NNP1PC's environmental obligations for Access Road construction and operation. The budget is estimated to be \$457,000.*

#### *10. Conclusion and Recommendation*

*This final chapter concludes that the Project is likely to generate positive impact in economic terms in that the new access road will enable the villagers to engage in trading and facilitate movement of goods with safer roads. The Project is also likely to generate negative impacts related to biodiversity and water quality. These impacts can be managed through the implementation of a series of management and mitigation measures as defined in this and other documents, however some residual impacts will remain which will need to be offset.*

*Understanding that construction is planned to commence in areas of modified habitat outside of the PPA, ground-truthing has been undertaken to confirm the locations of natural habitat within the proposed road corridor, where further approvals will be required prior to commencing works.*

*This EA is developed based on current road alignment as outlined within the updated EA. It is critical to note that in the case of adjustments or changes to the road alignment outside defined Project boundaries or any changes in construction method, additional assessments and studies in should be undertaken to assess any additional potential impacts. Environmental best practices should also be continually applied to maintain efficient environmental management.*



## **INTRODUCTION**

The Nam Ngiep 1 Power Company Limited (NNP1PC) is assisted and consulted by Asian Development Bank (ADB) to develop the Nam Ngiep 1 Hydropower Project (NNP1). One of the NNP1 tasks is to provide a safe access road network by upgrading the existing rural roads as well as construction of new roads. The access road construction work provides several benefits in term of convenient access, reduced travel time and easy transportation facilities for both NNP1 and local villages nearby.

The original EA for the Nam Ngiep1 Access Road Improvement Project in Lao PDR, was carried out between October 2008 and November 2008 by the Environmental Research Institute, Chulalongkorn University (ERIC). It was done concurrently with the Resettlement Action Plan (RAP), undertaken by the same specialist.

Due to amendments in the design and construction, the EA was modified in August 2013 by ERM-Siam to reflect new conditions. The EA was further revised in late 2013 to incorporate additional and up to date information, particularly regarding biodiversity, and to respond to comments provided by the ADB.

The scope of the Project is the improvement and construction of the access road between Ban Nonsomboun to Ban Hat Gniun, and Ban Han Gniun to the dam site, and associated facilities.

Information and data used in this EA are based on site visits; meetings with local representatives from provincial, district and village people's committees and review of available documentation, including district master plans for the urban areas through which the Project road passes. The updated EA also considers regulations and current baseline data available for the project; and the analysis of recent maps, dwelling units, survey data and inputs provided by the NNP1PC engineering team.

### **1.1**

#### **PURPOSE OF THE STUDY**

The Laos PDR Government Department of Electricity (DOE) requires official approval by the Science Technology and Environment Agency (STEA) (which has recently been renamed to the Water Resources and Environment Agency or WREA) of an environmental assessment (EA) statement for electricity development projects to proceed. As designated in the 1999 environmental protection law known as National Law 02/99, WREA is in charge of the overall coordination and monitoring of local and national environmental affairs and reports directly to the Prime Minister's Office (PMO) of the Lao PDR.

The EA statement must consist of the proposed Project's environmental effects on the physical, biological, socio-economic and cultural environments, as well as measures to prevent or mitigate any adverse environmental effects that are expected from the design, construction, operation and closure of the Project. According to DOE's regulations as declared in 2001, an investor in a power generation project must apply for the permits to build the hydropower plant before starting any of its activities that may cause impacts to the environment.

Investigation of the access road to the main dam and the re-regulation dam has been designed with sufficient concern for environmental issues. While most previous hydropower projects that consisted of dams and reservoirs were required to carry out an environmental impact assessment (EIA), their associated access roads were generally considered separately for an EA. Thus, depending on the anticipated environmental impacts, access road improvement could require either an EA or an EIA. However, given their scope, most access road projects required only the EA.

This EA report aims to provide a preliminary assessment of the potential impacts of the Project's conceptual designs on the existing environmental components and to provide suitable mitigations measures to offset any potential adverse impacts. In order to fulfil the main tasks of the EA, the following objectives were defined:

- To identify and describe the main environmental and social resources of the areas in and adjacent to the proposed access road (and upgrade of existing roads);
- To identify the nature of any adverse impacts that could occur from the development of the access road, in the absence of environmental protection measures. Adverse impacts were considered for both the construction and the operational phases of the access road (incorporating both new roads and upgrade of existing roads);
- To make an initial examination of the magnitude, scale, and significance of these potential adverse impacts; and
- To recommend mitigation measures required to avoid and/or minimize such adverse impacts.

## 1.2

### *APPROACH*

The study consists of activities recommended in the Environmental Management Standards issued by the DOE. It consists of four main components:

- A description of the existing environment in the Project area. This involves review of exiting baseline environmental data available associated with the proposed alignment. Particular focus is given to the data and description of baseline conditions that are important to the prediction of impacts and to the determination of measures to avoid and/or minimize anticipated adverse impacts.
- An evaluation of impact levels and feasible mitigation measures. This study used standards methods that follow acceptable EIA procedures for the preliminary evaluation of impact levels for each environmental aspect. Where impacts were quantifiable or had the potential to be observable, measures to prevent or minimize such impacts were identified.
- Preparation for the public involvement process. This study involved a series of meetings with the public and relevant authorities in the Project area to disseminate information about the Project and to receive comments and suggestions on issues of concern as well as suggestions for mitigation measures.
- Preparation and presentation of the EA report. This updated EA report complies with the requirements of environmental management standards issued by the DOE, Lao PDR.

### 1.3 KEY TERMS

Key terms used in this report are provided in *Table 1.1*.

**Table 1.1** *Key terms used in document*

Term	Meaning
NNP1	The NNP1 Hydropower Project
the Project	The Access Road Project, including ancillary infrastructure, as described in <i>Section 2</i> of this report.

### 1.4 STRUCTURE OF THIS REPORT

This report is structured in eleven chapters:

- *Chapter 1* provides an introduction to this document and the Project, including the purpose of this document, approach to the study and the legal and administrative framework governing the Project;
- *Chapter 2* describes the Project, and it is this description that forms the bases of the impact identification;
- *Chapter 3* describes the environmental baseline, including physical, biological and social resources;

- *Chapter 4* identifies potential impacts of the Project during the construction, operation and rehabilitation phases, and outlines measures to mitigate these impacts;
- *Chapter 5* outlines the alternative Project scenarios that have been considered, and the relative environmental and social impacts of these scenarios;
- *Chapter 6* described the information disclosure and consultation process undertaken and planned;
- *Chapter 7* outlines the grievance redress mechanism for the Project;
- *Chapter 8* provides an Environmental Management Plan (EMP) to address the identified impacts;
- *Chapter 9* provides an indicative budget for the implementation of the EMP; and
- *Chapter 10* provides a conclusion and general recommendations.

## 1.5

### ***LEGAL AND ADMINISTRATIVE FRAMEWORK FOR ENVIRONMENTAL AND SOCIAL PROTECTION IN LAO PDR***

One of the main principles of the Nam Ngiep 1 Hydropower Project (NNP1) is to ensure that the Project conforms to the environmental and social statutes and policies of the GOL, and relevant local government standards. This EA has been prepared in conformance with these statutes, policies, directives and procedures.

The Project is also to conform to international treaties to which the Lao PDR is signatory, to standards and safeguard policies of the Asian Development Bank (ADB), and to the Equator Principles. Where there is overlap in GOL and international standards, the most stringent standard will be used. In the case that a less stringent standard is used, justification will be provided within this document or other relevant documents.

### 1.5.1

#### ***National Laws and Decrees***

The key laws and decrees relevant to environment assessment and protection issues for NNP1 are:

- The Law on Environmental Protection (1999);
- The Law on Water and Water Resources (1996);
- The Law on National Heritage (2005);
- The Forestry Law (2007);

- The Wildlife and Aquatic Law (2007);
- The Land Law (2003);
- The Electricity Law (2008);
- The Road Law (1999);
- The Decree on Environmental Impact Assessment (2010);
- The Decree on State Land Lease or Concession (2009);
- The Decree on Compensation and Resettlement of People Affected by Development Projects (2006);
- The Technical Guidelines on Compensation and Resettlement of People Affected by Development Projects;
- The Regulation on EIA for Road Projects (2004); and
- The Decree on the Environmental Protection Fund.

*Environmental Protection Law (1999)*

The Environmental Protection Law (National Law 02/99) (EPL) was approved by the President on April 3, 1999. This law provides a legal framework for environmental management of development projects. It establishes the framework for unified environmental management with the aim of preserving the environment and making rational and sustainable use of natural resources. The sustainable use of natural resources is to contribute to the national socio-economic development and to the guaranteed health and improved quality of life of the people of Lao PDR. The Ministry of Natural Resources and the Environment (MONRE), previously the Water Resources and the Environment Administration (WREA), which was formerly the Science Technology and Environment Agency (STEA), is responsible for the implementation of EPL. While other ministries issue guidelines for implementing provisions of the EIA and of environmental protection, it is MONRE that is responsible for review of the EIA and that will issue the environmental compliance certificate.

Governmental Decrees, Regulations, and Standards relevant to the EPL are:

- The Implementing Decree of 2002, which provides the legal tool for implementation of the law, and
- The Environmental Management Standard of 2001, which stipulates the minimum environmental standards to develop a project.

WREA (now MONRE) has also developed a set of regulations for conducting the EIA of proposed hydropower projects (2000 and 2001). These regulations and standards establish general impact assessment requirements, including a timing of the EIA in the Project development cycle. They stipulate detailed project screening, Environmental Assessment and Environmental Impact Assessment requirements, including content and format of reporting, and approval of the report.

*Law on Water and Water Resources (1996)*

The Law on Water and Water Resources (1996) is intended to assure sustainable water use through policies related to ownership, preservation, use and management of water and water resources. It establishes a basis for classifying water according to use, defining catchments, and setting requirements for EIA for any 'large scale uses', inclusive of construction of water reservoirs for the purpose of irrigation, consumption, and energy production. In this respect the law mandates the requirement for the current EAMP work and should necessitate a review of the Environmental Assessment and Management Plan (EAMP) among the appropriate groups within GOL. The Water Resources Committee under the Prime Minister's Office administers the Water Law and is responsible for the review and evaluation of EIAs related to use of water resources.

*Law on National Heritage (2005)*

The Law on National Heritage (2005) defines national heritage as items produced by mankind or formed by nature to have outstanding cultural, historical or natural value, thereby becoming precious assets of the Lao national community. The term 'items' includes sites, ideas, practices and objects.

The law identifies the principles, regulations and measures for the administrations, use, protection, conservation, restoration and rehabilitation of national heritage and also determines the rights and duties of the State, social organisations and individuals to preserving these values.

*Amended Lao Forestry Law (No.06/NA-DEC.2007)*

The Amended Forestry Law, No 06/NA (Dec. 2007) stipulates the basic principles, regulations and measures concerning forest conservation, management, and use. It aims to make the forests and forestland a stable source of livelihood and use for the people, by ensuring sustainable preservation of water sources, preventing of soil erosion and maintaining soil quality, conserving plant and tree species and wildlife species, preserving the environment, and contributing to national socio-economic development.

The Amended Forestry Law (2007) confirms that natural forests and forestlands are the property of the national community and that these are centrally managed by the State. The State can grant individuals or

organizations the right to plant and own trees. Forests are classified into three general categories: Protection Forest, Conservation Forest (or National Biodiversity Conservation Areas), and Production Forest. Each category of forest is designated a different and distinct zone and area, within which there can be rich or dense forest, degraded forest, bare forestland and village use forest according to each zoning plan.

Conversion of public forestland to another land use type is only possible when allowed if it is to bring maximum benefits to the nation and to the wellbeing of people and is included in the national socio-economic development plan. Such conversion is only allowed in designated areas. Entities given approval for forestland conversion are responsible for paying fees for technical service, royalties and conversion fees. For temporary conversion such as mining exploitation and other production activities, the land must be restored and trees must be replanted. If the State converts the forestland, which is allocated to individuals or organizations for agreed upon and determined purposes, the State shall compensate according to laws and regulations. For permanent forestland conversion into another land use type for long-term purposes, such as for roads or hydropower construction, the State owns the timber and forest resources that are cut or harvested in those forests or forestlands.

The law stipulates which administrative authorities have the right to approve conversion of degraded forestland that cannot naturally regenerate or of barren forestland. While district, municipal, or provincial authorities can approve conversion of smaller areas of forestland, the conversion of more than 100 ha to 1,000 ha of degraded forestland per activity and of more than 200 ha to 10,000 ha of barren forestland per activity must be approved by the government, through proposals by the National Land Management Authority and agreement by the Ministry of Agriculture and Forestry and the Provincial Agriculture and Forestry Office. The National Assembly Standing Committee must endorse the conversion of forestland greater than those amounts (1,000 ha of degraded forestland or 10,000 ha of barren forestland).

*Wildlife and Aquatic Law, No 07/NA (2007)*

The Wildlife and Aquatic Law regulates the management, monitoring, conservation, and protection of wildlife and aquatic species in their natural habitats. Wildlife and aquatic species living within the territory of the Lao PDR are considered property of the national community, with the State representing the national community in managing those species. If an individual or organization has permission to raise and reproduce any of these species, it is then considered their own property so long as they abide by the laws and regulations.

Wildlife includes both terrestrial and aquatic life, and all forms of animal life, whether mammals, birds, reptiles, amphibians, or insects. Wildlife is classified into three categories for protection: 1) prohibition, 2) management, and 3) common or general. Whether any species are classified as prohibition or

management depends upon the level of threat to them (endangered, threatened, rare), the condition of their habitat, and the condition of their regeneration and reproduction. The Ministry of Agriculture and Forestry recommends to the government for consideration and approval the list of species under the prohibition and management categories. The Ministry of Agriculture and Forestry has authority to include or remove species itself from the list of animals in the common or general category.

#### *Land Law (2003)*

The land law was enacted on October 23, 2003. The law determines the management, protection and use of land to ensure its efficient use and to conform with land-use objectives, with other laws and regulations, to contribute to national socio-economic development, and to contribute to the protection of the environment.

#### *Electricity Law (2008)*

The Electricity Law No 03/NA dated 8 Dec 2008, requires a license for the generation and transmission of electricity. The Law also requires that:

- EIAs be prepared for at least the larger hydroelectric dams, along with budget estimates for environmental mitigation measures;
- Transmission lines and related activities are done in such a way as to limit any damages to natural environment and people's property; and
- The concessionaire is required to pay compensation for damages to the environment and to the lives and property of people, if any resettlement or other movement of people is required.

#### *Road Law (1999)*

The Road Law (1999) requires that the environment be protected during road construction and related activities and in the maintenance of roads, and that the national as well as the provincial levels of the Ministry of Communication, Transport, Post and Construction (MCTPC) have duties to protect the environment in relation to roads.

#### *Labour Law (2006)*

The Labour Law (2006) sets out the employment standards and conditions that must be met, including the rights afforded to workers and employers. This includes a requirement to contribute to the development of a skills base in Loa PDR.



*Prime Ministerial Decree No. 112/PM on Environmental Impact Assessment (2010)*

The 2010 Prime Ministerial Decree No. 112/PM established the procedures and guidelines for conducting Environmental Impact Assessments in Lao PDR. It stipulates the rights of those affected by projects, including their rights of participation. The decree outlines the process, both for WREA (now MONRE) and the developer of projects, of conducting the EIA, preparing environmental management and monitoring plans, social management and monitoring plans, issuing environmental compliance certificates, monitoring compliance with the various plans, and establishing the institutional framework for implementing the EIA of the Nam Ngiep 1 Hydropower environmental and social components of projects, and for hearing and deciding on grievances of affected parties.

*Decree on State Land Lease or Concession (2009)*

The Decree on State Land Lease or Concession, dated May 25, 2009, establishes the principles, procedures and measures for the leasing or providing concessions of land, for purposes of development for agriculture, industry, tourism, and other activities.

Among the obligations of those leasing or obtaining a concession are that they should not cause damages to the land quality, nor cause negative impacts to the environment or society.

*Decree on Compensation and Resettlement Of People Affected by Development Projects (2006)*

The Decree on Compensation and Resettlement of People Affected by Development Projects defines the principles, rules, and measures to mitigate adverse social impacts and to compensate for damages that may result from involuntary acquisition or repossession of land and of fixed or movable assets, including changes in land use and restrictions to access of community or natural resources, which would affect sources of community livelihood and income. This decree aims to ensure that people affected by a project are compensated fairly and are assisted in ways to improve or maintain their pre-project incomes and living standards, so that they are not worse off than they would have been without the Project.

*Technical Guidelines on Compensation and Resettlement Of People Affected By Development Project (2005)*

Pursuant to Prime Ministerial Decree No. 112/PM, GOL endorsed the Technical Guidelines on Compensation and Resettlement of People Affected by Development Projects, first issued in November 2005. These guidelines were initially adopted under the Decree on Compensation and Resettlement of People Affected by Development Projects in 2006, and have now been endorsed and promulgated as official GOL policy and procedure for the

assessment, planning, and mitigation of environmental as well as social impacts from development projects.

These guidelines include detailed procedures for the conduct of public consultation and other participatory processes, to inform affected people of the environmental and social impacts, and to assure their involvement in all aspects of the mitigation and compensation process, from planning to implementation.

*Regulation on EIA of Road Project In Lao PDR (2004)*

This regulation clarifies the principles and methodologies for environmental impact assessment of road projects, including setting out necessary and appropriate mitigation measures to avoid or reduce negative environmental impacts on the natural environment and society resulting from the implementation of road projects in the Lao PDR.

*Decree on the Environmental Protection Fund (2005)*

This Decree defines the principles, rules and procedures for the organization and operation of the Environmental Protection Fund (EPF). The fund is to finance eligible activities that can strengthen environmental protection, sustainable natural resources management, and specifically, biodiversity conservation and community development in Lao PDR. Among the objectives of the EPF are to implement chapter V of the Environmental Protection Law, Article 47 of the Forestry Law, and Article 15 of the Decree to Implement the Law on Water and Water Resources. Sources of funds for the EPF are grants and loans from domestic and foreign entities, State budget, development projects and other activities, and interest or benefits accrued from investing the EPF endowment.

*Key Provisions of Lao PDR Laws and Decrees Pertinent To Environmental Aspects of the NNP1 Project*

The table below provides a brief summary of the key provisions of the various laws and decrees of the Lao PDR, as they relate to the environmental components of the Project.

**Table 1.2** *Key Provisions in the Laws, Decrees and Regulations of the Lao PDR Pertinent to the EIA of the Nam Ngiep 1 Hydropower Project*

Law or Decree	Article	Relating to	Content
Constitution of the Lao People's Democratic Republic (1991, amended 2003)	Article 17	Environment in general	"All organisations and citizens must protect the environment and natural resources: land, underground, forests, fauna, water sources and atmosphere."

Law or Decree	Article	Relating to	Content
Environmental Protection Law (1999)	Article 5	Environment in general	Conservation takes priority over mitigation and restoration.  Socio-economic development planning must include planning for environmental protection.
	Article 8	EIA Process	MONRE is main agency to issue regulations for EIA.  People affected by projects, mass organizations, and local administrations are to be involved in the EIA process.
	Article 10	Responsibility of those engaged in development works	Those engaged in development works must adhere to safeguards, and to standards and regulations issued by GOL agencies.
	Article 14	Responsibility of those engaged in development works	Those engaged in development works must abide by laws on land, forests, water, etc.
	Article 16	Responsibility toward cultural, historical, natural heritage sites	Those engaged in development works must abide by laws and regulations to protect such heritage sites.
	Article 22	Pollution control	All are responsible for control of pollution, and applying technologies appropriate to control such pollution.
	Article 23	Hazardous wastes / emissions	Restrictions to hazardous wastes and means to control such wastes and emissions.
	Article 28	Damage to environment	Those causing damage to environment are responsible for repair through appropriate GOL agencies.
	Article 38, 39	Local environmental management and monitoring	Stipulates responsibilities of local administrations (provinces, municipalities, special districts, districts) to establish environmental management and monitoring units.
	Article 40	Local environmental responsibilities	Stipulates responsibilities of village administrations to follow environmental regulations.
Water and Water Resources Law (1996)	Article 4	Rights to use water resources	Defines rights, obligations, and procedures to gain approval for use of water resources.
	Article 18	Permission for use	Stipulates that medium and large scale uses require feasibility studies, EIAs, and mitigation plans, before permission is granted for use of the resource.
	Article 22	Principles in water resource development management	Stipulates that water resource development must be consistent with national and sector plans, must ensure preservation of the natural beauty of the resources, and must protect against harmful effects of water.

Law or Decree	Article	Relating to	Content
	Article 25	Promotion of Watershed and Water Resource Protection for Hydropower Development	Stipulates that 'hydropower projects must be developed with due concern for environmental protection, flood protection, water supply, irrigation, navigation, fisheries and others.'
	Article 29	Water and water resource protection	Requires that water resources be protected from becoming spoilt, polluted, or drying up, and that forest and land resources be protected to help protect the water resources.
Lao Forestry Law (amended 2007)	Article 5	Policy on forest and forest land	The GOL has the policy to preserve, regenerate, and develop forests and forest land to help preserve the environment, water resources, biodiversity, and people's livelihoods.
	Articles 9 to 13	Forest types	Classify the various types of forests according to use, including forests for village use.
	Article 26	Preservation of water resources in forest zones	Stipulates the preservation of water resources in forest zones for those areas where waterways originate and flow, including strict management and regulations to control logging, shifting cultivation, and destructive forest uses.
	Article 70	Conversion of forestland	Stipulates that forestland can be converted to other land type if it brings a high level of benefits to the nation and to livelihoods of the people, and is included in the national development plan.
	Article 71	Types of converted forestland	Stipulates that for uses such as dam construction, the timber and forest resources to be harvested in those areas are property of the State.
Wildlife and Aquatic Law (2007)	Article 31	Use for Household purposes	Allows use by village households of wildlife and aquatic species in the common and general category list in particular seasons or permitted areas, using tools or equipment that do not adversely affect habitats or compromise the species population.
	Article 32	Customary Use	Allows use of wildlife or aquatic species in the common and general category list by village households for "necessary cultural beliefs".
	Article 52	Prohibitions	Prohibits taking of wildlife, including parts of the animals, from their habitats; tormenting wildlife and aquatics; illegal catching, hunting, trading and possession; catching aquatic and hunting in conservation zones, in breeding season, or when pregnant; devastation of habitats and feeding zones.

Law or Decree	Article	Relating to	Content
Land Law (2003)	Article 6	Protection of Land and Environment	Declares that all individuals and organizations are obliged to protect the land from degradation.
	Article 14	Changes in Land Category	Land use can be changed if it does not cause social or environmental harm and if prior approval is obtained from the authorities.
Decree on Land Lease or Concession (2009)	Article 39	Obligation of Person or Legal Entity Who Leases or Obtains Concession	The person or legal entity who leases land or obtains a concession is obligated, among other things, “not to cause any damage to the quality of land and negative impact to the natural environment and the society”.
Electricity Law (1997)	Article 6	Environmental Protection	Stipulates the need to assess the impact of electricity enterprises on the natural environment, ecological system, society and wildlife habitats
	Article 13	Feasibility Study	Requires a feasibility study and indicates the contents to be included in such a study.
	Article 14	Environmental Impact Assessment	Requires an environmental impact assessment and indicates the contents to be included in such an assessment
	Article 18	Obligations of Concessionaires	Includes the obligations to protect the environment and to pay compensation for any damage to the environment, or to the lives and property of people, or for resettlement.
	Article 27	Transmission Lines	Installation and construction of electricity transmission lines to be done in ways to limit damage to environment and to people’s property
Road Law (1999)	Article 15	Public Road Construction	Construction of public roads must include protection of the environment
Prime Ministerial Decree No. 112/PM on Environmental Impact Assessment (2010)		Stipulates the need for Environmental Impact Assessment	Stipulates rights of those affected by projects, and need for participation. Outlines the process of conducting the EIA, preparing environmental management and monitoring plans, social management and monitoring plans, issuing environmental compliance certificates, monitoring compliance with the various plans, establishing the institutional framework including grievance procedures.
Decree on Compensation and Resettlement of People Affected by Development Projects (2006)		Establish the procedures for compensation and resettlement for project affected people	Defines the principles, rules, and measures to mitigate adverse impacts and to compensate for damages that may result from involuntary acquisition or repossession of land and of fixed or movable assets, including changes in land use and restrictions to access of community or natural resources.

## 1.5.2

### *International Treaties*

The Lao PDR is party to several major international environmental treaties, which oblige it to abide by conditions of those treaties. Among those potentially relevant to this project are:

#### *Convention on Biological Diversity*

The government of the Lao PDR accepted the Convention on Biological Diversity in September 1996. Under this convention, the Lao PDR accepted several obligations, among them the establishment of protected areas, management of those areas, identification of key components of biological diversity, monitoring of those key components, increase public awareness and participatory management of biodiversity, and assessment of proposed projects that could have an adverse impact on biological diversity. The Prime Minister Decree 164 of 1993 to establish National Biodiversity Conservation Areas, the Environmental Protection Law of 1999, the Wildlife and Aquatics Law of 2007, and the Amended Forestry Law of 2007 were all enacted in part to meet the obligations of the Convention on Biological Diversity.

In 2004, the Lao PDR prepared a Biodiversity Strategy to 2020 and Action Plan to 2010. Recognizing the importance of hydropower for national development, the strategy and action plan found that most hydropower projects to date did not take adequate measures to assure protection of biodiversity. Issues of particular concern were that:

- Watershed management and protection is currently inadequate;
- Hydropower development often results in reduced forest cover, wildlife habitats and biodiversity resources;
- Dam construction has a direct impact on fisheries and local income, especially in downstream areas;
- Some hydropower construction has occurred without prior detailed studies;
- The resettlement of the local people can have a direct and indirect impact on biodiversity;
- Dam construction changes the natural water flow; and
- The compensation schemes for lost land and property are not clearly defined according to different scale. (Science, Technology and Environmental Agency, National Biodiversity Strategy to 2020 and Action Plan to 2010, STEA, GOL:2004, p.35)
- The report recommends addressing these issues through several options:

- Ensure that hydropower development takes social and environmental concerns into consideration;
- Manage and protect forests in watershed areas;
- Effectively enforce relevant laws and regulations; and
- Ensure that environmental and social impact assessments are effectively applied for hydropower projects. Promote effective and economical energy use, as well as the utilization of renewable energy. (Ibid)

#### *Convention on Climate Change*

Having ratified the Convention on Climate Change in January 1995, the Lao PDR is obligated to mitigating greenhouse gas emissions. Of concern to this project are the possible impacts of the reduction of forest area, the emission of greenhouse gasses from organic matter in the reservoir, the development of renewable sources of energy, and the promotion of sustainable forms of agriculture.

#### *Agreement on the Cooperation for Sustainable Development of the Mekong River Basin*

In April 1995, the Lao PDR ratified the Agreement on the Cooperation for Sustainable Development of the Mekong River Basin. This agreement, between the countries of Cambodia, Lao PRD, Thailand and Vietnam, established the Mekong River Commission and formed the basis for the joint management and development of the water resources of the Mekong River and its tributaries.

The four signatory countries agreed “to cooperate in all fields of sustainable development, utilization, management and conservation of the water and related resources of the Mekong River Basin including, but not limited to irrigation, hydro-power, navigation, flood control, fisheries, timber floating, recreation and tourism, in a manner to optimize the multiple-use and mutual benefits of all riparians and to minimize the harmful effects that might result from natural occurrences and man-made activities.” (Article 1)

Key provisions that concern this project are:

- “To promote, support, cooperate and coordinate in the development of the full potential of sustainable benefits . . . and the prevention of wasteful use of Mekong River Basin waters . . . through the formulation of a basin development plan . . .” (Article 2);
- “To protect the environment, natural resources, aquatic life and conditions, and ecological balance of the Mekong River Basin from pollution or other harmful effects resulting from any development plans and uses of water and related resources in the Basin.” (Article 3);

- In cases of utilization of waters “On tributaries of the Mekong River, . . . intra-basin uses and inter-basin diversions shall be subject to notification to the Joint Committee.” (Article 5, Paragraph A);
- “To cooperate in the maintenance of the flows on the mainstream from diversions, storage releases, or other actions of a permanent nature . . .” (Article 6); and
- “To make every effort to avoid, minimize and mitigate harmful effects that might occur to the environment, especially the water quantity and quality, the aquatic (eco-system) conditions, and ecological balance of the river system, from the development and use of the Mekong River Basin water resources or discharge of wastes and return flows.” (Article 7).

*Agreement on International Trade in Endangered Species of Wild Fauna And Flora (CITES)*

The Lao PDR joined the Convention on International Trade in Endangered Species of Wild Fauna and Flora (or CITES) in March 2004, with it coming into force on 30 May 2004. The Wildlife and Aquatics Law of 2007 includes provisions that meet the obligations of the Lao PDR to CITES.

*Inter-Governmental Agreement on Regional Power Trade in the Greater Mekong Sub-Region*

The Inter-Governmental Agreement on Regional Power Trade in the Greater Mekong Sub-Region between Cambodia, China, Lao PDR, Myanmar, Thailand and Vietnam sets the framework for electricity development and trade among the countries of the sub-region. The agreement is based on principles of:

- Cooperation: That issues related to regional interconnection be handled in a spirit of cooperation and mutual benefit, that the Parties have equal rights and obligations, act in solidarity, and refrain from taking advantage of one another;
- Gradualism: That the Parties consider the progressive development of regional electricity trade; and
- Environmentally Sustainable Development: That regional electricity trade is operated within a framework of respect for the environment. (Article 2, Paragraph 2.2).



### 1.5.3

#### *ADB Environmental Safeguard Policies and Social Protection Strategy*

Funding for the project is expected from the Asian Development Bank (ADB), and the ADB's Safeguard Policy Statement (SPS) and associated Safeguard Requirements apply to the project. The objectives of the SPS are to avoid, or when avoidance is not possible, to minimize and mitigate adverse project impacts on the environment and affected people, and to help borrowers strengthen their safeguard systems and develop the capacity to manage environmental and social risks.

The Environmental Safeguard Requirements include requirements for:

- environmental assessment as prescribed in ADB's SPS;
- preparation of an Environmental Management Plan (EMP) to manage unavoidable impacts;
- meaningful consultation with affected people;
- establishment of grievance redress mechanisms;
- monitoring and reporting activities;
- planning for unanticipated environmental impacts;
- Biodiversity Conservation and Sustainable Natural Resource Management;
- pollution prevention and abatement;
- health and safety; and
- physical cultural resources.

This Project is classified as a Category A project, which requires full environmental assessment of the potential negative and positive impacts and assessment of alternatives, recommended mitigation measures, and participation of the affected people and other stakeholders.

The key environmental concerns of the ADB as noted in its policy that need to be addressed in the NNP1 project EIA are: deforestation and land degradation, biodiversity loss, aquatic resources, water pollution, and climate change.

Of particular relevance to NNP1 are the requirements for Biodiversity Conservation and Sustainable Natural Resource Management. The Safeguard Policy includes requirements for operating in areas of modified, natural and critical habitat, and legally protected areas. The following standards are an extract from the ADB SPS:

### *A. Modified Habitat*

25. In areas of modified habitat, where the natural habitat has apparently been altered, often through the introduction of alien species of plants and animals, such as in agricultural areas, the borrower/client will exercise care to minimize any further conversion or degradation of such habitat, and will, depending on the nature and scale of the project, identify opportunities to enhance habitat and protect and conserve biodiversity as part of project operations.

### *B. Natural Habitats*

26. In areas of natural habitat,<sup>3</sup> the project will not significantly convert or degrade such habitat, unless the following conditions are met:

- (i) No alternatives are available.
- (ii) A comprehensive analysis demonstrates that the overall benefits from the project will substantially outweigh the project costs, including environmental costs.
- (iii) Any conversion or degradation is appropriately mitigated.

27. Mitigation measures will be designed to achieve at least no net loss of biodiversity. They may include a combination of actions, such as post-project restoration of habitats, offset of losses through the creation or effective conservation of ecologically comparable areas that are managed for biodiversity while respecting the ongoing use of such biodiversity by Indigenous Peoples or traditional communities, and compensation to direct users of biodiversity.

### *C. Critical Habitats*

28. No project activity will be implemented in areas of critical habitats unless the following requirements are met:

- (i) There are no measurable adverse impacts, or likelihood of such, on the critical habitat which could impair its high biodiversity value or the ability to function.
- (ii) The project is not anticipated to lead to a reduction in the population of any recognized endangered or critically endangered species<sup>6</sup> or a loss in area of the habitat concerned such that the persistence of a viable and representative host ecosystem be compromised.
- (iii) Any lesser impacts are mitigated in accordance with para. 27.

29. When the project involves activities in a critical habitat, the borrower/client will retain qualified and experienced external experts to assist in conducting the assessment

#### *D. Legally Protected Areas*

30. In circumstances where some project activities are located within a legally protected area, in addition to the requirement specified in para. 28, the borrower/client will meet the following requirements:

- (i) Act in a manner consistent with defined protected area management plans.
- (ii) Consult protected area sponsors and managers, local communities, and other key stakeholders on the proposed project.
- (iii) Implement additional programs, as appropriate, to promote and enhance the conservation aims of the protected area.

#### *Social Protection Strategy*

The ADB's Social Protection Strategy (2001) requires a company and its contractors and subcontractors to comply with Lao PDR's Labour Laws and establish measures to comply with the international core labour standards (CLS).

- (a) The ADB's Social Protection Strategy requirements are as follows: Carry out its activities consistent with the intent of ensuring legally permissible equal opportunity, fair treatment, and non-discrimination in relation to recruitment and hiring, compensation, working conditions and terms of employment for its workers (including prohibiting any form of discrimination against women during hiring and providing equal work for equal pay for men and women engaged by the Borrower);
- (b) Not restrict its workers from developing a legally permissible means of expressing their grievances and protecting their rights regarding working conditions and terms of employment;
- (c) Engage contractors and other providers of goods and services:
  - i) Who do not employ child labour or forced labour;
  - ii) Who have appropriate management systems that will allow them to operate in a manner which is consistent with the intent of (A) ensuring legally permissible equal opportunity and fair treatment and non-discrimination for their workers, and (B) not restricting their workers from developing a legally permissible means of expressing their grievances and protecting their rights regarding working conditions and terms of employment; and
  - iii) Whose subcontractors contain provisions which are consistent with paragraphs (i) and (ii) above.

ADB further identifies additional labour standards that reinforce CLS, such as those related to workers with family responsibilities, protection of migrant workers, working hours for young workers, and industrial relations. Other labour standards that complement the CLS that contribute to inclusive social development cover such subjects as occupational health and safety, employment promotion, minimum wages and payment of wages, social security, and labour administration and labour inspections.

#### 1.5.4 *Equator Principles*

Private Banks nowadays cover a large amount of the financing for international development. Initiated by several of the world's largest banks, the Equator Principles were established to assure that borrowers from the private banks for development projects abide by similar environmental and social standards as those applied by the World Bank, the ADB and other international financial institutions. The Equator Principles incorporate the International Finance Corporation's Environmental and Social Performance Standards. Of particular relevance to the environmental aspects of the NNP1 project are the need and means for biodiversity conservation and sustainable natural resource management, and pollution prevention and abatement. More than 60 of the world's leading banks have adopted the principles, which require them to stop lending if the borrower is found not to abide by the processes.

As with the ADB, projects deemed to have potentially great environmental impact, such as dams, are classified as Category A projects. These are required to have social and environmental impact assessments, adequate consultation with project affected people and local organizations, and adequate management and grievance mechanisms, similar to those required by the ADB.

Some of the environmental issues of concern in the Equator Principles that relate to the NNP1 project are:

- protection and conservation of biodiversity, including endangered species and sensitive ecosystems in modified, natural and critical habitats, and identification of legally protected areas;
- sustainable management and use of renewable natural resources (including sustainable resource management through appropriate independent certification systems);
- use and management of dangerous substances;
- major hazards assessment and management;
- consideration of feasible environmentally and socially viable alternatives; and

- pollution prevention and waste minimization. (The Equator Principles, July 2006, Exhibit II: Illustrative list of potential social and environmental issues to be addressed in the Social and Environmental Assessment documentation, p.7).

These issues are not considered exhaustive, but indicative of the types of issues to be addressed.

### 1.5.5 *Huay Ngua Provincial Protected Area*

The Huay Ngua PPA was established for district protection in 1995 by agreement and endorsement of District Part Committee Meeting and upgraded to the Provincial Protected Area in 1998. The Huay Ngua PPA was established as a Provincial Protected Area in accordance with governor decree no. 0294/BLX, dated 24 January 2010.

The Huay Ngua Provincial protected Area management Plan 2011-2015 (December 2010) records the Decree of the Governor of the Bolikhamxay Province that:

*Article 1. The Huay Ngua Management Plan for the period of: 5 years starting from 2011 to 2015 is hereby promulgated*

*Article 2. Appointed the Provincial Agriculture and Forestry Office to supervise on implementation of Huay Ngua Provincial Protected Area Management Plan*

*Article 3. Other agencies and section of province and district level that relate to this plan should be collaborated to accomplish the goals and objectives*

*Article 4. This decree shall enter into force on the dated it is signed.*

The goals of the Huay Ngua PPA Management Plan are defined as:

1. Protect the abundance of natural resources and integrated of biodiversity in the Huay Ngua PPA
2. Supply water resources for national socio-economic development
3. Meet the requirements of the local population for the proper and sustainable use of resources within the Huay Ngua PPA

## 2 *DESCRIPTION OF THE PROJECT*

### 2.1 *PROJECT OVERVIEW*

The purpose of the Project is to provide infrastructure to facilitate the transport of construction materials and equipment from outside the NNP1 Project area. Construction materials include cement and steel bars used for concrete, gates and penstocks for metal-work, turbines and generators for the power station, and other equipment. Construction equipment and infrastructure will include earth transport and construction equipment, as well as an aggregate and concrete plant.

A majority of the equipment and materials will be imported from foreign countries. At present, it is expected that the cement and steel bars will be from Thailand, and that construction equipment, transformers, gates, penstocks, and other equipment will be imported mainly from other developed countries. The most promising transportation route for these imported equipment and materials would be through Thailand. Equipment would first be discharged at either the Bangkok Port or the Laem Chabang Port in Thailand, and then be taken by road to Vientiane, Lao PDR via the Friendship Bridge. From Vientiane, the equipment and materials will be taken by Route 13 South to Pakxan, then to the north on a provincial road to Ban Nonsomboun before turning left onto the access road to the dam site.

### 2.2 *CURRENT ROAD CONDITIONS*




The existing roads from the Vientiane Friendship Bridge to Ban Nomsomboun are sealed asphalt roads. The asphalt-paved road from Vientiane to Pakxan, or Route 13 South, was developed and used to transport materials and equipment for several large-scale projects in the central and southern region from Vientiane. No upgrades to these roads are currently proposed, however future road improvements may be required.

The existing road from Ban Nomsomboun to Ban Hat Gniun is a dirt road, with a width of approximately five to ten metres. Areas of the road are prone to flooding or otherwise unsuitable following rain events. Currently, the road is not suitable to support NNP1 project activities.

Jica Road is an existing dirt road running between Ban Hat Gniun and the dam site along the left bank of the Nam Ngiep River. Jica Road was built for geological surveys for JICA-F/S. The condition of the road is poor, with pot holes, eroded areas, standing water and vegetative debris covering the road. The current condition is not suitable to support the transport loads required for NNP1 project construction.

Road conditions and transport distances for each section of the route between Vientiane and Ban Hat Gniun are shown in *Table 2-1*. A complete photolog of road conditions between Ban Nomsomboun and Ban Hat Gniun is provided in Annex A and photos of Jica Road are provided in Annex B.

**Table 2.1** *Conditions of existing roads between Vientiane and Dam Site*

Section	Dimensions	Condition	Photograph
Vientiane– “Friendship Bridge” to Pakxan	Length: 161.7 km  Width: 6m	Existing road. All asphalt paved, crossing 2 PC bridges on the way (Capacity: 80 tons)	
Pakxan to Ban Nonsomboun	Length: 19.9 km  Width: 6m	Existing road. Asphalt paved up to Ban Nonsomboun from Pakxan, crossing a PC bridge on the way (Capacity: 80 t, Width: 6 m, Length: 25 m)	
Ban Nonsomboun to Ban Hat Gniun	Length: 21.2 km  Width: 5 - 10 m	Upgraded existing dirt road.	
Ban Hat Gniun to Dam Site (Jica Road)	Length: 9.25  Width: 4.5 - 13.5 m (Average 6.6m)	Existing dirt road, with some potholes, erosion, fallen branches and trees, and areas with standing water.	

## 2.3

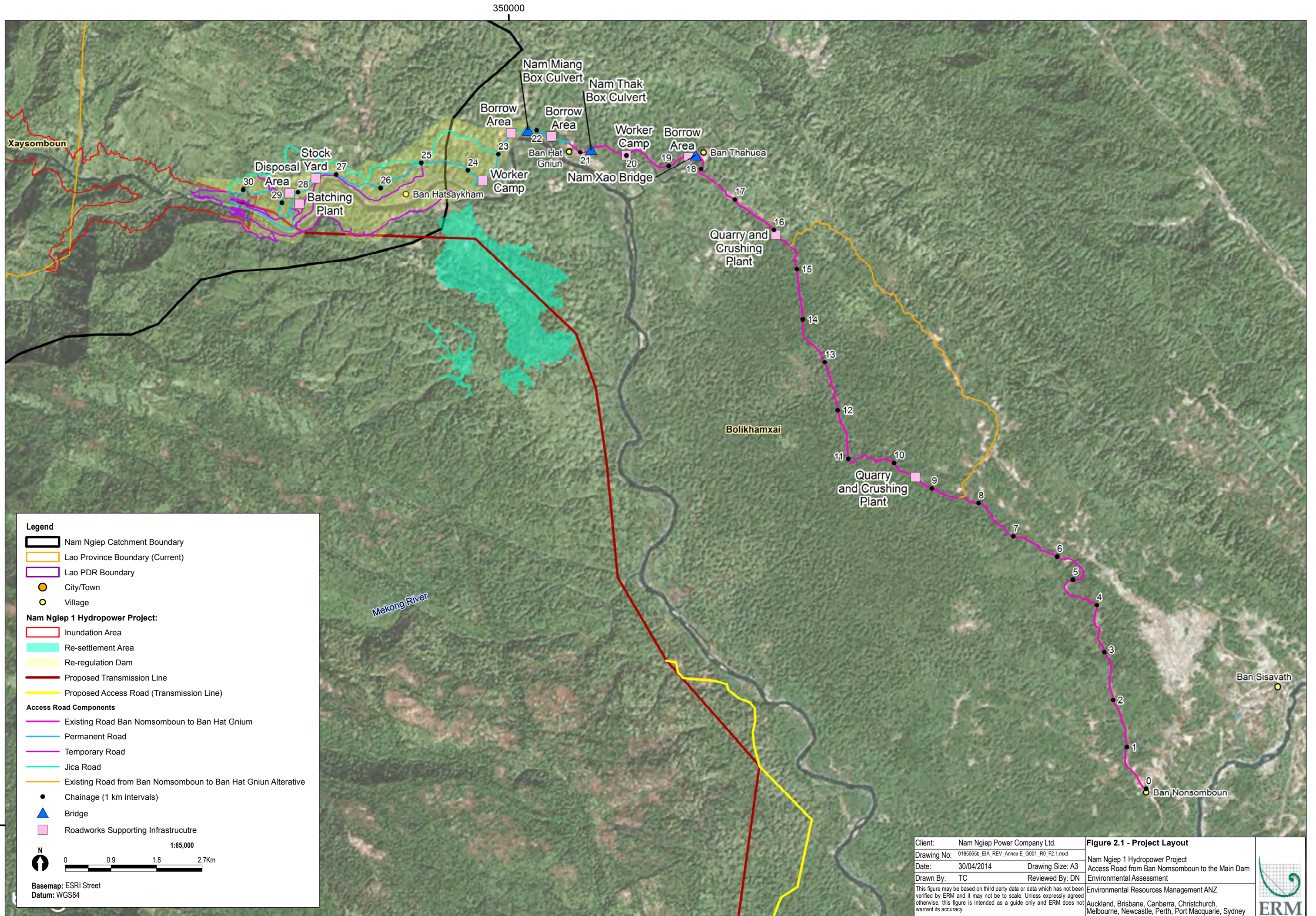
### *PROJECT COMPONENTS*

The proposed roadworks extend from Ban Nomsomboun to the Dam Site, with a total length of 58.42 km. Road works include the following components:

- An existing road from Ban Nomsomboun to Ban Hat Gniun to be upgraded (21.2 km);
- JICA road: an existing road from Ban Hat Gniun to Dam Site to be upgraded (9.25 km);
- P1 and P2: permanent roads from Ban Hat Gniun to Dam site to be constructed (11.16 km);
- Temporary Roads: a network of temporary roads (numbered T1 to T13) from Ban Hat Gniun to the Dam Site to be constructed (16.81 km);
- Bridges and culverts, at four locations; and
- Associated infrastructure including a worker's camp, batching plants and quarries.

*Figure 2.1* shows the overall layout of the Project, including the alternative access route (discussed in *Section 5.1*). *Figure 2.2* provides further detail on the road layouts between Ban Hat Gniun and the dam site, and locations of associated infrastructure for the full length of the Project.





**Legend**

- Nam Ngiep Catchment Boundary
- Lao Province Boundary (Current)
- Lao PDR Boundary
- City/Town
- Village

**Nam Ngiep 1 Hydropower Project:**

- Inundation Area
- Re-settlement Area
- Re-regulation Dam
- Proposed Transmission Line
- Proposed Access Road (Transmission Line)

**Access Road Components**

- Existing Road Ban Nomsomboun to Ban Hat Gniun
- Permanent Road
- Temporary Road
- Jica Road
- Existing Road from Ban Nomsomboun to Ban Hat Gniun Alternative

- Chainage (1 km intervals)
- Bridge
- Roadworks Supporting Infrastructure

Scale: 1:65,000  
 0 0.9 1.8 2.7km

Basemap: ESRI Street  
 Datum: WGS84

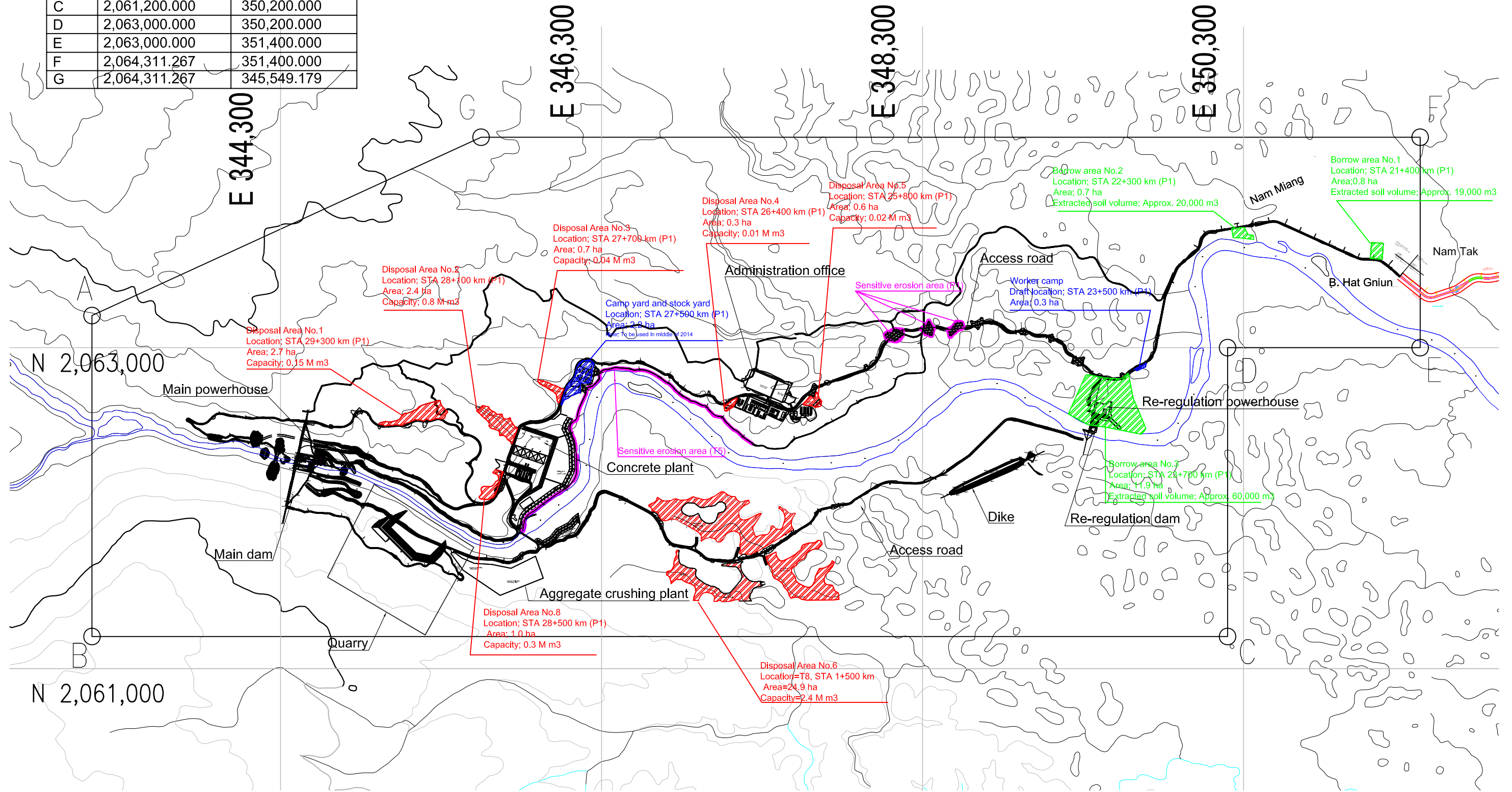
Client: Nam Ngiep Power Company Ltd.	<b>Figure 2.1 - Project Layout</b>
Drawing No: 0185065b_EIA_REV_Annex E_G001_R0_F2.1.mxd	Nam Ngiep 1 Hydropower Project
Date: 30/04/2014	Access Road from Ban Nomsomboun to the Main Dam
Drawn By: TC	Environmental Assessment
Reviewed By: DN	Environmental Resources Management ANZ
<small>This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.</small>	
<small>Auckland, Brisbane, Canberra, Christchurch, Melbourne, Newcastle, Perth, Port Macquarie, Sydney</small>	





Grid Coordinate Datum Lao-97-NEW

	North	East
A	2,063,200.000	343,125.074
B	2,061,200.000	343,125.074
C	2,061,200.000	350,200.000
D	2,063,000.000	350,200.000
E	2,063,000.000	351,400.000
F	2,064,311.267	351,400.000
G	2,064,311.267	345,549.179



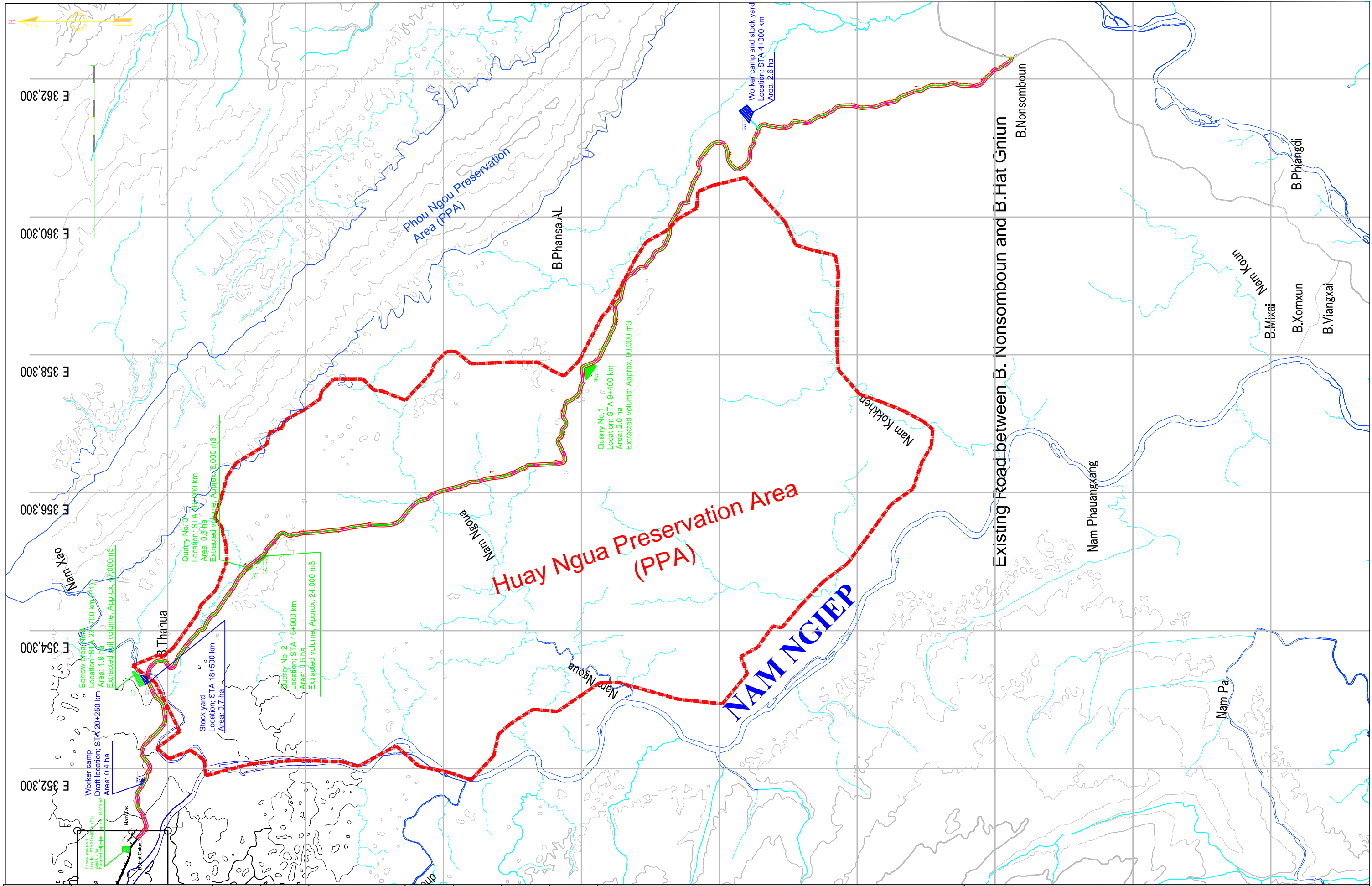
Construction area (Total 2,224ha)

REV.NO.	JOB NO.	JOB DESCRIPTION	DRAWN	DESIGNED	VERIFIED	VALIDATED	RECOMMENDED	CONCURRED	APPROVED	DATE





  
**THE KANSAI ELECTRIC POWER CO., INC.**  
 ELECTRICITY GENERATING AUTHORITY OF THAILAND

NAM NGIEP 1 HYDROPOWER PROJECT				
DRAWN	VALIDATED	DRAWING NAME		
DESIGNED	RECOMMENDED	Construction area		
VERIFIED	CONCURRED	Location map of facilities during road construction works		
APPROVED	DATE : December, 2013	SCALE: 1/ 24,000	REPLACING DWG. NO. JOB NO.	DWG. NO. REV. 02



REV. NO.	JOB NO.	JOB DESCRIPTION	DRAWN	DESIGNED	VERIFIED	VALIDATED	RECOMMENDED	CONCURRED	APPROVED	DATE


  
**KANSAI**  
 ELECTRIC POWER CO., INC.


  
 THE KANSAI ELECTRIC POWER CO., INC.  
 ELECTRICITY GENERATING AUTHORITY OF THAILAND

NAM NGIEP 1 HYDROPOWER PROJECT				
DRAWN	VALIDATED	DRAWING NAME		
DESIGNED	RECOMMENDED	General Layout of the Access Road		
VERIFIED	CONCURRED			
APPROVED		SCALE:	REPLACING DWG. NO.	DWG. NO.
		1/50,000	JOB NO.	NNP1-CW-
		DATE : December, 2013		

### **2.3.1 Existing road from Ban Nonsomboun to Ban Hat Gniun**

Works on the road from Ban Nomsomboun to Ban Hat Gniun will aim to improve all-weather accessibility and riding quality. Roads will be upgraded through structural overlays; bridges and culverts will be rehabilitated or constructed; and road levels will be raised where required in flood prone areas. Given the very low traffic volumes on the access road, improvement works will take priority over road widening.

### **2.3.2 Jica Road (Ban Hat Gniun to Dam site)**

The road is very steep and, due to the complex topography, long-term use of the road would require substantial maintenance and repair costs. Instead, the road will be upgraded to allow temporary access to the left bank of the dam site during construction. Due to a delay in commencement of civil works, the use of JICA road is required to begin excavation of the main dam while a more suitable permanent road is being constructed to improve the overall NNP1 construction schedule.

### **2.3.3 P1 and P2 (Ban Hat Gniun to Dam site)**

Due to the unsuitability of Jica Road for a permanent access road, an alternative permanent road is required. The proposed permanent route (P1) originates from Ban Hat Gniun, by way of the left bank of the re-regulation power house and the administration office, to the power house with switch yard and the dam crest, separately at the left bank. This road requires one-year construction schedule by the completion, thus the rehabilitation works of the JICA road and construction of T5 temporary access road precedes for securing the access to the main dam top and the inlet of the diversion tunnel.

### **2.3.4 Temporary Roads (Ban Hat Gniun to Dam site)**

The temporary roads are the roads which will only be used during construction, and are required to support the construction of the dam and associated infrastructure. The main temporary road is T5. The T5 road is required to access the gorge area (Location H, *Figure 2.2*) for the construction of the temporary bridge (Point H to F, *Figure 2.2*) and P2 road. The temporary bridge and P2 road are required for the construction of the diversion tunnel, and will assist in recovering the construction schedule. This road will only be used during the construction period and will be flooded after impounding the re-regulation pond. Other temporary roads will be rehabilitated and revegetated in accordance with the ESMMP-CP for the access road.

Table 2.2 Detail of road construction

Road Name	P/T	Current Length	Current Width	Final Length	Final Width	Current Condition	Rehabilitation Works	Upgrade Works	New Construction Works	Final Road Type	Drainage Type
Ban Nonsomboun - Ban Hat Gniun	P	21.2 km	5 to 10 m	21.2 km	5.7 m	Natural habitat and modified habitat, Passes through Huay Ngua PPA from km 6+700 to km 18+400, Passes thorough Ban Nonsomboun, Ban Thahuea and Ban Hat Gniun.	None	Lay sub-base course (t=30 cm) and create side ditch.	None	Sub base course	Side ditch
JICA road	T	9.3 km	4.5 to 13.5 m	9.3 km	Same as existing width	Dirt road, surrounded by natural and modified habitat. Road passes thorough Ban Hat Gniun.	Flatten road, cobble stone placing in small stream.	Create side ditch.	None	Dirt	Side ditch
P1 (To Dam Top) and P2 (To Power House)	P	1.8 km	5.7 m	11.2 km	3.7 m to 13.5 m	Some existing road. Area contains natural habitat and modified habitat, Passes thorough Ban Hat Gniun.		Lay sub-base course (t=30 cm) and create side ditch on existing 1.8 km of road.	Create an additional 9.4 km of road, at width of 3.7 m to 9.0 m. Lay sub-base course (t=30 cm) and create side ditch.	Sub base course	Side ditch
T1, T2 (Haul road EL 230 and 250m)	T	Not constructed	Not constructed	1.58 km	9.0 m	Modified and natural habitat.	None	None	Temporary Roads 1 to 13:	Sub base course	Side ditch
T3 (RCC&CVC plant road)	T	Not constructed	Not constructed	0.55 km	12.0 m	Modified and natural habitat.	None	None	Create total of 16.8 km of temporary roads.	Sub base course	Side ditch
T4 (Upstream approach road)	T	Not constructed	Not constructed	1.94 km	3.5 m	Modified and natural habitat.	None	None	Lay sub-base course (t=30 cm) and create side	Sub base course	Side ditch

Road Name	P/T	Current Length	Current Width	Final Length	Final Width	Current Condition	Rehabilitation Works	Upgrade Works	New Construction Works	Final Road Type	Drainage Type
T5 (Temporary access road)	T	Not constructed	Not constructed	3.88 km	3.5 m	Modified and natural habitat.	None	None	ditch on existing 1.8 km of road.	Sub base course	Side ditch
T6 (Jetty road)	T	Not constructed	Not constructed	0.2 km	3.0 m	Modified and natural habitat.	None	None	Construct temporary bridge (see Section 2.3.5).	Sub base course	Side ditch
T7 (Haul road to dam top)	T	Not constructed	Not constructed	1.54 km	3.0 m	Modified and natural habitat.	None	None		Sub base course	Side ditch
T8 (Soil disposal road)	T	Not constructed	Not constructed	3.2 km	4.5 m to 9.0 m	Modified and natural habitat.	None	None		Sub base course	Side ditch
T9 (Haul road to quarry)	T	Not constructed	Not constructed	1 km	9.0 m	Modified and natural habitat.	None	None		Sub base course	Side ditch
T10, T11 (Approaching)	T	Not constructed	Not constructed	1.68 km	9.0 m	Modified and natural habitat.	None	None		Sub base course	Side ditch
T12 (Diversion outlet)	T	Not constructed	Not constructed	0.72 km	3.0 m	Modified and natural habitat.	None	None		Sub base course	Side ditch
T13 (Diversion outlet)	T	Not constructed	Not constructed	0.52 km	3.7 m	Modified and natural habitat.	None	None		Sub base course	Side ditch

P = Permanent, T = Temporary.

Source: NNP1PC November 2013

### 2.3.5 *Bridges and Culverts*

The construction of bridges and culverts is required to improve all-weather access to the Project site. As of November 2013, one permanent bridge and two permanent culverts have been constructed as discussed in *Section 2.7.1 and Table 2.3*. Plans of the permanent bridge and culverts are provided in *Annex C*.

A temporary bridge is also planned for construction, and will be located near the main dam site. The temporary bridge is required for the construction of the diversion tunnel, and will assist in recovering the construction schedule.

**Table 2.3** *Details of bridges and culverts*

Name	Status	Description	Location
Nam Xao	Permanent, constructed 2013	Plate girder bridge, L=40m, W=5.5m	Nam Xao (STA18km+400m)
Nam Thak	Permanent, constructed 2013	Box culvert, L=11.35m, W= 12 m	Nam Tak (STA 20km+780m)
Nam Miang	Permanent, constructed 2013	Box culvert, L=11.35m, W= 11 m	Nam Miang (STA 22km+200m)
Temporary bridge	Temporary bridge, planned for construction	Plate girder Length: 90 m Width: 5 m	Nam Ngiep (Start point H to End point F in <i>Figure 2.2</i> )

Source: NNP1PC November 2013

### 2.3.6 *Supporting Infrastructure*

In addition to road upgrades and construction, supporting infrastructure is required. This includes bridges, as well as a temporary worker camp, a quarry, a moveable crushing plant, batching plant, spoil area and borrow area. Details of supporting infrastructure are provided in *Table 2.4*. The locations of supporting infrastructure are provided in *Figure 2.1 and Figure 2.2*. Detail of quarry locations and stockyard locations is provided in *Figure 2.3*.

**Table 2.4** *Details of supporting infrastructure*

Name	Description	Location
Worker camps	Two workers camps will be constructed in separate locations totalling 2 ha of land.	STA 4+000 km (P1) STA 20+250 km (P1) STA 23+500 km (P1) STA 27+500 km (P1)

Name	Description	Location
Quarry	Estimated extracted quantity 120,000 m <sup>3</sup> : <ul style="list-style-type: none"> <li>• STA 9.4km - 2.0ha - 90,000 m<sup>3</sup>;</li> <li>• STA 15.9km - 0.6 ha - 24,000 m<sup>3</sup>;</li> <li>• STA 16.0km - 0.3 ha - 6,000 m<sup>3</sup>.</li> </ul>	STA 9+400 km (P1) STA 15+900 km (P1) STA 16+000 km (P1) Quarries are located adjacent the existing permanent road from Ban Nomsomboun to Ban Hat Gnium within Huay Ngua PPA. There is no candidate site outside the PPA. As of December 2013, the quarry at ST 16+000 km had been opened.
Batching Plant	To be used for construction of temporary bridge. Specification not yet decided.	STA 28+100 km (P1)
Crushing Plant	Gravel to be crushed by movable crushing facility.	STA 28+500km (P1) Mobile facility located temporarily at quarry sites.
Spoil area	To be disposed in fill section. Estimated disposal capacity; 0.8 M m <sup>3</sup> .	No. 1 STA 29+300 km (P1) No. 2 STA 28+100 km (P1) No. 3 STA 27+700 km (P1) No. 4 STA 26+400 km (P1) No. 5 STA 25+800 km (P1) No. 6 STA 1+500 km (T8) No. 8 STA 28+500 km (P1)
Borrow area	Extracted soil volume approximately 86,000m <sup>3</sup> , across a 3.4 ha area.	STA 21+400km (P1) STA 22+300km (P1) STA 23+700 (P1)
Stockyard	Total area of worker camp and stockyard at STA 4+000km is 2.6 ha. Stockyard location at 18+500km is 0.7 ha.	STA 4+000 km (P1) STA 18+500 km (P1)
Source: NNP1PC (December 2013)		

## 2.4

### UTILITIES

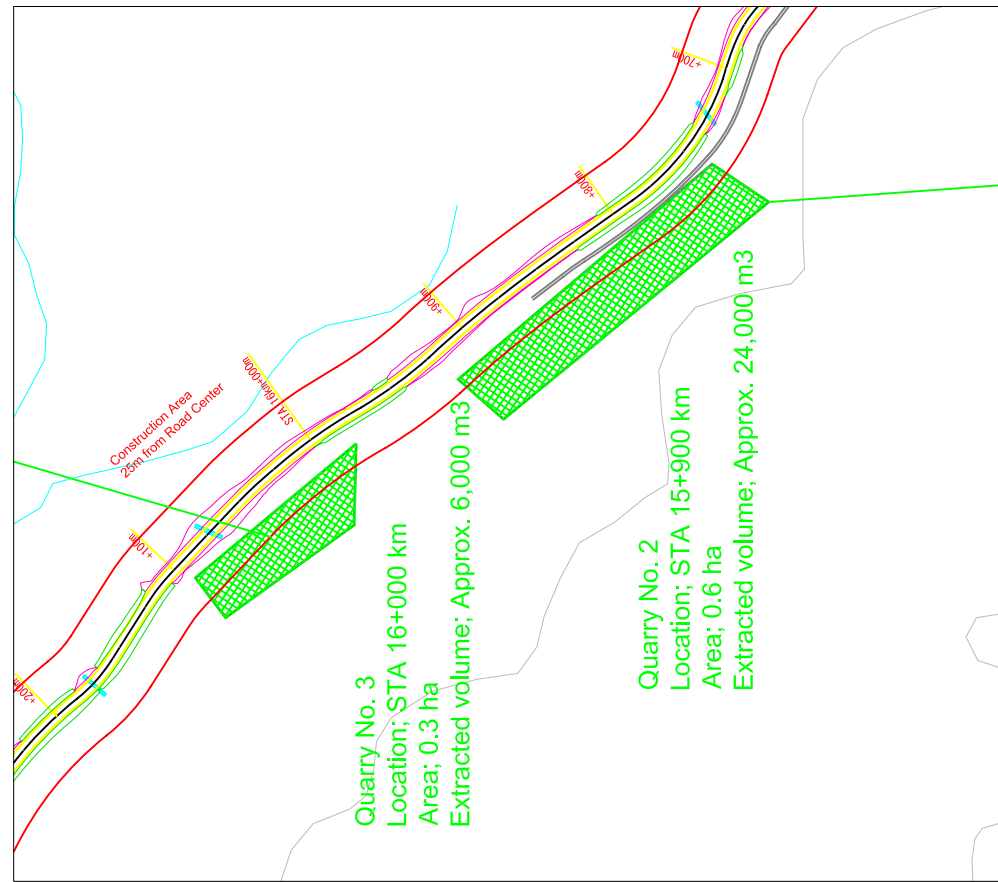
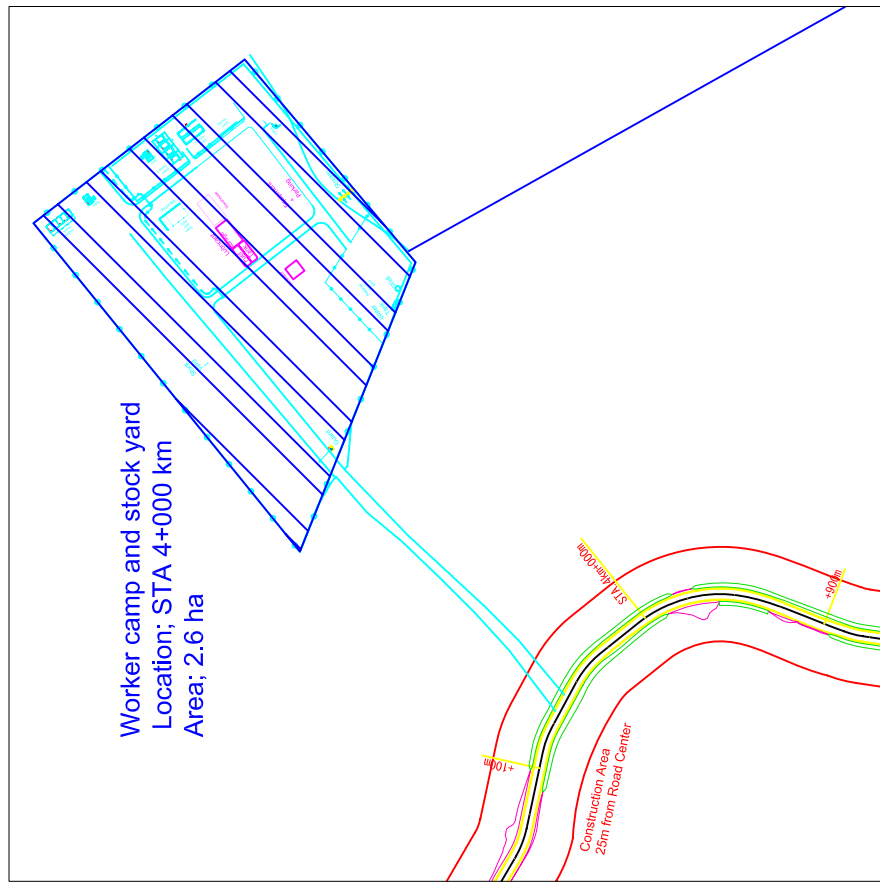
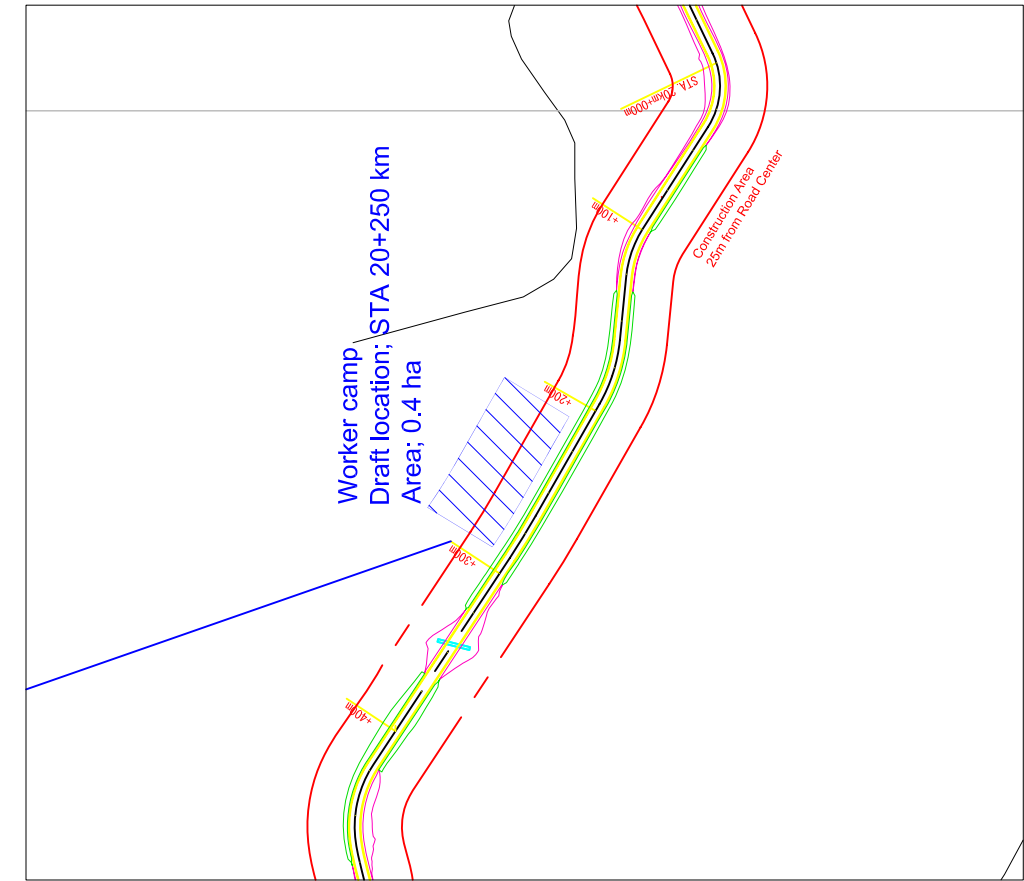
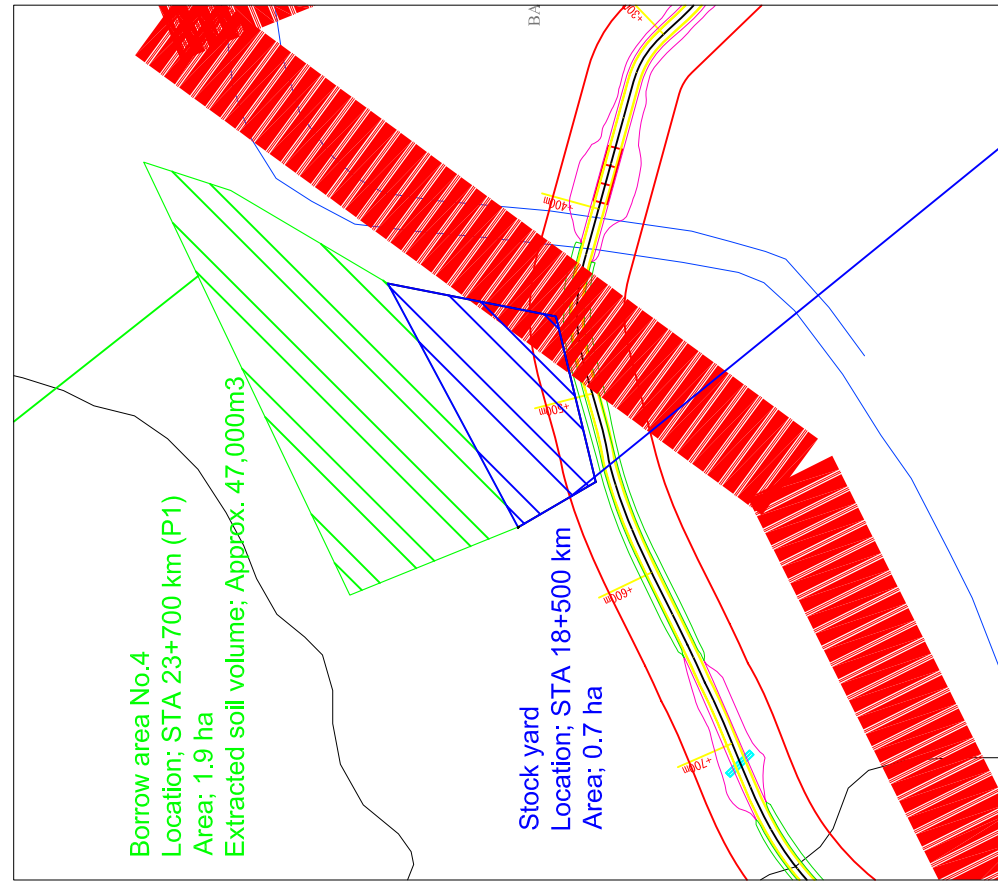
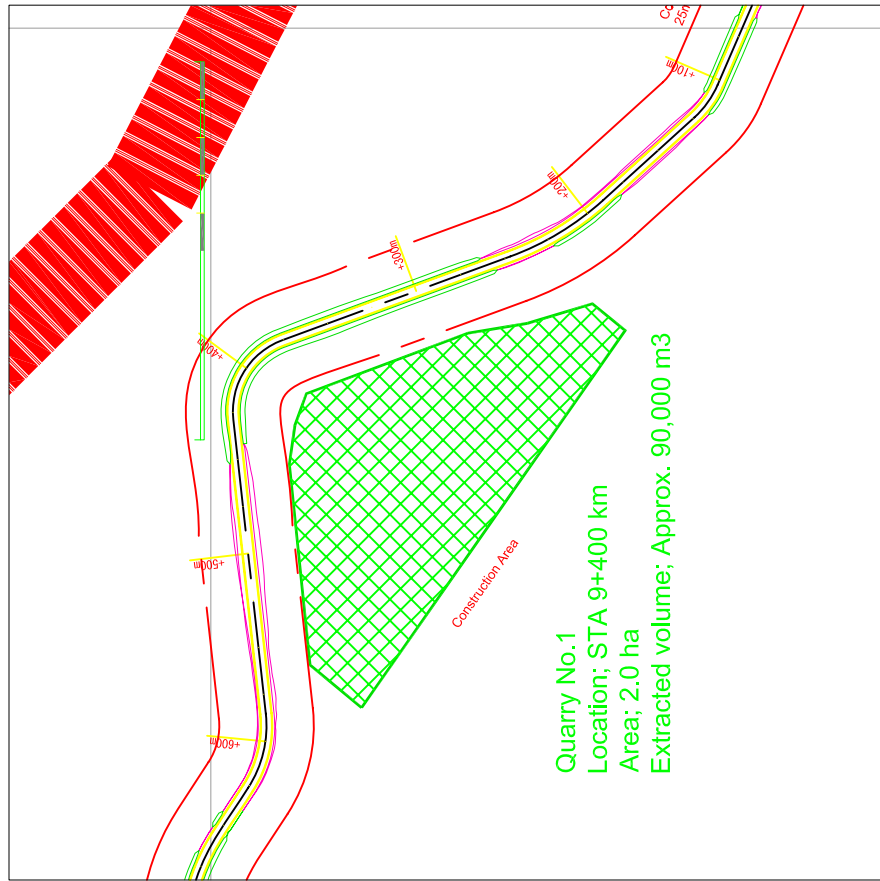
Drinking water will be brought from Pakxan. Water for domestic use in the worker camp as well as for dust control during construction will be pumped up from Nam Ngiep or well. Water for the worker camp will be purified using a filter. Power will be supplied during construction through 250 kV portable generators.

## 2.5

### WORKFORCE

The construction phase will require a total of approximately 2,400 workers. An average of 80 people will be employed each month, with a maximum workforce of 120 employees per month.





REV. NO.	JOB NO.	JOB DESCRIPTION	DRAWN	DESIGNED	VERIFIED	VALIDATED	RECOMMENDED	CONCURRED	APPROVED	DATE



NAM NGIEP 1 HYDROPOWER PROJECT				
DRAWN	VALIDATED	DRAWING NAME		
DESIGNED	RECOMMENDED	Location map of facilities		
VERIFIED	CONCURRED			
APPROVED		SCALE:	REPLACING DWG. NO.	DWG. NO.
		1/4,000	JOB NO.	NNP1-CW-
		DATE : December, 2013		
				REV.
				02

## 2.6 CONSTRUCTION TIMING

### 2.6.1 Current Status of Construction Activities (November 2013)

Between early February and September 2013, NNP1PC conducted road rehabilitation works of a rural road between Ban Nonsomboun and Ban Hat Gnium and constructed the permanent bridges. The works included:

- Construction of one bridge “Nam Xao bridge”;
- Construction of two box culverts “Nam Thak and Nam Miang box culvert”;
- Installation of pipe culverts at 34 locations; and
- Soil improvement along the Access Road.

A report on the construction and environmental management measures implemented is provided in *Annex D* and summarized below.

Works were required to secure the accessibility of the site for survey in the rainy season, specifically geological survey, land use survey, UXO survey, and pilot village activities for resettlement.

The works did not alter the existing road alignment; the area affected by earthworks was very limited compared to the main construction works to be implemented by the main contractor. Based on a review of the Lao regulations and discussion with the Government of Lao PDR, ESMMPCP and EA were not required for the rehabilitation works for survey purpose. Despite this, Environmental Mitigation measures were planned and conducted.

During bridge construction, NNP1PC considered the mitigation measures in *Table 2.5* to avoid or minimize environmental damage.

**Table 2.5 Design measures in bridges and culverts for environmental protection**

	Nam Xao bridge, Nam Thak box culvert, and Nam Miang box culvert	Pipe culvert	Soil improvement
Geology Soil erosion	Gabion box installation mitigates the erosion of the embankment. Installation of bridge and box culvert minimizes the turbidity water occurrence when the vehicles and motorbikes cross the river.	Installation of bridge improves water quality and minimizes water turbidity when vehicles and motorbikes cross the river.	Place 100% gravel on road surface to reduce soil erosion.
Hydrology	To design for adequate water flow within the river	Set the pipe culvert elevation equivalent to river bed to ensure that water within the river flows smoothly.	No consideration

## 2.6.2

### *Construction Schedule*

Construction commenced in some areas in March 2013. The remaining construction activities commenced in November 2013, and will continue until February 2015 (refer to *Figure 2.4*).

Figure 2.4 Construction Schedule of Road Work (NNP1PC - November 2013)

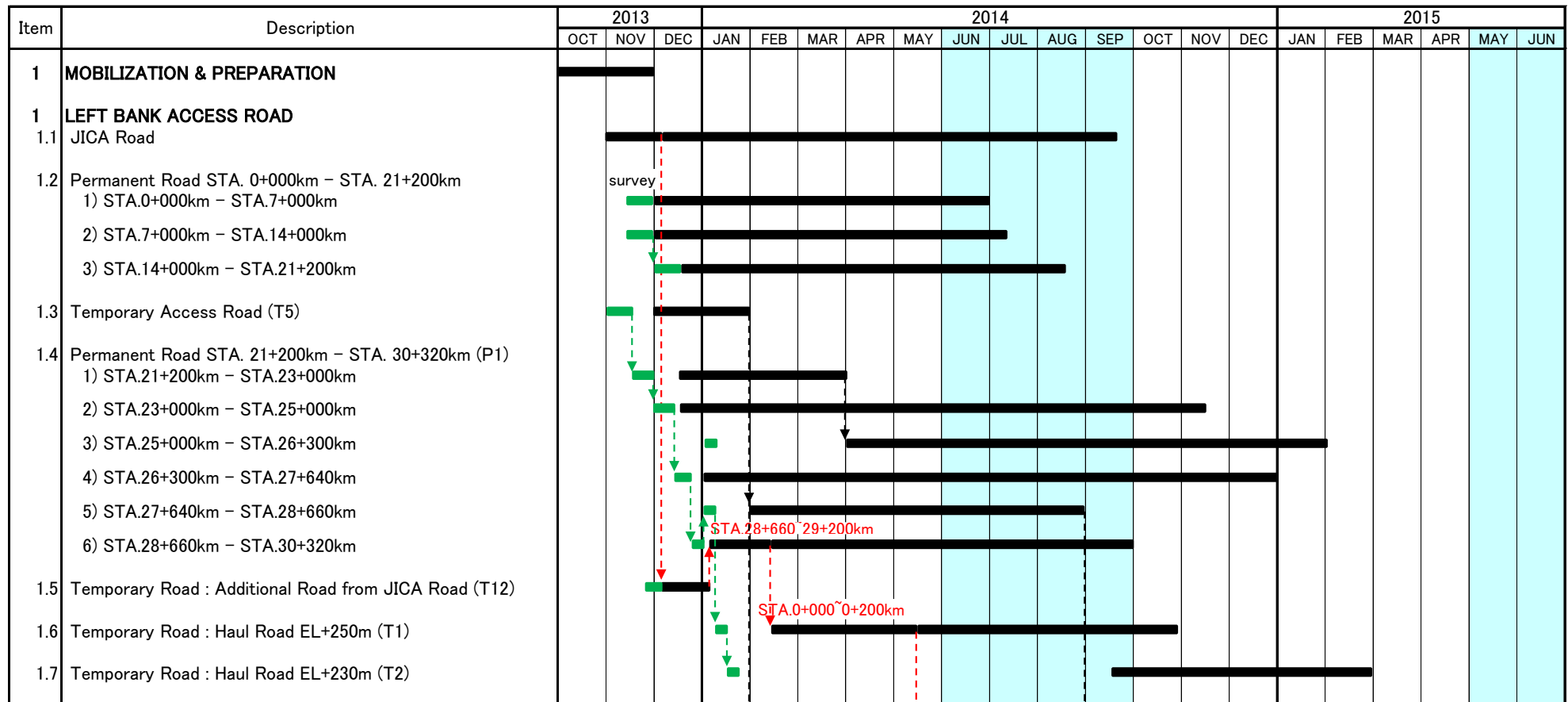
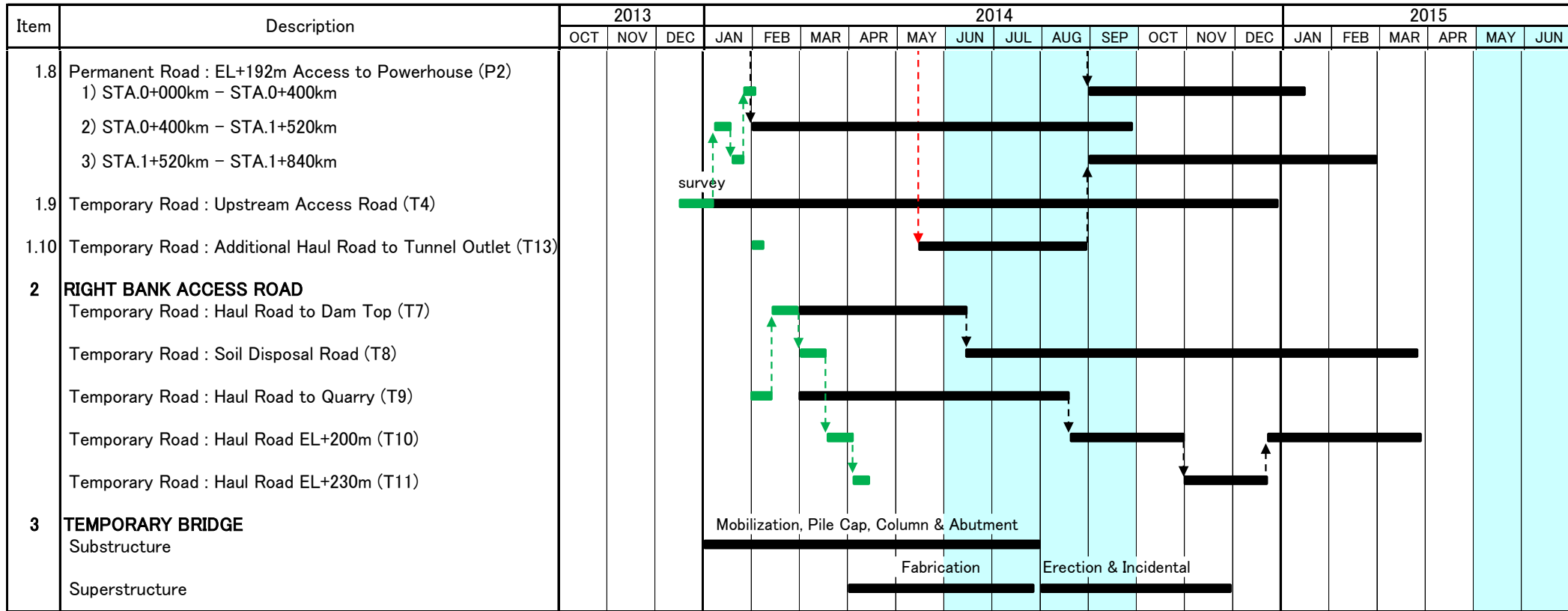


Figure 2.4 (continued) Construction Schedule of Road Work Continued (NNP1PC – November 2013)



### 3 DESCRIPTION OF THE ENVIRONMENT (BASELINE DATA)

#### 3.1 PHYSICAL RESOURCES

##### 3.1.1 Atmosphere

The access road is located in the Bolikhamxay Province, Lao PDR, which is influenced by a Southwestern monsoon climate regime. The Project area is located in a tropical climate. Weather is dominated by monsoons, which divides the year into clearly defined wet and dry periods. The wet season begins from May and extends until October, while the dry season runs from November to April.

The area around the Project site experiences good weather conditions in comparison to the rest of the Lao PDR. The EA study found that for the months of March to the end of May, temperatures ranged from 17°C to 38°C (Department of Meteorology and Hydrology, 2005). In the wet season, temperature ranged from about 19°C to 36°C, and from December to February (considered to be the dry season) temperatures ranged from about 11°C to 29°C.

The rainfall records were reviewed for the hydrological study and dam designs. The records of hydrological gauging locations in areas peripheral to the planned basin were evaluated.

Average annual rainfall in Lao PDR in selected locations is:

- Vientiane – about 1,600mm;
- Luang Prabang Province – about 1,200mm;
- Savanakhet – ranging from about 1,500mm to 2,000mm; and
- mountainous areas and in the western highlands of Anamit Mountain about 2,000 to 3,000mm.

Rainfall data was collected from three gauging stations within the basin and another eleven stations from the peripheral areas. Other meteorological data such as air temperature, relative humidity, barometric pressure, solar radiation, sunshine hours, evaporation, and wind velocity were not collected from the gauging stations. According to NNP1PC's Technical Report from 2007, the mean basin rainfall from 1971 to 2000 was assumed to be 1,870mm/year after comparing to the isohyetal map.

The mean rainfall in the Nam Ngiep River basin was lower than that of Pakxan because of the topographical characteristics of the region. According to the meteorological data of Pakxan District (DMH, 2005), the seasonal variation of monthly rainfall follows the general pattern of the Southeast Asia monsoon, with about 90% of rainfall during the six month wet season from May to October. In the dry season from November to April, the monthly precipitation levels are quite low, ranging from 3.7mm to 67.5mm, or about 10% of the annual precipitation for this region.

### 3.1.2

#### *Topography*

The Nam Ngiep River, which originates in the Phonsavan Basin, takes its course as a whole to a south-south-east direction, alternating the sections of southward and southeast-wards, and passes through the mountainous regions before reaching the outlet of the gorge approximately 7.7km from Ban Hat Gniun village. After that, it runs down the hilly region and finally joins to the Mekong River at Pakxan. Note that the access road (Pakxan to Bolikhan) runs along the Nam Ngiep River to Ban Nonsomboun.

Most parts of the Project area have a relief elevation of less than 180m. The re-regulated dam (which is within the Project area) is located about 6km from the main dam along the river which is running from west to east. The areas on both sides of the river are widening and consequently constructing more flat plains.

The study area is rather flat and tilted towards the Mekong River. There are tributaries from Phu Keng, Phu Ngou to Phu Pha Mela merging in this section of the Nam Ngiep. The major tributaries are the Nam Pa and the Nam Tak.

### 3.1.3

#### *Soil*

The following types of soils are likely to be represented in the Project area:

##### *Alisols (AL)*

Soil having an argic B horizon which has a cation exchange capacity equal to or greater than 24 cmol (+) kg<sup>-1</sup> clay and a base saturation (by NH<sub>4</sub>OAc) of less than 50 percent in at least some part of the B horizon within 125 cm of the surface; lacking the E horizon abruptly overlying a slowly permeable horizon, the distribution pattern of the clay and the tonguing which are diagnostic for planosols, nitisols and podzoluvisols respectively.

##### *Acrisols (AC)*

Soil having an argic B horizon which has a cation exchange capacity of less than 24 cmol (+) kg<sup>-1</sup> clay and a base saturation (by NH<sub>4</sub>OAc) of less than 50 percent in at least some part of the B horizon within 125 cm of the surface; lacking the E horizon abruptly overlying a slowly permeable horizon, the distribution pattern of the clay and the tonguing which are diagnostic for planosols, nitisols and podzoluvisols respectively.

##### *Haplic Acrisols (ACh)*

Acrisols which are not strongly humic; lacking ferric properties; lacking plinthite within 125 cm of the surface; lacking gleyic and stagnic properties within 100 cm of the surface.

### *Ferric Acrisols (ACf)*

Acrisols which are not strongly humic, showing ferric properties; within 125 cm of the surface; lacking plinthite within 125 cm of the surface; lacking gleyic properties within 100 cm of the surface.

### *Luvisols (LV)*

Soil having an argic B horizon which has a cation exchange capacity equal to or greater than 24 cmol (+) kg<sup>-1</sup> clay and a base saturation (by NH<sub>4</sub>OAc) of 50 percent or more throughout the B horizon; lacking a mollic A horizon; lacking the E horizon abruptly overlying a slowly permeable horizon, the distribution pattern of the clay and the tonguing which are diagnostic for planosols, nitisols and podzoluvisols respectively.

### *Haplic Luvisols (LVh)*

Luvisols having an argic B horizon with coloration which is not strong brown to red1; lacking an albic E horizon; lacking a calcic horizon and concentrations of soft, powdery lime within 125 cm of the surface; lacking vertic properties; lacking ferric properties; lacking gleyic and stagnic properties within 100 cm of the surface.

### *Ferric Luvisols (LVf)*

Luvisols showing ferric properties within 125 cm of the surface; lacking albic E horizon; lacking plinthite within 125 cm of the surface.

### *Lixisols (LX)*

Soil having an argic B horizon which has a cation exchange capacity of less than 24 cmol (+) kg<sup>-1</sup> clay at least in some part of B horizon, and a base saturation (by NH<sub>4</sub>OAc) of 50 percent or more throughout the B horizon; lacking a mollic A horizon; lacking the E horizon abruptly overlying a slowly permeable horizon, the distribution pattern of the clay and the tonguing which are diagnostic for planosols, nitisols and podzoluvisols respectively.

### *Haplic Lixisols (LXh)*

Lixisols lacking an albic E horizon; lacking ferric properties and plinthite within 125 cm of the surface; lacking gleyic and stagnic properties within 100 cm of the surface.

### *Ferric Lixisols (LXf)*

Lixisols showing ferric properties within 125 cm of the surface; lacking an albic E horizon; lacking plinthite within 125 cm of the surface; lacking gleyic and stagnic properties within 100 cm of the surface.



### *Cambisols (CM)*

Soil having a cambic B horizon and no diagnostic horizons other than an ochric or an umbric A horizon or a mollic A horizon overlying a cambic B horizon with a base saturation (by NH<sub>4</sub>OAc) of less than 50 percent; lacking salic properties; lacking the characteristics diagnostic for vertisols or andosols; lacking gleyic properties within 50 cm of the surface.

### *Dystric Cambisols (Cmd)*

Cambisols having an ochric A horizon and a base saturation (by NH<sub>4</sub>OAc) of less than 50 percent at least between 20 and 50 cm from the surface; lacking vertic properties; lacking ferralic properties in the cambic B horizon; lacking gleyic properties within 100 cm of the surface; lacking permafrost within 200 cm of the surface.

Soils in the Project area reflect variations in parent material and can be divided into fluvial environments (subject to river processes) or colluvial environments (subject to in situ weathering of bedrock initiated by rainfall). Small-scale spatial variation in soil depth is large for all soil types, with soil depths varying from less than 25 cm to over 1 m, but seldom exceeding 2 m over short distances. A deep solum (material between the effective root growth layer and bedrock) can exist up to a depth of 2 to 3 m in the highly weathered (but not easily eroded) material.

The skeletal soils (lithosoils), in more shallow horizons, are soils with a lithic or paralithic contact within 25 cm of the surface or with more than 50 percent rock fragments within this depth. Such shallow soils are susceptible to erosion after vegetation is removed. The structure of red-yellow podzolic soils ranges from massive to weakly coarse or medium blocks. They are acidic (i.e., pH < 5) and have low base saturation. The small percent of soils that are not podzolic are most often lateritic. These soils are well drained, still shallow (less than 2 m), and consist of yellow to red clay-loam material. They are also acidic (pH < 5.5), and have a high sesquioxide (Fe-Al) content, but a low base content; thus, they are poor in nutrients. One difference between the two is lateritic soils are more highly permeable when undisturbed, thus making these soils less susceptible to erosion (Whitmore, 1984).

Preservation of surface soil, with its all-important organic matter, is imperative. Low input farming on acrisols, in their present leached condition, is not very successful. Mechanical clearing of the natural forest by extraction of root balls and filling of holes with surrounding surface soil produces land that is largely sterile because toxic levels of aluminium in the former subsoil kill off new growth. All exposed soils erode at a faster rate, increasing the risk and adverse impact of greater sediment discharge rates into local waterways.

Adapted cropping systems with complete fertilization and careful management are required if sedentary farming is to be taken up on acrisols. Recent agricultural production research (Lao-IRRI, 1995) and shifting cultivation studies (UNDP, 1994) confirm the statements made here, and show soils in Lao lack sufficient mineral content. The studies indicate that soils are acutely deficient in phosphate, which is needed to help plants use nitrogen.

Studies regarding the paddy areas around the Project area in 2000 showed there is a consistent yield response to an incremental increase in P (phosphate) application rate (Lao-IRRI, 2000). There is also a need for K (potassium) in the fertilizer recommendations for this site. The application of limestone to correct soil acidity will also improve availability of phosphorus and potassium. Commonly used slash-and-burn agriculture (otherwise known as shifting cultivation), such as garden plots may utilize large areas of marginal lands, but can represent a well-adapted type of land use. The proven practice has been developed over centuries of trial and error. If occupation periods are short (one or two years) and followed by a sufficiently long regeneration period (up to 15 to 20 years), this system probably makes the best use of limited possibilities of acrisols (Driessen and Dudal, 1991). Due to access limitations to new land and government regulations, coupled with a growing food demand, the length of fallow is being shortened. This results in reduced yields, not higher production rates.

Gravel for stabilizing roads is available from the lateritic red soils. Presently, existing erosion is limited due to the protective forest cover. Erosion increases with road construction, particularly with roads built with steep grades, with the removal of such protective forest cover. Soils around the proposed construction sites and camps are also prone to wind and water erosion. Therefore, care must be taken as construction starts to implement appropriate measures to control erosion in work areas and camps. Appropriate measures vary by soil type exposed, and monitoring will be necessary to determine the effectiveness of mitigation measures.

#### **3.1.4** *Surface Water and Groundwater Quality*

The Nam Ngiep River originates in mountainous areas of Xieng Khouang province and runs through lowlands to the Mekong River in Bolikhamxay province. Its tributaries (Huay Peun, Huay Ngua, Nam Xao and Nam Tak) within the access road Project area are small compared to Nam Ngiep River.

##### *Surface Water Quality*

Water quality data was collected near Ban Hat Gnium (N: 18°39'15.25''; E: 18°39'15.25'') in April and October 2007. Water quality results were assessed against Lao water quality standards and Thai water quality standards, as Thai standards provide a more detailed classification of water quality. The results of the water quality monitoring indicate that the water around Ban Hat Ngui meets the Lao PDR ambient water quality standards. The majority of parameters met the criteria for Class 2 water, which is 'very clean fresh surface water resources used for consumption which requires ordinary water treatment process before use, and is appropriate for conservation of aquatic organisms, fisheries and recreation. The exception is Cadmium, which would require non-detection to be considered Class 2, and was detected with a concentration of less than 0.001mg/L. Water quality standards and results for the 2007 monitoring events are provided in *Table 3.1*.

**Table 3.1 Water quality standards and monitoring results at Ban Hat Gnium**

Parameters	Unit	Lao PDR Ambient Standards of Water Quality <sup>1</sup>	Thai Water Quality Standards <sup>2</sup>					April 2007	October 2007
			Class 1	Class 2	Class 3	Class 4	Class 5		
Temperature	°C	-	-	-	-	-	-	29.5	25.3
pH	-	5 - 9	-	-	-	-	-	7.09	7.09
Alkalinity	meq/L	-	-	-	-	-	-	0.26	0.14
DO	mg/L	>5.0	-	-	-	-	-	7.21	7.23
BOD <sub>5</sub>	mg/L	1.5	n	1.5	2.0	4.0	-	1.4	1.2
Oil and Grease	mg/L	-	-	-	-	-	-	<0.01	<0.01
Turbidity	FTU	-	-	-	-	-	-	17.9	16.2
Suspended solids	mg/L	-	-	-	-	-	-	21.4	22.1
TDS	mg/L	-	-	-	-	-	-	33.1	19.7
Hardness	mg/L	-	-	-	-	-	-	78.0	73.0
Conductivity	µS/cm	-	-	-	-	-	-	60.56	48.9
Phosphate-P	mg/L	-	-	-	-	-	-	0.48	0.10
Total P	mg/L	-	-	-	-	-	-	0.11	0.04
Ammonium-N	mg/L	0.2	n	0.5	0.5	0.5	-	0.05	0.02
Nitrate-N	mg/L	5.0	n	0.5	0.5	0.5	-	0.14	0.21
Total N	mg/L	-	-	-	-	-	-	0.07	0.05
Total coliform	MPN/100	5000 MPN/100 ml	-	5000	20,000	0	-	NA	NA
Fecal coliform	MPN/100	1000 MPN/ml	n	1000	4000	-	-	NA	NA
Cadmium, Cd	mg/L	0.005	n	0.00	0.005	0.005	-	<0.001	<0.001
Mercury, Hg	mg/L	0.002	n	0.002	0.002	0.002	-	<0.001	<0.001
Copper, Cu	mg/L	0.1	n	0.1	0.1	0.1	-	<0.10	<0.10
Iron, Fe	mg/L	-	-	-	-	-	-	0.22	0.20
Manganese, Mn	mg/L	1.0	n	1.0	1.0	1.0	-	0.18	0.11
Nikel, Ni	mg/L	0.1	n	0.1	0.1	0.1	-	<0.10	<0.10
Lead, Pb	mg/L	0.05	n	0.05	0.05	0.05	-	<0.01	<0.01
Zinc, Zn	mg/L	1.0	n	1.0	1.0	1.0	-	<0.02	<0.02
Arsenic, As	mg/L	0.01	-	-	-	-	-	<0.001	<0.001

n naturally

- not indicated

1. Ambient Water Standards of Lao PDR, MONRE, GOL

2. Standard Methods for the Examination of Water and Wastewater recommended by APHA : American Public Health Association, AWWA: American Water Works Association and WPCF : Water Pollution Control Federation.

Green shading indicates that the relevant standards have been complied with.

### *Groundwater Quality*

Groundwater quality at Ban Hat Gniun was not measured during the preparation of the environmental impact assessment (ERIC 2007), as, although there is a well at Ban Hat Gniun, the villagers use it only for disposal of waste, and do not draw water from the well. Spring water from a gravity-flow system built under Action Contre la Faim (ACF) and the Nam Ngiep River are the main water sources that supplied water to the village.

#### **3.1.5** *Geology*

Geologic investigations surrounding the main reservoir area provide insight into the geology of the region. The proposed dam site is surrounded mainly by Mesozoic (Jurassic to Cretaceous) flat formations containing sandstones, conglomerates and mudstones. Massive beds of sandstones and conglomerates are found homogeneously on the upper formations. Mudstones and rather thin siltstones can be interbedded with sandstones and conglomerates.

Other rock formations in the region include highly fractured and deeply weathered late Palaeozoic granites intruding into Palaeozoic formations (found in the middle part of the reservoir area), and three additional sedimentary sequences:

- Palaeozoic (Devonian to Permian) formations including shales, mudstones, sandstones and schists are consolidated and hardly permeable. These formations are suspected to be the oldest rocks in this area. Their occurrence was folded and separated into blocks caused by faulting during the Late Palaeozoic;
- Mesozoic (Triassic to Jurassic) sandstones, shales and conglomerates, which are partly fractured and deeply weathered. They are exposed parallel to the folded Palaeozoic basement formations; and
- Quaternary sediments are characterized by river deposits and talus deposits. They are young unconsolidated sediments found along the river and riverside depending on geographical landforms.

#### **3.1.6** *Seismology*

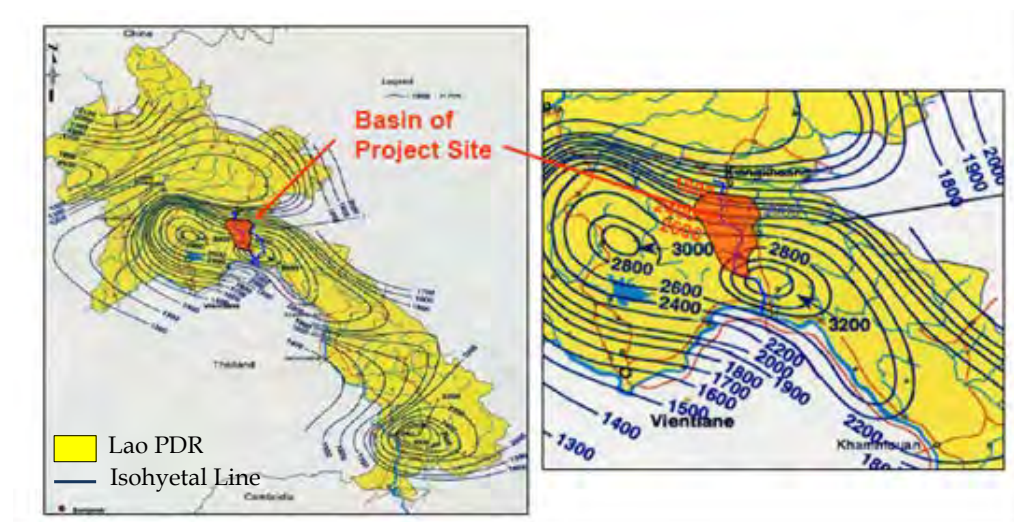
Seismic investigations of the proposed dam sites were conducted for project design. During the past 20 years, there has been no record of an earthquake in the area exceeding magnitude of 5 (ERIC 2007). It can be concluded that the investigated region is characterized by a geological structure with good stability and that seismic activities in the Nam Ngiep river basin are rare (ERIC 2007). This conclusion is supported by the report on “Lao PDR: Natural Hazard Risks”, edited by the OCHA Regional Office for Asia Pacific, issued on 08 March 2007.

### 3.1.7

#### *Hydrology*

The mean rainfall of the basin of 1,870mm/year was finally selected after considering the isohyetal map (Figure 3.1). The mean rainfall of Nam Ngiep River basin was assumed at 1,870mm/year which was substantially less than the annual rainfall in Pakxan (3,000mm). The tropical low pressure system, developed in the China Sea and moving along the Mekong Valley, is blocked by high mountains and steep cliffs of the northwestern region. Because of this formation of peaks and high elevation, there is a tendency for storm formations to stall there until the low pressure dissipates.

Figure 3.1 Isohyetal map



Note: Isohyetal lines represent points of equal rainfall.

Based on actual measurements of discharge at the Mouang Mai station over a fourteen year period, the estimated discharge for Nam Ngiep River at Ban Hat Gnium was calculated. The difference between measured discharge and calculated discharge was minimized through a trial-and-error method. This “tank model” methodology and low flow analysis resulted in annual average discharge (1971 to 2000) of 148.4 m<sup>3</sup>/s.

### 3.1.8

#### *Erosion and Sedimentation*

The Western and Northern edges of the Nam Ngiep watershed form a vast cirque with very steep sides due to headward erosion. On the eastern rim, only outliners remain of the eastern rim which separates this basin from that of the Nam Sane River.

The soils in the region surrounding the proposed reservoir are susceptible to wind and water erosion. A sedimentation assessment undertaken in ERI (2009) estimated the sediment yield from the Nam Ngiep catchment at 178 ton/km<sup>2</sup>/year. This is within the range of other catchments within Laos, and below the average for nine comparable catchments.

## 3.2 *BIOLOGICAL RESOURCES*

Biological resources were assessed using a variety of information sources. The full NNP1 Access Road Biodiversity Assessment Report, December 2013 is provided in *Annex E* and a summary is provided in this chapter.

### 3.2.1 *Survey Methods*

#### *Overview*

The baseline biodiversity values of the Project area have been determined using a number of information sources including:

- Flora and fauna survey within the Huay Ngua PPA and the Re-regulation dam area (as it encompasses the access road network in this area);
- Detailed flora surveys of the road corridor; and
- Desktop sources.

These sources provide description of vegetation communities and habitats, and an assessment of species that may occur in the Project area. The data collated for the purposes of this report can be categorised into two types:

*Direct:* Species recorded during biodiversity field surveys undertaken during the 2013 survey period are considered direct counts. In general the location and specific details of these records has been noted and a higher level of certainty can be inferred.

*Indirect:* Species reported from village surveys or within reports using a more regional study area are considered indirect records. These data sources provide a valuable understanding of the biodiversity of the locality and region however should be afforded further analysis or applicability considered. Data obtained from village surveys can contain errors in some instances, especially when considering identification of species with more challenging diagnostic features.

The reliability of the records has been considered throughout the report and the category of any species records are denoted throughout.

#### *Flora and Fauna Survey of the Access Road Network*

As part of the NNP1 Project Baseline Biodiversity Assessment, field investigations were undertaken by the Thailand Institute of Scientific and Technological Research (TISTR) in four key areas in the region: NNP1 Project area; Nam Xan River Catchment; Huay Ngua PPA; and Houay Soup Resettlement Site.

Field investigations were undertaken in March and July 2013 to collect data representative of wet and dry season biodiversity conditions. The field survey was completed by three teams comprising 25 people targeting separate taxa: vegetation (two teams of seven), terrestrial wildlife (one team of six) and aquatic biota (one team of five). The surveys incorporated detailed assessments that included forest and vegetation cover survey and assessment, wildlife survey and assessment, and aquatic ecology survey and assessment.

Biodiversity values around the main dam site are described in more detail in the Baseline Biodiversity Assessment of NNP1 (ERM 2013).

#### *Department of Forest Resource Management Road Corridor Flora Survey*

Specific to the proposed disturbance area for the road corridor, two surveys have been undertaken to ground-truth flora species and delineate natural/modified habitat.

The Lao PDR Department of Forest Resource Management (DFRM) undertook a flora survey to record tree species adjacent to the existing road between Ban Nomsomboun and Ban Hat Gniem in August 2013 and results were provided to ERM Siam. This assessment was completed independent of the NNP1 assessment.

#### *National University of Laos Ground-truth of Natural Habitat Survey*

Nam Ngiep 1 Power Company engaged Pheng Phengsintham, a local botanist and lecturer of the National University of Laos (NUL) to undertake a similar vegetation assessment along most of the Proposed Road in November 2013. The assessment aimed to identify areas of natural and modified habitat within the Proposed Road.

Areas of natural habitat (current forest) are defined as areas being suitable for forest production and having a tree cover with a crown density of at least 20% (except forest plantations) (NOFIP, 1992). The current forests found in the Project area are upper mixed deciduous forest (UMD) and lower mixed deciduous forest (LMD).

Areas of Modified Forest (Potential Forest) are defined as areas suitable for forest production having a crown density less than 20% and not permanently being used for other purposes (i.e. housing, agriculture, etc) (NOFIP, 1992). In the Project area, modified habitat included fallow land (temporary unstocked forest), bamboo and ray.

Some stretches of temporary and permanent roads in the vicinity of the re-regulation dam were not able to be accessed. Where access was limited, the assessment was based on 53 temporary sample plots where the representative vegetation type and tree species were recorded each side of the proposed road.

### *Desktop Review*

In conjunction with the results of the TISTR field survey results, a desktop review was undertaken to collate and assess other relevant sources. The desktop review included an assessment of:

- online reports relating to the Project area and biodiversity of Lao PDR;
- threatened species profiles and online species distribution information; and
- published literature relating to threatened species and Lao PDR biodiversity.

Specific to the PPA, species identified within the Houy Ngua Provincial Preserved Area Management Plan (MP) 2011-2015 by the Provincial Agriculture and Forestry Office of Bolikhamxay (PAFO) (December 2010) have been considered to have potential to occur in the Project area (indirect data). The management plan reports species based on some field survey and village interview results.

### *Geospatial Analysis*

Geospatial analysis was undertaken to assist in understanding the biodiversity values in the Project area. Primarily this was based on interpretation of a variety of spatial layers provided by DFRM and Rapideye Imagery.

Rapideye Imagery was used to identify the normalised difference vegetation index (NDVI) across the Project area. NDVI is a remote sensing indicator that provides a measure of vegetation density and condition by indicating the photosynthetic capacity of the land surface cover.

For the Project, condition classes (for a range of NDVI) were defined and are shown in *Table 3.2*. These condition classes were used to refine land cover calculations. Areas within the Impacted NDVI range were removed from habitat area calculations.

**Table 3.2**      *Condition Class NDVI Range*

Condition	NDVI Range
Benchmark	0.8 to 1.0
High	0.6 to 0.8
Moderate	0.4 to 0.6
Low	0 to 0.4
Impacted	-ve to 0



## Species Specialist Consultation

In addition to desktop sources, a number of species specialists were consulted to assist in developing an understanding of the importance of the Project area for the critical habitat candidate species.

A summary of the survey methods, including the key literature references, is provided in *Table 3.3*.

**Table 3.3** *Summary of survey methods and information sources*

Researcher	Date	Location	Study Topic
<i>Terrestrial</i>			
Pheng Phengsintham <sup>1</sup>	November 2013	Access Road Project Area	<ul style="list-style-type: none"> <li>Habitat classification (natural/modified)</li> <li>Tree species identification</li> <li>Study area included: <ul style="list-style-type: none"> <li>Full length of: Ban Nomsomboun to Ban Hat Gnum; Jica Road; T9; T10 and T11; and T12.</li> <li>Portions of T7 and T8.</li> </ul> </li> </ul> <p>The complete area surveyed, and locations of sample plots, are shown in Annex G.</p>
TISTR	March and July 2013	Resettlement site Huay Ngua PPA	<ul style="list-style-type: none"> <li>Targeted searches of fauna or signs of fauna (tracks, scats etc) in areas of preferred habitat</li> <li>Spotlighting</li> <li>Mist-net capture of birds</li> <li>Trapping of small mammals</li> <li>Interview of local residents</li> <li>Sampling plots for flora species diversity</li> </ul>
ERIC	October and March 2007	NNP1 Project area (from the dam site north)	<ul style="list-style-type: none"> <li>Interview of local residents</li> <li>Targeted searches of fauna or signs of fauna (tracks, scats etc) in areas of preferred habitat</li> <li>Assessment of flora diversity, density, and biomass of large trees.</li> </ul>
DFRM	2013	Ban Nomsomboun to Ban Hat Gnum road corridor	<ul style="list-style-type: none"> <li>Survey to record tree species in vegetation proposed to be cleared to widen the existing road.</li> </ul>
PAFO	Date unknown	Huay Ngua PPA	<ul style="list-style-type: none"> <li>Interview of local residents</li> <li>Camera trapping</li> </ul>
GIS	various	Regional scale	<ul style="list-style-type: none"> <li>Land cover mapping</li> <li>Rapid Eye imagery and NDVI processing</li> </ul>

Researcher	Date	Location	Study Topic
<i>Aquatic</i>			
ERIC	October and March 2007	Ten stations including stations at Hatsaykham, Hat Gniun and Somseun.	<ul style="list-style-type: none"> <li>• Fish sampling using a seine net</li> <li>• Plankton sampling</li> <li>• Benthic sampling</li> </ul>
PAFO	Date unknown	Huay Ngua PPA	<ul style="list-style-type: none"> <li>• Interview of local residents</li> <li>• Camera trapping</li> </ul>

Source: ERM 2013, ERI 2009

TISTR - Thailand Institute of Scientific and Technological Research

ERI - Environmental Research Institute, Chulalongkorn University

PAFO - Provincial Agriculture and Forestry Office (Bolikhamxay)

DFRM - Department of Forest and Resource Management

1. Local botanist and lecturer of the National University of Laos.

### 3.2.2

#### *Land Cover*

The Lao landscape has historically been dominated by dense forest and, despite more recent clearance, retains significantly more forest coverage than neighbouring countries Thailand, Vietnam and China (Yunnan Province) (Duckworth *et al.*, 1999). The original forests of the Northern-Central Highlands, where the Project area is located, were predominantly dry evergreen and mixed deciduous forests. However, shifting cultivation has removed much of the original forest and large areas of grassland, bamboo and other secondary vegetation are now present. Non-timber forest products such as leaves, shoots, flowers, fruits and bark are used extensively by the Lao people and are of great importance both as a food source and also medicinally and culturally.

Land cover type mapping based on DFRM 2010 forest mapping identifies the dominant forest types within the Project area to be deciduous forest with smaller proportions of old fallow land. The land cover types mapped within the Project area are presented in *Table 3.4*.

**Table 3.4 Land cover types within the Project Area**

Type	Description	Area within Project Area (ha)
<b>Natural Habitat</b>		
Deciduous forest	Deciduous forest occurs when deciduous tree species represent more than 50% of the stand. The forest storeys are not as dense as those of evergreen type. Most often bamboo occurs in this type of forest. Deciduous Forest includes both Upper and Lower deciduous forest types and this definition is based on relative altitude, forest occurring above 200 m is classified as Upper Mixed deciduous Forest and deciduous forest occurring at an altitude 200 m and below is classified as Lower Deciduous Forest.	19
Evergreen Forest	Area dominated by trees where 75% or more of the tree species maintain their leaves all year. Canopy is never without green foliage.	2
Bamboo	Bamboo area where the over-storey has a crown cover less than 5%.	7
<b>Modified</b>		
Old fallow land	Land that has been ploughed and tilled and left un-seeded during a growing season.	12
Young fallow land	Land that has been recently ploughed and tilled and left un-seeded during a growing season.	5
Rice paddy	Areas permanently being used for rice cultivation.	1
Slash and burn	Slash-and-burn is a description of land that has been subjected to an agricultural technique which involves cutting and burning of forests or woodlands to create fields.	1
Urban	Urban Areas include all areas being used for permanent settlements such as villages, towns, public gardens etc. It also includes roads having a width of more than 5 m and areas under electric high power lines. Any type of land under high power lines, except Rice Paddy, should be classified as Urban Areas.	<1
<b>Unclassified</b>		
Water	The land cover class Water includes rivers, water reservoirs (i.e. ponds and dams for irrigation and hydro power) and lakes. Water reservoirs and lakes with an area of 0.5 ha and rivers should be at least 10m wide to be classified as Water.	<1
Shadow	Shadow indicates limitations in the dataset from shadows and cloud contained in the aerial imagery.	1
Cloud	Cloud indicates limitations in the dataset from shadows and cloud contained in the aerial imagery.	<1
Project area is defined as 9.5m road width around the proposed centreline of the road.		

The NUL road flora survey provided an opportunity to ground-truth the spatial data (land cover) to more accurately understand the extent of natural and modified habitat within the proposed road. Ground-truthing results for the Ban Nonsomboun to Ban Hat Gnum section of the proposed road identified substantially less natural habitat (47% natural habitat) than detected in land cover mapping (61% natural habitat). Similarly, ground-truthing of the Jica Road results (11% natural habitat) were less than indicated on land cover mapping (22% natural habitat).

### 3.2.3 *Vegetation Condition*

Vegetation condition based on the NDVI data within the Project area is divided into four categories. The representation of these categories within the Project area is summarised in *Table 3.5* and *Table 3.6*.

The area of high condition with potential to be impacted is approximately 8ha, of which most of the area is located between Ban Hat Gniun and the dam site. The area of high condition vegetation in the route through the PPA (Ban Bonsomboun to Ban Hat Gniun) is less than 1 ha.

**Table 3.5** *Vegetation Condition in the Project Area*

Condition Category (NDVI range)	Area within Project area (ha)
Impacted (- to 0)	1
Low (0 to 0.4)	16
Moderate (0.4 to 0.6)	24
High (0.6 to 0.8)	8

**Table 3.6** *Vegetation Condition - Proposed Road Component Breakdown*

Condition Category (NDVI range)	Ban Nonsomboun - Ban Hat Gniun (ha)	Jica Road (ha)	Permanent Roads Ban Hat Gniun - Dam Site (ha)	Temp Roads Ban Hat Gniun - Dam Site (ha)
Impacted (- to 0)	<1	<1	<1	<1
Low (0 - 0.4)	11	2	1	2
Moderate (0.4 - 0.6)	6	4	6	8
High (0.6 - 0.8)	<1	<1	3	5

### 3.2.4 *Habitat types within the road corridor*

The corridor flora survey identified ground-truthed the Land Zone mapping to confirm the presence of natural or modified habitat in accessible areas of the proposed access roads. *Table 3.7* below summarises the habitat description for segments of the access road, as provided in the draft field report from the corridor flora survey (Phengsintham 2013).

**Table 3.7** *Habitat descriptions from road corridor flora survey*

Road Segment	Habitat Description	Road Status
Ban Nonsomboun to Huay Ngua PPA (km 0+000 to km 5+720)	Primarily modified habitat on left and right sides, except TSP no5 on the left hand side, where regeneration forest occurs across approximately 500 m of the access road.	Existing road

Road Segment	Habitat Description	Road Status
Inside Huay Ngua PPA	<p>Huay Ngua PPA primarily consisted of lower mixed deciduous forest (LMD) (natural habitats) with some patches of modified habitat. Within the corridor, the average DBH in LMD is 38 cm and average distance 9.3 m. In comparison, outside the corridor, the average DBH was 34.5 cm and the average distance 7.8m. Outside the corridor trees recorded where slightly smaller stems size on average though at a greater average distance, suggesting the forest is more dense outside the corridor.</p> <p>A total of 114 Mai Yang Khao have previously been recorded. 21 items were cleared by the EDL (pole installation), 29 exist within the road corridor; and the remaining will be preserved by NNPIPC and PAFO.</p> <p>Removal of Mai Yang Khao could be replaced by replanting the species inside the PPA, supporting the provincial office to improve Huay Ngua PPA through reforestation and providing a check point during road construction.</p>	Existing road
JICA road (km 22+000 to dam site at km 31+320)	<p>JICA road passes through Ban Hat Gnuin and Hatsaykham villages.</p> <p>The sections is primarily modified habitat forest, except two points (TSP no35 and no40), which are small patches of natural habitat (UMD). The Average DBH 43 cm and average distance 7.08 m for TSP no35.</p> <p>This vegetation type represented the dense vegetation (UMD) at the site, but the forest was disturbed by historical logging activities, shifting cultivation (ray) and other agricultural activities.</p>	Existing road
P2 and T12	<p>Three TSPs were established. The area between JICA road and TSP no43 was primarily Fallow Forest (modified habitat). Between TSP no43 and TSP no45 vegetation was primarily disturbed UMD (natural habitat) to the right of the road, and Fallow Forest (modified habitat) to the left of the road.</p> <p>This vegetation represented the highest quality dense vegetation, however the forest was disturbed by historical logging activities, shifting cultivation (ray) and fired in May 2013.</p>	<p>P2 - Proposed new permanent road</p> <p>T12 - proposed new temporary road</p>
T7, T8 and T9 Access Road	<p>Eight TSPs were surveyed in these access roads. The area included young fallow forest (modified habitat), plantation area (modified habitat) and mixed deciduous forest (natural habitat). The average DBH in UMD was 44.8 cm and the average distance 9.48m. In comparison, outside the corridor the average DBH was 28 cm and distance about 6.36m.</p>	Proposed new temporary road

Source: summary of Draft Land Use Study prepared by Pheng Phengsintham (Local botanist and Lecturer of the National University of Laos) (November 2013).

The segments of road from Ban Nonsomboun through the Huay Ngua PPA and along JICA Road are existing roads of varying condition. For these roads the road upgrade will require some disturbance to vegetation, whereas proposed new segments of road will require a larger disturbance to vegetation. *Table 3.4* and *Table 3.5* summarise the area of vegetation types within the corridor.

### 3.2.5

#### Flora Species

The climatic conditions (low temperature, high humidity and high winds) have led to dense growth of several plant species such as Rosewood, Mai Kebe, Mai Ngang (*Dipterocarpus alatus*), Maid Tae (*Sindora cochinchinensis*), Mai Peuy (*Lagerstroemia calyculata*, *Lagerstroemia floribunda*) and Mai Bark (*Anisoptera costata*) (Provincial Conservation Division, 2010).

Sampling undertaken during the 2013 surveys by TISTR recorded 446 species of vascular plants at the Huay Ngua PPA sampling locations and 390 species at the Re-regulation dam site.

In Huay Ngua PPA the vegetation is dominated by mixed deciduous forest with some areas of mixed evergreen forest and secondary growth of mixed deciduous forest. Canopy cover is approximately 60-70 per cent. The forest canopies are divided in 3 classes. In the Re-regulation dam site vegetation was dominated by lower mixed deciduous forest. Canopy cover is approximately 40% and the average height of the upper canopy is approximately 15m.

The dominant species recorded by TISTR in each canopy strata are summarised in *Table 3.8*.

**Table 3.8** *Dominant Flora Species*

Canopy class	Dominant species
<b>Huay Ngua PPA</b>	
Top canopy (20-35m)	<i>Anisoptera costata</i> , <i>Lagerstroemia calyculata</i> , <i>Shorea roxburghii</i> , <i>Irovingia malayana</i> , <i>Alstonia glaucescens</i> , <i>Schima wallichii</i> , <i>Vitex pinnata</i> , <i>Stereospermum fimbriatum</i>
Middle canopy (10-20m)	<i>Acronychia pedunculata</i> , <i>Peltophorum dasyrachis</i> , <i>Nauclea orientalis</i> , <i>Microcos tomentosa</i> , <i>Mallotus paniculatus</i> , <i>Gonocaryum lobbianum</i> , <i>Cratoxylum formosum</i>
Lower canopy (<10m)	<i>Croton cascarillicdes</i> , <i>Breynia glauca</i> , <i>Ardisia helferiana</i> , <i>Glycosmis pentaphylla</i> , <i>Melicope pteleifolia</i> , <i>Allophylus cobbe</i> , <i>Salacia chinensis</i>
<b>Re-regulation Dam area</b>	
Top canopy (~15m)	<i>Macaanga denticulata</i> , <i>Maesa ramentacea</i> , <i>Milletia acutiflora</i> , <i>Lagerstroemia calyculata</i> . The common species of bamboo found in the area, which are <i>Gigantochloa albociliata</i> , <i>Pseudostachyum polymorphum</i> , <i>Bambusa bambos</i> .

The botanical inventory collected within the disturbance footprint by NUL identified 139 species of vascular plants (Phengsintham 2013) that included one Bryophyta species, nine Pteridophyta species, 102 Dicotyledones species, 25 monocotyledons species and three mushroom species.

#### IUCN Listed Flora Species

A total of 12 plant species listed under the IUCN Red List were recorded during vegetation surveys in Huay Ngua PPA and the Re-regulation dam area in 2013 by TISTR, during the DFRM Road Corridor survey and the NUL vegetation ground-truthing survey. These are shown in *Table 3-9*. Threatened species include:

- One species listed as critically endangered;
- Six species listed as endangered; and
- Five species listed as vulnerable.

**Table 3.9** *IUCN Listed Flora Species Recorded within Huay Ngua PPA and Re-regulation Dam*

Scientific Names	Status	TISTR (PPA)	TISTR (Re-reg)	DFRM (Corridor)	NNP1 Botanist (Corridor)
<i>Dipterocarpus turbinatus</i>	CR	✓	✓		
<i>Azelia xylocarpa</i>	EN	✓	✓		
<i>Anisoptera costata</i>	EN	✓		✓	✓
<i>Dalbergia oliveri</i>	EN	✓	✓		
<i>Dipterocarpus alatus</i>	EN	✓		✓	✓
<i>Shorea roxburghii</i>	EN	✓			
<i>Vatica cinerea</i>	EN			✓	
<i>Cycas pectinata</i>	VU	✓			
<i>Dalbergia cochinchinensis</i>	VU	✓			
<i>Hopea odorata</i>	VU	✓	✓		
<i>Syzygium vestitum</i>	VU	✓			
<i>Ternstroemia wallichian</i>	VU	✓			

Mai Yang Khao (*Dipterocarpus turbinatus*) and Mai Bak (*Anisoptera costata*), the IUCN species detected within the disturbance area by NUL are economic trees and can be used for house construction (Phengsintham 2013). The DFRM corridor survey identified 159 *Dipterocarpus turbinatus* stems and 254 *Anisoptera costata* stems in the proposed road and surrounds (DFRM, 2013). The more detailed survey by NUL of the defined proposed road alignment confirmed 29 stems to be disturbed.

### 3.2.6 Fauna Species

A total of 38 terrestrial species of fauna from 19 families, and 31 genera were recorded from the field surveys undertaken in 2013 in Huay Ngua PPA by TISTR. Species diversity of animals recorded in this area was low in comparison to other areas surveyed nearby however this is expected to be due to the lack of secondary data, all records were obtained by direct observation during the field surveys.

Common fish species detected in the Nam Xan River during the recent 2013 surveys included Spiny Barb (*Mystacoleucus marginatus*), Sikuk Barb (*Sikukia gudgeri*), Horseface Loach (*Acantopsis choirorhynchos*), Long Finn Mystus (*Mystus singaringan*). Of these species the Sikuk Barb and Long Finn Mystus are known full migrant species.

Houy Ngua Provincial Preserved Area Management Plan reports (indirect data) fauna species occurring within the PPA to include Wild Pig, Munjac, Clouded Leopard (*Pardofelis nebulosa*), Civet, Flying Squirrel as well as Green Peafowl (*Pavo muticus*), Hill Myna (*Gracula religiosa*), Red Junglefowl (*Gallus gallus*) and the Siamese Fireback (*Lophura diardi*).

Overall, the surveys recorded:

- Nine amphibian species;
- Fifty-nine bird species;
- Twenty-seven mammal species;
- Nine reptile species; and
- Thirty-nine fish species (including twelve species considered to be migratory).

#### *Restricted Fauna Species*

Species listed as Restricted under the Regulation of the Ministry of Agriculture and Forestry No. 0360/MAF includes wild animals and fish which are rare, endangered, high conservation value, and special significance to the economy and national environment.

The surveys (2013) in Huay Ngua PPA and PAFO survey detected the following species listed as Restricted in the Regulation of the Ministry of Agriculture and Forestry No. 0360/MAF:

- Two mammal species;
- Six bird species;
- One reptile;
- One fish; and
- No amphibians.



**Table 3.10** No. 0360/MAF Restricted Fauna Species Noted within Huay Ngua PPA and Re-regulation Dam

Common Name	Scientific Name	TISTR (PPA)	TISTR (Re-reg)	Indirect Data Source (PAFO)	No. 0360/MAF Status
<b>Mammals</b>					
Leopard	<i>Panthera pardus</i>			✓	Restricted
	<i>Pardofelis</i>			✓	Restricted
Asiatic Golden Cat	<i>temminckii</i>				
<b>Birds</b>					
Greater Hornbill	<i>Buceros bicornis</i>			✓	Restricted
Greater Coucal	<i>Centropus sinensis</i>	✓	✓	✓	Restricted
Siamese Fireback	<i>Lophura diardi</i>			✓	Restricted
	<i>Lophura</i>			✓	Restricted
Silver Pheasant	<i>nycthemera</i>				
Grey Peacock-pheasant	<i>Polyplectron bicalcaratum</i>			✓	Restricted
Red-breasted Parakeet	<i>Psittacula alexandri</i>	✓		✓	Restricted
<b>Reptiles</b>					
Reticulated Python	<i>Broghammerus reticulatus</i>			✓	Restricted
<b>Fish</b>					
-	<i>Wallago leeri</i>			✓	Restricted
Common Name	Scientific Name	TISTR (PPA)	TISTR (Re-reg)	Indirect Data Source (PAFO)	No. 0360/MAF Status
<b>Mammals</b>					
Leopard	<i>Panthera pardus</i>			✓	Restricted
	<i>Pardofelis</i>			✓	Restricted
Asiatic Golden Cat	<i>temminckii</i>				
<b>Birds</b>					
Greater Hornbill	<i>Buceros bicornis</i>			✓	Restricted
Greater Coucal	<i>Centropus sinensis</i>	✓	✓	✓	Restricted
Siamese Fireback	<i>Lophura diardi</i>			✓	Restricted
	<i>Lophura</i>			✓	Restricted
Silver Pheasant	<i>nycthemera</i>				
Grey Peacock-pheasant	<i>Polyplectron bicalcaratum</i>			✓	Restricted
Red-breasted Parakeet	<i>Psittacula alexandri</i>	✓		✓	Restricted
<b>Reptiles</b>					
Reticulated Python	<i>Broghammerus reticulatus</i>			✓	Restricted
<b>Fish</b>					
-	<i>Wallago leeri</i>			✓	Restricted

*IUCN Listed Fauna Species*

Three IUCN Red Listed critically endangered, endangered or vulnerable fauna species were recorded within the Huay Ngua PPA area during 2013 surveys by TISTR while PAFO surveys identified 16 species listed as critically endangered, endangered or vulnerable on the IUCN Red List that may occur within the Huay Ngua PPA.

**Table 3.11** *IUCN Listed Fauna Species Recorded within Huay Ngua PPA and Re-regulation Dam*

Common Name	Scientific Name	TISTR (PPA)	TISTR (Re-reg)	Indirect Data Source (PAFO)	IUCN Status
<b>Mammals</b>					
Asian Elephant	<i>Elephas maximus</i>			✓	EN
Fishing Cat	<i>Prionailurus viverrinus</i>			✓	EN
Gaur	<i>Bos gaurus</i>			✓	VU
Malayan Sun Bear	<i>Helarctos malayanus</i>			✓	VU
Clouded Leopard	<i>Neofelis nebulosa</i>			✓	VU
Sambar Deer	<i>Rusa unicolor</i>				VU
Himalayan Black Bear	<i>Ursus thibetanus</i>			✓	VU
Large Spotted Civet	<i>Viverra zibetha</i>			✓	VU
<b>Birds</b>					
White-winged Duck	<i>Cairina scutulata</i>			✓	EN
Green Peafowl	<i>Pavo muticus</i>			✓	EN
Imperial Eagle	<i>Aquila heliaca</i>			✓	VU
<b>Reptiles</b>					
Big-headed Turtle	<i>Platysternon megacephalum</i>			✓	EN
Impressed Tortoise	<i>Manouria impressa</i>			✓	VU
<b>Fish</b>					
Giant Barb	<i>Catlocarpio siamensis</i>			✓	CR
Striped Catfish	<i>Pangasianodon hypophthalmus</i>				EN
Yellow Tail Brook Barb	<i>Poropuntius deauratus</i>	✓*			EN
Thicklip Barb	<i>Probarbus labeamajor</i>			✓	EN
Bandan Sharp-mouth Barb	<i>Scaphognathops bandanensis</i>	✓			VU
Jaguar Loach	<i>Yasuhikotakia splendida</i>	✓			VU
CR = Critically endangered, EN = Endangered, VU = Vulnerable					
*Specialist consultation identified potential for unreliable record					

## 3.2.7

**Priority Biodiversity Values**

Land cover mapping has been used to determine the areas of natural and modified habitat within the Project area. A summary of the area of each habitat type within the Project area and specifically within the project footprint in accordance with IFC PS6 definitions is provided in *Table 3.12*. The results using this remote sensing technique identified that approximately 40% of the area is considered to be natural habitat.

**Table 3.12 Area of Habitat Types within the Project Footprint**

Habitat Type	Estimate within Project Footprint (ha)*
Natural Habitat	28
Modified Habitat	19
Other	1

\*Estimate derived from land cover mapping based on 9-10 m disturbance width.

Assessment of the Project area has not identified any highly threatened and/or unique ecosystems, or key evolutionary processes. And as such, each of the candidate species has been assessed for the critical habitat determination criteria 1-3 using direct and indirect data sources. A summary of the analysis is provided below.

**Table 3.13 Candidate Species Critical Habitat Assessment Summary**

Species	Criteria	Record		Likely Critical Habitat	Comment
		Direct	In-direct		
<i>Azelia xylocarpa</i>	1	✓		No	Not recorded within the disturbance area during ground-truthing.
<i>Anisoptera costata</i>	1	✓		NA	Not native to Lao PDR.
<i>Dalbergia oliveri</i>	1	✓		NA	Not native to Lao PDR.
<i>Dipterocarpus alatus</i>	1	✓		NA	Not native to Lao PDR.
<i>Dipterocarpus turbinatus</i>	1	✓		No	Not recorded within the disturbance area during ground-truthing.
<i>Shorea roxburghii</i> White Meranti	1	✓		No	Not recorded within the disturbance area during ground-truthing.
<i>Vatica cinerea</i>	1	✓		NA	Not native to Lao PDR.
<i>Elephus maximus</i> Asian Elephant	1		✓	No	Project area not of significant importance for the species.
<i>Panthera pardus</i> Leopard	1		✓	NA	Unreliable record.
<i>Pardofelis temminckii</i> Asiatic Golden Cat	1		✓	NA	Unreliable record.
<i>Prionailurus viverrinus</i> Fishing Cat	1		✓	NA	Unreliable record.
<i>Buceros bircornis</i> Great Hornbill	1		✓	No	Project area not of significant importance for the species.
<i>Cairina scutulata</i> White Winged Duck	1		✓	NA	Unreliable record.

Species	Criteria	Record		Likely Critical Habitat	Comment
		Direct	In-direct		
<i>Centropus sinensis</i> Greater Coucal	1	✓		No	Project area not of significant importance for the species.
<i>Lophura diardi</i> Siamese Fireback	1		✓	No	Project area not of significant importance for the species.
<i>Pavo muticus</i> Green Peafowl	1		✓	No	Project area not of significant importance for the species.
<i>Polyplectron bicalcaratum</i> Grey Peacock Pheasant	1		✓	No	Project area not of significant importance for the species.
<i>Psittacula alexandri</i> Red-breasted Parakeet	1		✓	No	Project area not of significant importance for the species.
<i>Brogammerus reticulatus</i> Reticulated Python	1		✓	No	Project area not of significant importance for the species.
<i>Platysternon megacephalum</i> Big-headed Turtle	1		✓	No	Project area of influence limited, i.e. watercourse crossings only.
<i>Cartilopterus siamensis</i> Giant Barb	1,3		✓	No	Project area of influence limited, i.e. watercourse crossings only.
<i>Pangasianodon hypophthalmus</i> Striped Catfish	1,3		✓	No	Project area of influence limited, i.e. watercourse crossings only.
<i>Poropuntius deauratus</i> Yellow Tail Brook Barb	1	✓		NA	Unreliable record
<i>Probarbus labeamajor</i> Thicklipped Barb	1,2		✓	No	Project area of influence limited, i.e. watercourse crossings only.
<i>Yasuhikotakia splendida</i> Jaguar Loach	2	✓		NA	Unreliable record.
<i>Wallago leeri</i>	2		✓	No	Project area of influence limited, i.e. watercourse crossings only.
Migratory fish species		✓		No	Project area of influence limited, i.e. watercourse crossings only.

### 3.3

#### SOCIAL AND CULTURAL RESOURCES

##### 3.3.1

##### Population

There are four villages that will be affected by the access road. These include Ban Thahuea, Ban Sisavath, Ban Nonsomboun, and Ban Hat Gniun/Hatsaykham (a sub-village of Ban Hat Gniun), all in Bolikhan District, Bolikhamxay Province.

It is anticipated that approximately 257 households will be affected by the access road (Table 3-14), which means that approximately 1,285 people will be affected. (It is important to note that Ban Hatsaykham will be resettled as a result of the dam construction (and subsequent inundation) not because of the access road.)

**Table 3.14** *Potentially affected households*

Village	No. of HH	Lao Lum HH	Hmong HH	Khmu HH
Ban Hat Gniun	71	71	--	--
Ban Hatsaykham (sub-village)	41	--	41	--
Ban Thahuea	29	28	--	1
Ban Nomsomboun	70	69	1	--
Ban Sisavat	46	45	1	--
<b>Total</b>	<b>257</b>			

Source: Land Acquisition and Compensation Management Plan: Access Road from Nomsomboun to the Dam Site (2013) Loa Consulting Group

The majority of potentially affected households belong to the Lao ethnic group, while approximately 17% are Hmong and 0.1% belong to the Khmu ethnic group. Thirteen of the potentially affected households are female headed (i.e. 5%), all of which are from the Lao ethnic group.

The potentially affected population may be impacted in a number of ways, including:

- an increase in noise and dust, which is likely to occur as a result of construction activities. This may lead to disturbances within the local villages;
- a temporary loss of access to the road, which is used by villagers to access local markets. This is likely to occur during the construction phase; and
- an increase in traffic once the road is upgraded. This increase will generate additional noise, as well as potentially contribute to an increase in traffic accidents and injuries.

Further details are socio-economic impacts are provided in *Chapter 4*.

In addition, the access road will require the acquisition of land. . Based on existing information, this includes land currently under cultivation (*Table 3.15*), which will impact cash crops (such as cassava) and timber production. In order to manage the impacts associated with land acquisition a Land Acquisition and Compensation Management Plan has been developed.

**Table 3.15** *Impact Land*

Land Type	Ban Hat Gniun	Ban Thahuea	Ban Nonsomboun	Ban Hatsaykham	Ban Sysavath
Abandoned	7	3	--	3	--

Land Type	Ban Hat Gniun	Ban Thahuea	Ban Nonsomboun	Ban Hatsaykham	Ban Sysavath
Building land	3	--	--	--	--
Garden land	27	20	10	3	20
Housing land	7	6	46	0	2
Not cultivated	9	--	--	8	--
Rice field	--	3	--	--	1
Rice field (with supplementary irrigation)	--	1	--	--	--
Unused land	2	--	--	--	--
<b>Total</b>	<b>55</b>	<b>33</b>	<b>56</b>	<b>14</b>	<b>23</b>

Source: NNP1 (December 2013)

The impacts (and the number of people impacted) described above may change depending on the outcomes of field surveys that are currently being undertaken. The survey outcomes will be used to update management measures (and corresponding documentation) that have been designed to mitigate that impacts that are likely to be experienced by local villages.

### 3.3.2

#### *Community Profiles*

Ban Hatsaykham, Ban Hat Gniun, and Ban Thahuea are close to each other along the left bank of Nam Ngiep River, separated from each other by only a few kilometers. Ban Thahuea lies 18 kilometers from the start of the access road, Ban Nonsomboun. *Figure 3.2* to *Figure 3.4* show photos of the villages.

The villages are quite typical for rural Lao PDR, with the houses built in clusters and the productive lands distributed around their settlement.

The governing structure of each village is also typical, with a village headman, deputy village headman, and villagers who are members of the Lao National Front, the Lao Youth, the Lao Women Union, and of village forestry watch groups, village health volunteers, and other similar committees and groups. The villages, especially the Hmong community of Ban Hatsaykham, also have clan leaders and in some cases shamans, who are informal but still influential leaders.

These villages have moderate infrastructure, much of it still in need for improvement. The access road to the villages (except at the start at Ban Nonsomboun) is currently a dirt road which can only be used during the dry season (*Figure 3.6*). Two villages, Ban Thahuea and Ban Nonsomboun, do not have electricity. However, at Ban Hat Gniun and Ban Hatsaykham, about ten small stream-powered electric generators each produce electricity sufficient for just a few lamps or a television.

The villagers tend to use underground water from wells or springs for their consumption and water from the river for general usage. There are primary schools in all the villages, though the schools in Ban Hatsaykham and Ban Thahuea only cover the first 2 or 3 years of primary school. None have a secondary school. Ban Hat Gniun and Ban Thahuea have a Buddhist temple

each (*Figure 3.5*). Each village has its own cemetery. None of the villages have a health center, the patients have to travel to the nearest district health center at Bolikhan District, three kilometers away from Ban Nonsomboun but about 20 kilometers distance for Ban Hat Gniun, Ban Thahuea and Ban Hatsaykham. *Table 3.16* below provides a summary of the infrastructure of these four villages.

**Figure 3.2** *Ban Hat Gniun*





**Figure 3.3** *Ban Thahuea*



**Figure 3.4** *Ban Nonsomboun*





**Table 3.16** Existing infrastructure of villages affected by the access road

Village	Infrastructure Service					Social Welfare				
	Electricity	Water supply	Road	Market	1 <sup>st</sup> school	2 <sup>nd</sup> school	Health centre	Temple	Cemetery	Grocery
Hat Gniun	-	✓	✓	-	✓	-	-	✓	✓	✓
Hatsaykham	-	✓	✓	-	-	-	-	✓	✓	✓
Thahuea	-	✓	✓	-	✓	-	-	✓	✓	✓
Nonsomboun	✓	✓	✓	-	✓	-	-	NA	✓	✓

Source: Data from field survey 2007, and Resettlement and Ethnic Minority Development Plan (REDP), Revision in 2013

**Figure 3.5** A Buddhist temple at Ban Hat Gniun



Other than a small band of homes along the access road and in some areas near the existing access road, communities in the two villages along the project area are remote and difficult to access. This is especially the case during the wet season. Often villages can only be accessed by four-wheel drive vehicles or on foot.

Figure 3.6 The existing access road



In addition, the infrastructure for the local educational system poses a major challenge. In many of the villages, the schools were built during the late 1990s for children at the elementary school level. Children from Ban Thahuea village attend a joint school operated with the village of Ban Hat Gniun (*Figure 3.7*). The condition of the schools is described to be good at these two villages.



Figure 3.7 A school at Ban Hat Gniun



There is a public water supply which originates from the Nam Tak stream in Ban Hat Gniun. However, the lack of a suitable water supply system in Ban Thahuea is one of main complaints from the local people. The lack of a suitable supply system has forced residents to have to carry water from the Nam Xao River for all their domestic usage (Figure 3.8).

Figure 3.8 Nam Xao





One of the main challenges for villagers in this area results from a lack of adequate health care facilities - there are no healthcare facilities in the villages surrounding the access road. Instead each village has a health volunteer. This individual is responsible for maintaining the village emergency medical kit and providing general advice for minor illnesses.

Given the lack of healthcare facilities, people in this area typically use traditional medicine or treatments when they fall ill or when they incur injury.

Both Ban Hat Gniun and Ban Thahuea are particularly hard to access during the rainy season. Only small boats are used for transportation at that time. Nearest villages are Ban Nonsomboun and Ban Somseun but they are located far away about 18 km.

*Figure 3.9* *Nam Ngiep*



### 3.3.3

#### *Livelihood*

The villagers rely on agriculture for their living, with rice being the main crop mainly for household consumption, and some surplus being sold. In addition to rice, people in these four villages also grow maize, sugar cane, cassava, banana, and pineapple, with some of these also for sale. At their houses, they have stands with flat beds where they grow spices and herbs, at a high enough level to protect the plants from their animals. They also grow vegetables around the homestead and along the riverbank. Villagers surround the vegetable plots with woven bamboo fences, again to keep out animals. All households raise a variety of animals. Chickens, ducks and pigs roam around the houses. Some larger pigs are kept in stalls. Other large animals such as buffaloes, cows and goats are usually left to roam or herded during the day before being brought back to stay near the house at night. Animals are an important source of income for the families.

The villagers also make use of many of the surrounding natural resources, in particular the community forests and the river. Their houses are built from wood and bamboo from the forests and grasses from the fields. Their food is cooked with fuel wood gathered from the forests. Many foods, such as mushrooms, bamboo shoots, vegetables, and herbs are gathered from the forests, and wildlife commonly hunted. The rivers are also an important source of food, with almost every meal including some fish, either fresh or preserved.

### 3.3.4

#### *Socio-economic*

The main sources of income of the people in the villages affected by the access road are the sale of livestock and the sale of agricultural products. Agricultural products are cultivated for household consumption; it is often the excess that is sold at market for income.

Secondary sources of income are the sale of surplus fish, NTFPs, and handicrafts. These goods are either sold to other villagers or taken for sale to the market at Pakxan. On occasion a trader will come to the villages to buy the products.

As agricultural production is a key source of income, improvements in the access road will likely provide positive benefits for the villages. For example, the road will reduce the amount of time spent traveling to and from local markets. This means more time can be spent cultivating crops or on other relevant activities.

In addition, this improvement in market access may result in changes in agricultural production. This includes a shift in the types of crops grown – i.e. a move towards more marketable crops – as well as a potential increase in the number of people involved in agricultural production.

### 3.3.5

#### *Education and Health*

Availability of educational facilities has a direct impact on educational levels of the villagers. Children from Ban Hatsaykham and Ban Thahuea can only complete their primary education at the primary school in Ban Hat Gniun. Many families in these villages do not believe it is worth the effort or cost to send their children to another village for studies, and so Ban Hatsaykham and Ban Thahuea have on average lower education levels and higher rates of illiteracy. In contrast, the children of Ban Nonsomboun, living close to Pakxan, have more opportunities and much greater convenience to continue their studies to at least the secondary level at the district centre.

Attitudes of some villagers remain an obstacle to education. Education is not a high priority for their children (in particular for girls) as major concerns are around the inadequacy of food availability. Therefore, these families are not likely to understand the impact of education in improving their daily life. Traditionally, girls are supposed to work at home and education is not considered important for them.

Though no health centres are available in the affected villages, there are village health volunteers in charge of the emergency medical kit and they are able to provide advice on some minor illnesses. Generally, villagers seek traditional medical treatment for minor illnesses and turn for health care to the government health centres or hospital only for more serious illnesses.

### 3.3.6

#### *Public health*

The public health infrastructure and personnel of Bolikhamxay Province is presented in *Table 3.17* below. Despite the following health facilities, there are no facilities located in the villages immediately surrounding the access road.

**Table 3.17** *Public Health Facilities and Public Health Personnel in Bolikhamxay Province*

No.	Facility	Units	Bolikhamxay Province
1	Provincial Hospitals	Sites	1
	Capacity	Beds	80
2	District Hospitals	Sites	6
	Capacity	Beds	70
3	Health Centers	Sites	5
	Beds	Beds	80
	Villages in revolving drug funds program	%	78
4	Village Health Kits	Kits	N/A
5	Physicians, top level	People	N/A
6	Physicians, high level	People	N/A
7	Medical workers, medium level	People	N/A
8	Medical workers, elementary level	People	N/A
	Total Health Care Workers	People	368
	Provincial Hospitals	People	77

No.	Facility	Units	Bolikhmxy Province
	District Hospitals	People	41
	Health Centers	People	11

Source: Resettlement and Ethnic Minority Development Plan (REDP), Revision in 2013.

In 2006, the Provincial Health Office (PHO) collected data to assess the public health situation in Bolikhmxy Province. The ten most common diseases and causes of illness and death in this province are summarized in *Table 3.18*.

**Table 3.18** *Top ten diseases and causes of illness in Bolikhmxy province*

No	Disease - causes of illness in 2005-2006	Number of Cases
1	Dengue Fever	246
2	Diarrhea	142
3	Dysentery	90
4	Malaria	74
5	Food Poisoning	65
6	Meningitis	38
7	Typhoid	36 (01 death)
8	Hepatitis B	11
9	Measles	02
10	Tetanus in babies	09

Source: Bolikhmxy Provincial Health Office

Based on similar data collection by the District Health Office (DHO) in Bolikhan and Pakxan districts, the diseases and illnesses present include malaria, dengue fever, diarrhea, dysentery, acute respiratory infection (ARI), bronchitis, influenza, measles and stomachache. Public health concerns in the Bolikhan District mainly focus on endemic or seasonal epidemic diseases. For children under the age of five, the leading causes of death reported by the health services throughout the district in the last three years include malaria, acute respiratory infection (ARI), and severe diarrhea. For adults, the leading cause of death includes hypertension and accidental circumstances.

**Table 3.19** *Mother and child health condition*

No	Mother and Child Health in 2005	Bolikhan District	Pakxan District
1	Mortality rate - under 1 year of age	18/1,000	14/1,000
2	Mortality rate - under 5 year of age	16/1,000	16/1,000
3	Maternal Mortality rate	402/100,000	100/100,000
Children Vaccinated			
1	BCG	95%	99%
2	DPT 3	82%	88%
3	Measles	72%	73%
4	TT	32%	33%



*Figure 3.10 Bolikhan district hospital*



*Figure 3.11 Moung Mai health centre*





Figure 3.12 Sanoudom health centre



### 3.3.7

#### *Archaeology*

##### *Ban Hat Gniun (Bolikhnan District, Bolikhamxay Province)*

The village is situated on the left bank of the Nam Ngiep River. During the Indochinese war time (1960s), the village was destroyed by the Royalist troupes and was thus abandoned as the inhabitants went to live in the forest. It was resettled again in 1970. Ban Hat Gniun was a stronghold of Pathet Lao forces because it was the gate from the Xieng Khouang Plateau (under Pathet Lao control) to the plain of the Mekong River. In 1975, Ban Hat Gniun played an important role for the Pathet Lao when they overthrew the Royalist administration and seized the power at Pakxan, the capital city of the Bolikhamxay province.

**Figure 3.13** *Buddhist temple at Ban Hat Gniun*



### Artefacts

There were not any artefacts displayed in this village.

### *Ban Thahuea ( Bolikhan District, Bolikhamxay Province)*

Ban Thahuea is located on the left bank of Nam Xao, a tributary of Nam Ngiep. The inhabitants migrated from inland areas such as Nakhata and Vang when they founded the village during the 1980s. There is a Buddhist temple at the village but it lacks a permanent monk. “Thahuea” means “river port”. In old times when tracks were not constructed, this area could only be reached from the Mekong valley by boats coming upstream on the Nam Ngiep River. The boat trip ended at Thahuea because the river was no longer navigable beyond this port due to cascades and rapids. From the north, a land route connected Thahuea to the Plateau of Xieng Khouang. Caravans ensured transportation of goods between these two centres. Some caravans descending from the Xieng Khouang Plateau prolonged their journey beyond Thahuea as far as to Bolikhamxay city because the land route was shorter than that on the river. Nowadays, in parallel with the land transportation, the fluvial traffic remains important because it inter-connects the villages that are on the riverine network which includes the Nam Ngiep and its tributaries. A regular navigation service is operational from Thahuea down to Bolikhamxay and includes the villages along the Nam Xao, an important tributary of Nam Ngiep.

Thahuea is also referred to in local oral traditions. The story goes that, once upon the time, a golden boat sank in the Nam Xao, nearby its confluence with the Nam Ngiep. In reverence to the spirit of this mythical boat, the boatmen still to this very day give offerings of flowers, candles and cigarettes when they pass the wreck site.

The history of the village was told to the Project consulting team by Mr. Bounhieng Sayalath, aged 47, deputy headman of the village. Mr. Sombat Chaleunsay, aged 31, village security, showed three historic sites of ruins that probably were brick Buddhist temples at one point. These sites are located on the opposite bank of the river.



*Figure 3.14 Ban Thahuea*



*Figure 3.15 The Buddhist Temple of Ban Thahuea*



Table 3.20 Artefacts



**Dimensions (cm)**

Height : -  
 Width : -  
 Thick : -

**Provenance:** This bronze Buddha image was found in the ruins of an old temple (site no.1) located on the opposite bank of the actual Ban Thahuea village in 2006, now kept in the new temple.

**Significance:**

Inventory No.20: Bronze Buddha image (meditation)

**Date:** Late Lane Xang Period, (c. 19 A.D)

Figure 3.16 Location of the ancient Buddhist temples, site number 1, 2 and 3






Ancient Buddhist temple of Ban Thahuea, Site No. 1



The site Number 1 is located on the right bank of a flat terrace of Nam Xao River, which is now transformed to a farm land of the village. This land parcel is fenced around and belongs to private property. The brick structure is situated at the central part of this land parcel, about 20 m from the river bank. Its actual state of preservation is very poor. It suffered from weathering and vandalism, only a mound of bricks about 2.50 m high without any precise shape remained. According to the limit of the mound, its shape seems to be rectangular about 8 x 16 m, oriented east-west. Because of the thick brush, it



was difficult to generate a detailed description of this temple. The survey team did observe a looting hole in the middle of the mound and the remains of some fragmented Buddha statues which were made of stone and mortar. The size of bricks is 5 x 11 x 23cm and 5 x 12 x 24cm. The supporting beams of this temple were probably made of wood, with the roof covered in tiles. The remains of any wooden structure cannot be seen but the evidence of roof tiles can still be found *in situ*.

**Figure 3.17** Site no. 1, Ban Thahuea

Item No.	Photo
1	
2	
3	

Item No.	Photo
4	
5	

Note: Site No. 1: Remains of a Buddhist temple in Ban Thahuea. The brick structure of the altar and sanctuary, along with fragmented Buddha statues, are still visible at the site.  
 1 and 3: A mound of ruins covered by vegetation.  
 2: Stone image of Buddha seated on Naga, from Maravijaya period.  
 4 and 5: Fragment of arm and body of the main Buddha statue made of mortar and bricks.

### Ancient Buddhist temple of Ban Thahuea, Site No.2

Site No.2 is located approximately 100 m south of Site No. 1. Only a platform of bricks about 1 m high remains visible at the site. A big hole about 2 x 2 m and 1.50 m deep indicates recent vandalism at this site.

Potsherds of historic significance were also observed by the survey team in the vicinity of these ruins; this may indicate the presence of important historic settlements in this area. According to Mr. Sombat Chaleunsay, similar but smaller ruins once existed in the village; this might indicate that dense populations have once settled in this area.

*Figure 3.18 Site no. 2, Remains of Buddhist temple*



Ancient Buddhist temple of Ban Thahuea, Site No. 3

This site is located about 400 m south-west of Site No.2. Its size is approximately 12 x 18 m, oriented NE-SW. The remaining brick platform is about 2 m high. Brick size: 6 x 12 x 24cm.



Figure 3.19 Site no. 3, Remains of Buddhist temple





## **ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES**

Impacts have been identified based on the project as described in *Section 2*. In summary, Project activities will include:

### Construction

- Clearing of vegetation for new roads (26.21 km), passing bays, quarries (2.9 ha), workers camps (2 ha), borrow area (3.4 ha), spoil area and batching plant;
- Earthworks for new roads and passing bays;
- Grading of new roads (26.21 km);
- Surfacing roads (49.21 km);
- Filling potholes and areas of erosion in existing roads (32.3 km);
- Creation of side ditch drains on all roads (58.51 km);
- Construction of permanent culverts (completed);
- Construction of a permanent bridge (completed);
- Construction of a temporary bridge (0.09 km);
- Extraction of material from quarries (estimated 120,000 m<sup>3</sup>);
- Extraction of soil from borrow area (estimated 86,000m<sup>3</sup>);
- Crushing of material at the crushing facility;
- Disposal of excess material in spoil area;
- Construction of worker camp; and
- Operation of worker camp.

## Operation<sup>1</sup>

- Vehicle travel on access roads;
- Presence of roads and bridges; and
- Road maintenance.

Some impacts are discussed in relation to 'sensitive receptors'. Sensitive receptors in the Project area are shown in *Figure 4.1* and include four villages (and one subvillage) and two water courses:

- Ban Thahuea;
- Ban Sisavath;
- Ban Nonsomboun;
- Ban Hat Gniun/ Hatsaykham (a sub-village of Ban Hat Gniun);
- Nam Xao;
- Nam Miang;
- Nam Tak; and
- Small streams within Huay Ngua.

## 4.1 DESIGN AND PRE-CONSTRUCTION STAGE

### 4.1.1 Hydrology

Poor design of road works and bridges can lead to:

- Inappropriate drainage in quarries and borrow areas that could alter the flow of surface water and impact groundwater levels by drawing the water table closer to the surface.
- Altered river flows due to poor bridge and culvert design.

#### *Mitigation Measures*

- Construction will be scheduled to occur during the dry season wherever possible;

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<sup>1</sup> The worker camp may be used during operation, i.e. during construction of the reservoir, however impacts of the operation of the worker camp is within the scope of the environmental assessment of the construction phase of the main NNP1 project.

- Bridges and culverts will be designed in accordance with the Best Available Techniques provided in Annex 2.1 of the ESMMP-CP; and

- Quarries and borrow areas will be contoured to avoid surface water collecting.

#### 4.1.2 *Water Quality*

Poorly design road and infrastructure layouts can lead to:

- High levels of erosion and sediment run off;
- Contaminated run off from waste and hazardous materials storage areas; and
- Leaching of sewage and domestic waste from camp and construction areas.

##### *Mitigation Measures*

- Construction of roads in steep areas and watercourse crossings will be minimized wherever possible;
- Adequate waste and materials storage areas will be provided for within the site layout; and
- Stockpile materials (excavated soil, quarry materials etc.) will be located at least 30 m away from steep slopes, watercourses or drainage paths;
- Solid and septic waste management systems will be planned for.

#### 4.1.3 *Biodiversity*

Inappropriate layout design can lead to unnecessary, avoidable impacts to flora and fauna species and their habitats.

##### *Mitigation Measures*

- A flora assessment and other targeted environmental assessments have been undertaken within the access road to identify areas of biodiversity value to be avoided;
- The design and layout has been planned in consideration of alternative routes to avoid protected areas (refer *Section 5*);
- Further design and layout considerations will minimise tree cutting and protected area disturbance where possible.

#### 4.1.4 *Land Use*

Inappropriate layout design can lead to unnecessary, avoidable impacts to existing land uses and subsequent impacts to livelihoods.

## *Mitigation measures*

The project layout has been designed to minimize the acquisition of productive land, and it has been determined that there will be no significant losses of vegetation or land use that will impact on the social conditions of the surrounding communities. If further layout changes occur, productive land acquisition for the road alignment will be minimized as far as possible. Compensation for the loss of property will be provided to the affected people. This will be managed by the Land Acquisition and Compensation Management Plan that has been developed by the Project, which means that it will be dealt with through a separate process.

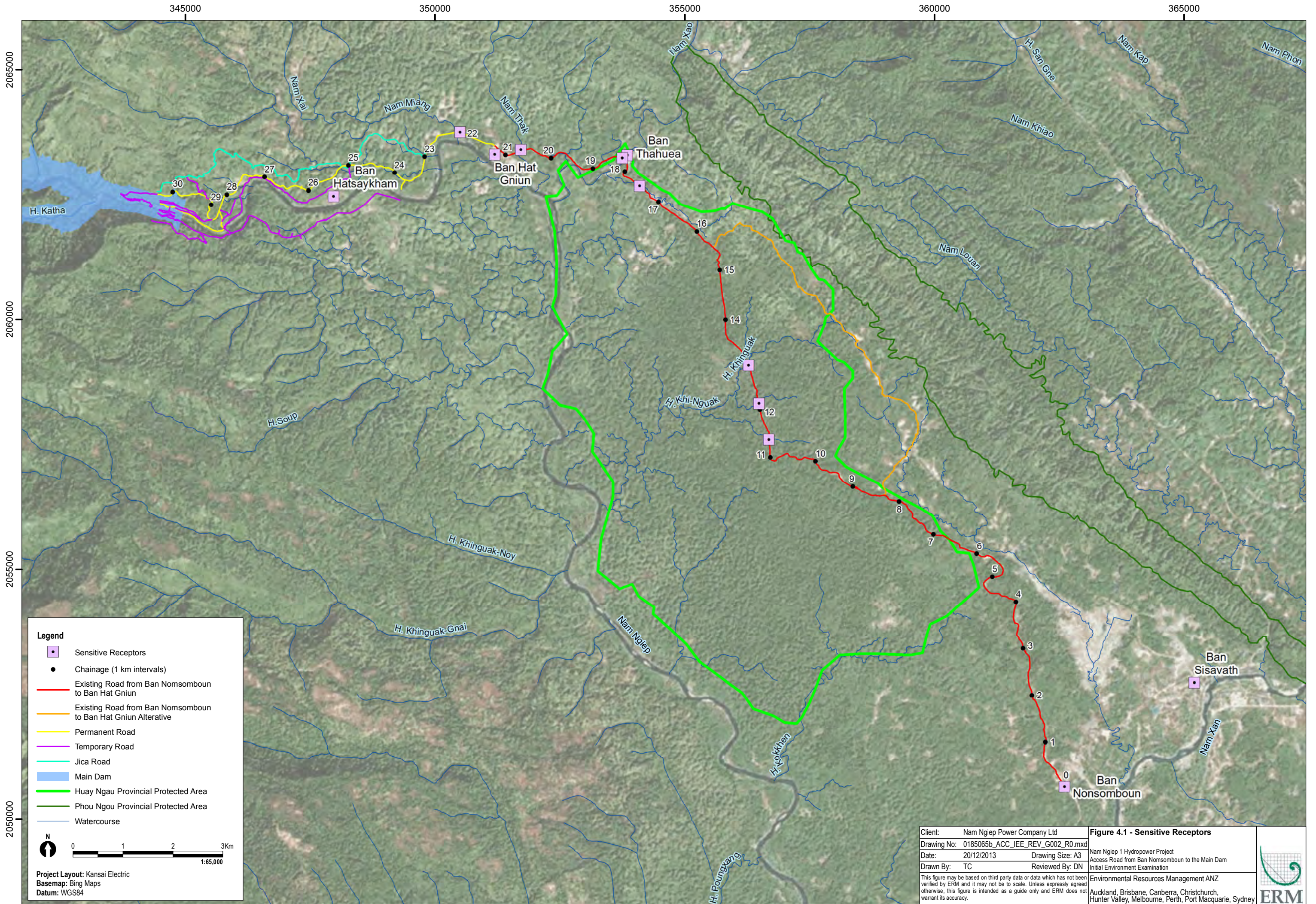
## **4.2 CONSTRUCTION STAGE**

### **4.2.1 Hydrology**

Impacts to hydrology may include the following:

- Clearing of vegetation for road construction may speed the movement of surface runoff, however the construction of side ditches will retain run off from roads and allow infiltration in close proximity to the access roads. Given the construction of side ditches and a maximum road width of 13.5 m (average 9.5 m) the impact of this to the area's hydrology is expected to be minor;
- Construction of a temporary bridge may require temporary diversion of water (for example through earth damming and use of a diversion pipe). This impact to hydrology will be short-term, occurring only during the construction of the bridge. Hydrological impacts of the construction of the temporary bridge are negligible compared to inundation during the main project; and
- Extraction of material from the quarry and borrow area may create depressions which result in the collection of standing water. This could alter the flow of surface water by draining to the depressions, and impact groundwater levels by drawing the water table closer to the surface.





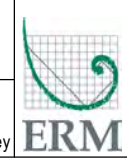
**Legend**

- Sensitive Receptors
- Chainage (1 km intervals)
- Existing Road from Ban Nomsomboun to Ban Hat Gniun
- Existing Road from Ban Nomsomboun to Ban Hat Gniun Alternative
- Permanent Road
- Temporary Road
- Jica Road
- Main Dam
- Huay Ngau Provincial Protected Area
- Phou Ngou Provincial Protected Area
- Watercourse

N  
 0 1 2 3km  
 1:65,000

Project Layout: Kansai Electric  
 Basemap: Bing Maps  
 Datum: WGS84

Client: Nam Ngiep Power Company Ltd	<b>Figure 4.1 - Sensitive Receptors</b>
Drawing No: 0185065b_ACC_IEE_REV_G002_R0.mxd	Nam Ngiep 1 Hydropower Project
Date: 20/12/2013	Access Road from Ban Nomsomboun to the Main Dam
Drawn By: TC	Initial Environment Examination
Reviewed By: DN	Environmental Resources Management ANZ
<small>This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.</small>	
<small>Auckland, Brisbane, Canberra, Christchurch, Hunter Valley, Melbourne, Perth, Port Macquarie, Sydney</small>	





### *Mitigation Measures*

- Wherever possible, construction will occur during the dry season;
- River diversion during bridge construction will be designed with the intent of maintaining water flows within the watercourse. If river diversion is expected to alter flows to an extent that would lower the downstream water level, local people must be informed of changes to water levels, including expected extent and duration of change;
- Quarries and borrow areas will be contoured to avoid surface water collecting; and
- Following completion of extraction, quarries and borrow areas will be rehabilitated to reinstate contours as similar as possible to the original contours. Rehabilitation will aim to reproduce surface water flows, groundwater flows and groundwater levels as similar as possible to the original state.

#### 4.2.2

#### *Water quality*

Impacts to water quality can occur from erosion and sediment run off, discharge of inadequately treated sewage and domestic waste, and release of hazardous materials. These pollution sources are discussed further below.

#### Erosion and Sediment

The EIA for the main NNP1 Project estimated sediment yields as between 178 tons/km<sup>2</sup>/year and 248 tons/km<sup>2</sup>/year (ERI 2009). Based on relative areas of clearing, the contribution of project components for the Access Road Project is estimated to be between 98 tons/km<sup>2</sup>/year and 137 tons/km<sup>2</sup>/year.

Sensitive erosion areas have been defined to identify areas with the greatest risk and include: areas with slopes greater than 30 per cent; areas within 30 m of a bank of a natural watercourse; and cut and fill slopes in areas of slope instability or erodible geology. In total, sensitive erosion areas cover 16,000 m<sup>2</sup>, and the expected soil volume from these areas is 800 m<sup>3</sup>.

These level of erosion have the potential to lead to deposition of sediment and increased turbidity of water which can limit photosynthesis, suffocate benthic fauna and more broadly degrade aquatic habitat. Sources of erosion and sediment run off include:

- Erosion and sediment run off from construction activities that expose or move soil (including clearing of vegetation, earthworks, extraction of material from quarries and borrow areas and disposal of excess material);
- Release of sediment laden effluent during construction, for example drilling and tunneling wastes; and

- Erosion and sediment released from stream bed and bank disturbance during bridge construction.

### Effluent

Sources of sewage and domestic waste include:

- construction camps, which can discharge litter, sewage, and wastewater containing high levels of nutrients, organic matter, pathogens, oils and heavy metals;
- concrete batching plants, which if not adequately managed can produce highly alkaline wastewater;
- discharge of bitumen overspray; and
- wastewater from equipment clearing during road surfacing.

### Hazardous Materials

Hazardous materials that may be used in the Project include:

- Paints and solvents;
- Petroleum products such as oils, fuels, and grease;
- Acids for cleaning masonry;
- Concrete curing and repair compounds; and
- Contaminated waste material.

There is potential for hazardous materials to be released to the environment, particularly during hazardous material storage and handling and equipment/vehicle maintenance.

### *Mitigation Measures*

Implementation of appropriate mitigation measures can significantly reduce the impacts of the project on water quality. Specific mitigation measures are provided in the site-specific ESMMPs and sub-plans of the ESMMP-CP, including:

- SP01 Erosion and Sediment Control;
- SP02 Water Availability and Pollution Control; and
- SP06 Hazardous Material Management.

In general terms, the following water quality management measures should be implemented:

## Erosion and Sediment

- Clearing and earthworks will be undertaken in the dry season to minimize erosion and subsequent release of sediment;
- The period of soil exposure will be minimized through staged clearing and construction activities, and covering exposed areas (for example by planting fast growing ground cover or covering with riprap, sand bags, erosion mats, bale dikes, mulch, or excelsior blankets) at the earliest time possible. Exposed areas of stream banks will be covered immediately, and preferably be replanted with locally native herbaceous and woody vegetation;
- If in-stream diversion is required during bridge construction, any diversion infrastructure must be clean and made of suitable materials that will not contribute to turbidity or salinity;
- At watercourse crossings, machinery will operate from stream bank, not the stream channel, whenever practicable with minimal streambed disturbance. All disturbed streambeds will be returned to their original condition or better as soon as possible;
- If vegetation clearing is required on stream banks, vegetation will be cut near or at ground level to leave root mass in the ground. This helps to reinforce soil stability and reduce erosion;
- For areas in direct runoff path to a watercourse, sediment and erosion control devices will be installed and maintained until vegetation replanting can occur to stabilise disturbed surfaces;
- Stockpile materials (excavated soil, quarry materials etc) will be located at least 30 m away from steep slopes, watercourses or drainage paths;
- Water quality will be monitored regularly, and if found to exceed standards defined in the ESMMP-CP, additional water quality measures will be implemented.

## Effluent

- Prior to operation of asphaltic concrete batching plants and casting yards, the contractor shall install wastewater treatment systems that have the capacity to treat wastewater to a quality compliant with relevant standards (refer to ESMMP-CP);
- Solid and septic system waste management systems will be installed and maintain facilities in good working order;
- Pollution prevention techniques such as drip pans and absorbent materials for all paving machines to limit leaks of paving materials will be used; and



- Do not carry out bitumen spraying in windy or rainy conditions, or when rainy conditions are imminent.

#### Hazardous Material

- All the fuel and hazardous material storage will be adequately bounded to prevent any spillage problem;
- Only minimal chemicals, hazardous substances and fuel will be stored on site works;
- Whenever feasible, mobile fuelling/maintenance units will be used for construction equipment to avoid/reduce on-site fuel/lubricant storage; and
- Discharge of oil contaminated water into the environment is prohibited.

#### 4.2.3

#### *Air Quality*

Air quality can be impacted by:

- Dust emissions from exposed soils (due to clearing of vegetation, earthworks, extraction of material from quarries and processing areas);
- Dust emissions from increased traffic on existing unsealed roads, and new roads prior to surfacing;
- Dust emissions from transport of soils and materials; and
- Chemical pollutants from fuel combustion for road vehicles and equipment.

Air emissions have the potential to impact the health of workers, as well as flora and fauna (*Section 4.2.5*). With appropriate mitigation measures in place, impacts to air quality are expected to be minimized to an appropriate level.

#### *Mitigation Measures*

Specific air quality mitigation measures are provided in the ESMMP-CP, particularly in SP07 Emission and Dust Control. Measures include:

- Restricting vehicle movement to designated access routes;
- Covering all loads;
- Watering exposed surfaces during windy conditions;
- Maintaining the condition of the vehicle fleet;
- Daily monitoring of dust levels through visual inspection; and

- Implementing measures to limit vehicle speeds, particularly around sensitive receptors, for example by installing speed bumps.

#### 4.2.4 *Noise and Vibration*

Operation of construction machinery has the potential to cause noise disturbance to nearby villages, as well as flora and fauna. Noise can also present a health and safety risk to workers. The majority of the access road and ancillary infrastructure are located within sparsely populated areas, however the project infrastructure does pass through or near Ban Nonsomboun (KP 0), Ban Thahuea (KP 18) and Ban Hat Gnium (KP 20).

##### *Noise Impacts*

The WHO report entitled “Guidelines for Community Noise” establishes health-based guideline values of noise exposure, for which no adverse effects of community noise exposure on human health would be expected. The report provides guidance on various levels of risk to public health due to noise. This concept allows countries and developers to adopt their own level of noise control, according to affordability and technical feasibility versus public health risks. It is also recommended that community noise exposure should be managed through the use of environmental health impact analyses.

Potential noise impacts associated with grading and construction have been assessed using methodology developed by FTA (Federal Transit Administration, 1995). Noise levels generated from construction equipment are provided in *Table 4.1*.

**Table 4.1** *Noise Levels Generated from Construction Equipment*

Type of Equipment	Maximum Level (dBA at 50 feet)
1. Grader	85
2. Scrapers	89
3. Bulldozers	85
4. Heavy Tracks	88
5. Backhoe	80
6. Pneumatic Tools	85
7. Concrete Pump	82
8. Crushing Equipment	77

Source: Federal Transit Administration (1995)

Typically, construction equipment operates intermittently, and multiple pieces of equipment can operate simultaneously. In order to model the possible effects from construction equipment at the Project site, the consulting team assessed a typical scenario in which a grader (85dBA) and a scraper (89 dBA) operate concurrently and continuously in the same area. The combined sound level of these two pieces of equipment would be approximately 90 dBA at a distance of 50 feet from the construction site.

Noise outputs from grading activities have been investigated, and noise estimates at various distances are provided in *Table 4-2*. Noise estimates are based on a source level of 90 dBA (measured at 50 feet). Distance attenuation, molecular absorption, and anomalous excess attenuation were taken into account in the calculation.

The results in the table indicate that the foreseeable construction noise could be approximately 90 dBA at the closest residences. If short-term sound-level measurements at residential locations in the Project area indicated that existing ambient sound levels are in the range of 40 to 45 dBA, the construction noise will have a potential to be more than 5 dBA above the existing ambient sound level.

#### *Vibration Impacts*

Vibration levels from different construction activities must be calculated. Using reference source vibration levels and typical usage factors, peak particle velocities (PPV) must be calculated for construction activities.

Using the method recommended by FTA (Federal Transit Administration, 1995) known as reference vibration amplitude (PPV<sub>ref</sub>), the vibration produced by the grading activities of a large bulldozer was 0.089 in/s at 25 feet of distance. The vibration was assumed to attenuate over changing distance according to the following equation:

$$PPV = PPV_{ref} \times (25/\text{distance})^{1.5}$$

Using the above equation and recommended reference amplitude, the estimated vibration amplitude at various distances was calculated and summarized in *Table 4.2*.

**Table 4.2** *Estimated Grading-Related Construction Noise in the Project Area\**

Distance to Receptor (feet)	Sound Level at Receptor (dBA)	PV (in/S)
25	-	0.08900
50	90	0.03100
100	84	0.01100
200	78	0.00390
400	71	-
500	-	0.00100
600	67	-
800	65	-
1,000	-	0.00035
1,200	60	0.00027
1,500	58	-
2,000	55	0.00012
2,500	52	-
3,000	49	-

Distance to Receptor (feet)	Sound Level at Receptor (dBA)	PV (in/S)
4,000	45	-
5,280	41	-
7,500	34	-

The above table is based on the following assumptions:

- Basic sound level drop-off rate: 6.0 dB per doubling of distance
- Molecular absorption coefficient: 0.7 dB per 1,000 feet
- Analogous excess attenuation: 1.0 dB per 1,000 feet
- Reference sound level: 90 dBA
- Distance for reference sound level: 50 feet
- Vibration estimate is based on the vibration of a large bulldozer

### *Mitigation Measures*

Measures to limit impacts from noise and vibrations are provided in the ESMMP-CP, and specifically in sub-plan SP04 Noise and Vibration. The following general measures will be applied:

- All noise and vibration generating construction equipment shall be operated and maintained to minimize noise emissions, including using appropriate sound dampening equipment and avoiding unnecessary revving and idling of vehicles;
- Construction equipment and vehicles will be subjected to regular inspections to check noise emissions and noise control equipment;
- Stationary noise sources will be positioned as far as practicable from dwellings, worker camps, schools, business and sensitive receptors;
- Hearing protection will be made available for all construction personnel; and
- High noise activities, such as blasting, will be carried out only within the hours of 6am to 7pm, and residents should be informed of these activities.

#### **4.2.5**

### ***Biodiversity***

Impacts of the road corridor on biodiversity, including terrestrial and aquatic biodiversity, have been assessed in the NNP1 Access Road Biodiversity Assessment Report (ERM 2013). The full Biodiversity Assessment (ERM 2013) is provided as Annex A to the ESMMP-CP.

The assessment identified that impacts to areas of natural and modified habitats are of negligible or minor significance; however impacts to threatened species, listed on the IUCN list are of moderate significance.

Impacts to natural and modified habitats include:

- *Loss of natural and modified habitat due to vegetation clearing:* In general, the natural and modified habitats to be cleared are common and widespread within the region and the loss will be limited to that necessary for construction. The areas to be temporarily disturbed are considered unlikely to impact the viability or functioning of adjacent ecosystems. A diversity of flora and fauna species were reported to occur in the Huay Ngua PPA (based on targeted ecological surveys and/or village surveys), including IUCN listed species (sensitivity medium) in the disturbance area and the habitat for these populations will be locally reduced. Considering the extent of clearing in the context of the broader Huay Ngua PPA, the removal is not likely to threaten the long-term viability of the habitat and biodiversity;
- *Barrier to movement and habitat fragmentation:* new road construction and widening of roads may cause a barrier to the movement of terrestrial fauna. In addition, the construction of water crossings may require a temporary barrier to flows which may inhibit the movement of aquatic biota;
- *Habitat Degradation:* construction may degrade habitats through the introduction of invasive species, release of hazardous materials or impacts to water quality;
- *Edge effects:* Where vegetation clearing occurs, adjacent vegetation and habitats are exposed to increased noise, light, dust and wind environment as well as increased competition from predators and invasive species. In general, the habitats that may be impacted are common and widespread within the region and the impact is not likely to impact the viability/function of adjacent habitats;
- *Fauna mortality:* Fauna mortality can occur during vegetation clearing activities and road transport in the event individuals are struck by vehicles and machinery. It is likely that most individuals will disperse from clearing locations into adjacent habitats however some less mobile species may experience a localised reduction in abundance during this period; and
- *Disturbance to fauna behavior:* Noise and light disturbances during construction have the potential to influence fauna breeding, roosting or foraging behaviour. The Project area has an existing road where human activity is likely to induce a base level of disturbance in directly adjacent areas however the construction activities are likely to increase these types of disturbance.

Impacts to threatened species (listed on the IUCN Red List of national restricted species list) can be of moderate significance. These include:

- The removal of up to 28 ha of natural habitat that may provide suitable habitat for Critically Endangered, Endangered, Vulnerable and Restricted species, including the Asian Elephant, Fishing Cat, White-winged Duck and Green Peafowl, Gaur, Malayan Sun Bear, Clouded Leopard, Sambar Deer, Himalayan Black Bear and Large Spotted Civet. The majority of the mammal species are highly mobile and home ranges are not likely to be contained within the disturbance area. The turtle is susceptible to mortality during construction. An assessment of critical habitat status in accordance with the ADB Sourcebook guideline identified that it is unlikely the area would be considered critical habitat; and
- Disruption of aquatic habitat during the construction of watercourse crossings. Species that may utilise the area include the Big-headed Turtle, Giant Barb, Striped Catfish and Thicklipped Barb. Construction of watercourse crossings could inhibit movement of aquatic fauna and degrade habitat through water quality, noise and vibration impacts.

### *Mitigation Measures*

Key measures to minimize impacts to aquatic and terrestrial biodiversity are provided in *Table 8-2*. Comprehensive measures to manage impacts to biodiversity are provided in the ESMMP-CP, particularly sub-plans SP07 Vegetation Clearing, SP08 Landscaping and Revegetation, SP09 Protected Areas, SP10 Biodiversity Management and SP16 Training and Awareness.

In summary, the following mitigation measures apply to the conservation of biodiversity:

- The measures outlined in the ESMMP-CP, including measures to manage hydrology and water quality (SP02), weed and pest management (SP10), hazardous material management (SP06), air quality (SP03) and noise and vibration (SP04), will be implemented;
- The design and layout plan will be prepared to minimise tree cutting and protected area disturbance where possible;
- Restriction of clearing to the pre-defined clearance area will be strictly enforced;
- Efforts will be made to raise awareness of the values of natural habitat to construction personnel;
- Regularly monitor the road corridor for signs or evidence of illegal logging or poaching and inform government controlling agency of any illegal activity;
- Strict rules against logging outside the approved construction areas and against wildlife hunting and poaching will be imposed on project staff, workers, and all contractors and personnel engaged in or associated with NNP1. Penalties will be levied for anyone caught carrying and using fire arms, or using animal snares and traps, including fines and dismissal, and prosecution under the laws of the Lao PDR;

- Landscaping and re-vegetation will be undertaken after completion of construction using native species where possible;
- Speed limits to maximum of 40 km/hr for construction vehicles will be enforced to minimise potential for fauna strike; and
- Hunting wild animals will be strictly prohibited and will apply to all staff.

The implementation of these measures will substantially reduce the significance of the impact to biodiversity. There is likely, however, to be a residual impact which cannot be avoided, including the clearing of areas of natural and modified habitat. These residual impacts will be offset in accordance with the Biodiversity Offset Design Report (ERM 2014). The proposed offset package includes the option of improved management of the Huay Ngua PPA, Phou Khao Khouy National Protected Area and the Nam Ngiep Watershed. The offset design is proposed to offset the residual values lost for the entire NNP1 project, including the values lost from the access road construction.

#### 4.2.6

#### *Land Use*

The impacts on changes in land and resource use as related to the resident populations in the Project area and the resultant indirect effects these changes will have on individuals and communities vary greatly among the Project zones. The proposed changes to resource utilization patterns are integral to the Project's main management plans, which will likely enable more stable and sustainable resource utilization. In some areas changes to natural resources as a result of the Project will likely lead to new opportunities for resource and land use. Some effects may be difficult to predict and are less known at this stage of planning. Such effects will be closely observed and monitored to ensure the health, well-being and lifestyle of individuals and their surroundings are not compromised by the Project.

There will be no significant losses of vegetation or land use that will impact on the social conditions of the surrounding communities. While some of the surrounding areas are being used for swidden areas the impact assessment shows that the losses are minor; when compared to the extent of the surrounding unstocked forest, the losses can be more than easily absorbed. There will be no exacerbated impact on the already existing dry evergreen or dry deciduous forests, which are the two most important forest resources in the area in terms of forest use for NTFPs and as wildlife habitats.

In case of a delay in access road construction, the local people might use the Land Use Right along some section of the road for their agriculture activities. NNP1PC must take consideration of compensation actions in regards to those who are using the Land Use Right before starting the construction.

After approval of the NNP1 by the Lao PDR government, NNP1PC must recheck the access road alignment and place signs along the road in order to inform the public and to limit the extent of land intrusion for agriculture purposes.

At Ban Hat Gniun and Ban Thahuea, NNP1PC has to reach agreement with the chief of the community and the villagers for the access road alignment. At present the villagers are willing to have the access road passing through the village. Public consultations at villages before starting road construction should be undertaken.

#### *Mitigation Measures*

Agriculture has an important role in the local subsistence economy. For this reason, it is very important to restore agriculture productivity in the Project area as timely and efficiently as possible. The following improvement activities in the Project area should be taken into account.

- Livestock in affected areas will be relocated to the newly provided agricultural land;
- Productive land acquisition for the road alignment will be minimized as far as possible. Compensation for the loss of property will be provided to the affected people;
- In case the agricultural techniques are to be changed due to the characteristics of the site (i.e., different elevation, steeper plainer slopes, etc.), the farmers will be provided with necessary inputs such as seeds, fertilizer and mulch (for increasing soil organic matter);
- A separate Land Acquisition and Compensation Management Plan has been prepared, which sets out the land acquisition and compensation arrangements for the Project. This means that this impact will be managed through a separate process.

#### **4.2.7** *Economy and Livelihoods*

The access road will have a major positive effect on the economy within and around the Project site. The main sources of income of the people in the villages affected by the access road are the sale of livestock and agricultural products. Secondary sources of income are the sale of surplus fish, of NTFPs, and handicrafts. These goods are either sold to other villagers or taken for sale to the market at Pakxan. On occasion a trader will come to the villages to buy the products.

#### *Mitigation Measures*

The following measures should be implemented to maximize the benefits of the project to the economy and livelihoods:

- NNP1PC will carefully manage the labor conditions and atmosphere around the construction site;
- NNP1PC will monitor the quality of life of the villagers in the Project area during the construction phase;



- Even though the local people can be categorized as unskilled laborers in regard to construction work, the construction contractor will aim to hire more local people during the Project development. Local hiring will help the villagers with new sources of income and new skill sets. This can help to improve the quality of life in the villages. At the very least, the local people will be informed that the Project aims to involve the public. Local people who join the Project staff can learn more about the construction occupation such as using construction equipment and working as a team. It is acknowledged, however, that much of the labour, especially skilled labour, will come from outside the Project area. NNP1PC will prioritise hiring local labour for unskilled work as well as skilled positions, where the applicants are qualified for skilled positions; and
- In addition to the above measures, a Land Acquisition and Compensation Management Plan has been developed. It sets the compensation arrangements for the Project – which means that this issue will be dealt with through a separate process.

#### 4.2.8

#### *Community Health and Safety*

The negative effects on community health and safety are may include the following:

- A possible increase in the transmission of communicable diseases (i.e., malaria, dengue fever, diarrhoea, HIV/AIDs and STDs, and other endemic diseases) in the Project area. This impact should be minor and most cases prevented if the necessary mitigation and monitoring measures are carried out as detailed in the assessment; and
- A possible decrease in the availability of food sources resulting in malnutrition of the local residents. This is due to the requisition of land for the Project activities. However, the probability of this situation occurring is considered to be extremely low because of the compensation provided by NNP1PC to ensure the residents have access to at least the same previous level of nutrition or better.

The positive impacts on public health may include the following:

- Improved health care in the area, and improved access to district and provincial health centres due to road improvements;
- Increased income could lead to improved nutritional status; and
- Community development funds from the Project operation could result in greater investment in infrastructure and services such as clean drinking water systems, latrines, health education programs, and mobile clinics.

According to a survey conducted over the years, there have been a number of diseases occurring in and around the Project area. While many of these diseases are not very dangerous or life threatening, such diseases need to be closely monitored to ensure the well-being of all communities in the Project area.

#### *Mitigation Measures*

- A public health education campaign will be carried out by one of the Project's social safeguard staff to ensure that the local population understands and is aware of proper hygiene, disease prevention (including transmission pathways and symptoms of relevant diseases) and basic health promotion. It is likely that resettlement and migration will be quite rapid due to the expansion of job opportunities, fisheries, transportation, local trading, health services and tourism. For a rural community with a large number of people living together, public health education would be very helpful in relation to maternal and child health, nutrition, malaria, Japanese encephalitis, intestinal parasitic diseases and some water-borne diseases such as opisthorchiasis and paragonimiasis with vectors and intermediate hosts existing in the area. The Nam Ngiep1 Project will cooperate with district and local health authorities in this regard. This will be carried out by one of the Project's social safeguard staff;
- Impregnated mosquito nets will be provided to the Project workers and the general population. The provision of treatment programs and rapid diagnostic testing must also be available in the Project area and will be implemented in cooperation with health authorities, including volunteer health workers; and
- Latrines will be provided for each household in the Project area so that villagers have access to clean and safe water as soon as possible, particularly before the construction phase is launched.

#### **4.2.9**

#### ***Damage to Property***

The access road will run adjacent to community infrastructure and intersect drainage and irrigation channels. This could affect quality of farming practices, thereby affecting livelihoods, as well as public attitudes toward the Project.

#### *Mitigation Measures*

- When constructing in the vicinity of irrigation and drainage channels, channels should be pegged and marked out to avoid unnecessary disturbance (such as driving over/through channels);
- If irrigation/drainage channels are to be intersected by the road, they will be reinstated in the final road design, for example by installing pipes below ground;

- The contractor shall immediately repair and/or compensate for any damage caused by the project to properties (houses, farmlands, aquaculture ponds, irrigation canals, etc.), community facilities such as water supply, power supply, communication facilities and the like; and
- In addition to the above measures, a Land Acquisition and Compensation Management Plan has been developed. It sets the compensation arrangements for the Project – which means that this issue will be dealt with through a separate process.

#### **4.2.10** *Occupational Health and Safety*

Construction activities present health and safety risks to personnel, including:

- accident and injury while working;
- spread of transmissible diseases between workers; and
- contraction of disease due to poor sanitation and environmental conditions in work and accommodation areas.

##### *Mitigation Measures*

Health and safety measures are detailed in the SP17 – Project Personnel Health and Safety Program. The following measures are a summary of the key measures in SP17:

- Health Awareness Training will be mandatory for all personnel, and will address both on-the-job safety, and health awareness;
- Clean drinking water will be provided to all camps and work areas;
- Adequate sewage treatment will be provided;
- First aid kits will be readily accessible by workers and first aid teams will be specifically trained and assigned in groups of two to three persons to the different sites; and
- Vector control of mosquitoes and other pests will be managed including by minimizing mosquito breeding habitat and providing mosquito nets and other barriers.

#### **4.2.11** *Physical Heritage*

The preliminary archaeology and cultural heritage survey report of Nam Ngiep 1 Hydropower Project (produced in October 2007) indicated that there was potential for the area surrounding the access road to be rich in sites of archaeological, historical, cultural and natural beauty significance.

This information has been used as part of the Land Acquisition and Compensation Management Plan. The Plan indicates that 22 grave sites at a

cemetery in Ban Hat Gniun/ Hatsaykham will need to be removed during construction of the access road.

#### *Mitigation Measures*

In terms of mitigation measures, compensation will be provided for appropriate rituals and ceremonies to remove the impacted graves from the road alignment.

#### **4.2.12** *Traffic*

Traffic disturbance will occur during construction works at the junction of Ban Nonsomboun along the section of the existing highway from Pakxan to Bolikhan and Thasi. The road used to access the market may be temporarily closed. In this location, disturbance of traffic will be high. In addition, construction vehicles will be very large compared to the local vehicles used by the community and this may present a safety risk.

#### *Mitigation Measures*

The following mitigation measures will be applied to minimize impacts from construction traffic, and impacts of roadwork on local traffic:

- All roads within the construction area will be signposted to facilitate traffic movement, provide directions to various components of the construction activities and provide safety advice and warnings in Lao and English;
- Traffic speed regulation devices, such as speed bumps, and signage will be installed at sensitive locations including in the vicinity of villages, construction camps, at busy intersections or before the sharp bend, and in areas of high habitat value if necessary;
- Prior to the movement of special loads on public roads, including hazardous materials or large items of including hazardous materials or large items of construction equipment, the ESMMU will be notified. If the ESMMU require additional measures, reasonable and practical measures will be implemented to ensure that the risk of harm to the community and environment is minimized during transportation of special loads; and
- Temporary detours will be provided and communicated where required, to minimise disruption to local traffic.

### **4.3** *OPERATION STAGE*

The operation stage of the Access Road Project covers the use of the access roads and bridges, including the use of the temporary roads and bridge during the construction of the main components of NNPI, and use of permanent roads during construction and operation of NNPI, and maintenance of access roads. The operation stage does not consider further operations of the quarries, spoil areas, borrow area or worker camp. Use of

this ancillary infrastructure following construction of the Access Road Project is part of NNPI.

#### 4.3.1 *Hydrology*

The following impacts to hydrology may occur during the operational phase:

- The presence of impermeable bitumen roads in place of vegetated areas or dirt roads will prevent infiltration at the road and may increase the velocity of surface runoff. This could lead to erosion, and, in extreme cases, landslides. However, the drainage design is expected to retain run off from roads and allow infiltration in close proximity to the access roads. Given the construction of side ditches and a maximum road width of 13.5 m the impact of this to the area's hydrology is expected to be minor; and
- If poorly designed, the presence of bridges has the potential to disrupt streamflows. In particular, restriction of flows may lead to increased upstream flood levels and accelerated erosion due to increased flow velocities. Removal of a beneficial restriction could also lead to increased downstream flows.

#### *Mitigation Measures*

- Road drainage will be designed and constructed to retain surface runoff and facilitate infiltration; and
- Bridges will be designed to maintain pre-construction flows, including by designing the bridge to: minimize the use of pylons to retain the existing channel section; operate with a freeboard between the flood level and bridge deck, avoid encroachment of bridge abutments into the channel.

#### 4.3.2 *Water Quality*

Access roads may have the following impacts to water quality during the operational period:

- The presence of hardstand areas (roads sealed during construction) has the potential to impact water quality through the operational phase by reducing infiltration, which has the potential to increase overland flows carrying pollutants to watercourses. As discussed in *Section 4.3.1*, the drainage design is expected to sufficiently retain surface runoff to avoid this risk; and
- Heavily used roads can become contaminated with heavy metals, oils and surfactants that may be released to waterways in surface run-off. Sources of contaminants include tyre wear, brake lining wear and vehicle exhaust. Due to the anticipated low levels of traffic, the risk of contamination from these sources is low.

#### *Mitigation Measures*

- Road drainage will be designed and constructed to retain surface runoff and facilitate infiltration.

#### **4.3.3** *Air Quality*

Air quality during the operation phase may be impacted by dust emissions from the use of unsealed roads. Impacts to air quality from vehicles traveling on access roads are included in the scope of the NNP1 environmental assessment.

#### *Mitigation Measures*

During operation, the following mitigation measures may be required:

- Watering unsealed roads during windy conditions;
- Implementing measures to limit vehicle speeds, particularly around sensitive receptors, for example by installing speed bumps; and
- Undertaking daily monitoring of dust levels through visual inspection.

#### **4.3.4** *Noise and Vibration*

Vehicle noise emissions can affect both surrounding fauna, and vehicle operators/passengers. Management actions are required to avoid noise emissions significantly exceeding pre-disturbance noise levels on existing roads.

#### *Mitigation Measures*

To minimize noise generation:

- Vehicles will be operated and maintained to minimize noise emissions, including fitting sound dampening equipment (such as sound and vibration absorbing materials to reduce engine, gearbox and road noise, and improved exhaust systems) and avoiding unnecessary revving and idling of vehicles;
- Vehicles will be subjected to regular inspections to check noise emissions and noise control equipment; and
- All vehicle operators will be provided with hearing protection;

#### **4.3.5** *Biodiversity*

The operation of the road may adversely impact biodiversity through:

- Mortality of animals due to vehicle strike; and

- Potential increased levels of hunting due to improved access to natural areas, including the Huay Ngua PPA.

#### *Mitigation Measures*

Impacts to biodiversity during the operational phase will be mitigated through the following measures:

- Speed limits to maximum of 40 km/hr for construction vehicles will be enforced to minimise potential for fauna strike;
- Strict rules against logging outside the approved construction areas and against wildlife hunting and poaching will be imposed on project staff, workers, and all contractors and personnel engaged in or associated with NNP1. Penalties will be levied for anyone caught carrying and using fire arms, or using animal snares and traps, including fines and dismissal, and prosecution under the laws of the Lao PDR; and
- Commitment will be made to raise awareness of values of natural habitat areas to construction and operation work force and arrangements will be made for restriction of poaching and forest product collection.

The residual impact to biodiversity will be offset in accordance with the Biodiversity Offset Design Report (ERM 2013 in draft).

#### **4.3.6**

#### *Traffic*

The creation of new access roads and upgrade of existing access roads will significantly improve traffic flow in the area. This may have additional subsequent benefits, including a positive economic impact as people can travel more easily for employment and trade, and a positive improvement to safety of road travel in the area.

#### *Mitigation Measures*

To maximize the benefits of the Project to traffic flow, economic activity and road safety, a regular maintenance program will be implemented.

#### **4.4**

#### **REHABILITATION**

Following construction of NNP1, temporary access roads, and any areas no longer required for use (such as quarries and borrow pits) will be rehabilitated. It is recommended that rehabilitation occur at the earliest time practicable, and may be staged to allow areas to be rehabilitated as each area is no longer required. The following measures will be implemented:

- Upon completion of construction, grade any disturbed area outside the limits of dams, reservoirs pools, permanent roads, and other permanent facilities to provide proper drainage and blend with natural contour with



the land. Following grading, revegetate using plants native to the area, suitable for the site condition, and beneficial to wildlife;

- Engage a suitably qualified botanist/ecologist to prepare a rehabilitation management plan, including advice on appropriate species and rehabilitation methods to gain a positive conservation benefit;
- Sites for disposal of excess soil and spoil were selected to minimise cut sections and will be designed to drain to stable soil surfaces and above the area to prevent run-on onto these areas. These areas will also be seeded with appropriate local seed stock;
- Following abandonment, remove all yards, offices, and construction buildings, including concrete footings and slabs from the site;
- Obliterate all temporary construction roads above high-water mark, restore to the original contour, and make them impassable to vehicle traffic when no longer needed by the contractors. Remove culverts as appropriate, contour and vegetate road escarpment, and scarify all road surfaces to establish conditions appropriate for reseeding, drainage, and erosion prevention. Temporarily or permanently block all access roads to permit establishment of planted vegetation;
- Where applicable, consult with the following agencies to determine the recommended plant species composition, seeding rates, and planting dates: Department of Natural Resources and Environment, Department of Agriculture and Rural Development; and
- Grasses, forbs, shrubs, and trees appropriate for site conditions and surrounding vegetation will be included in the plant list. Species chosen for a site will be matched for site drainage, climate, shading, resistance to erosion, soil type, slope, aspect, and vegetation management goals. Wetland and riparian species will be used in revegetating disturbed wetlands. Upland revegetation shall match the plant list to the site's soil type, topographic position, elevation, and surrounding natural communities.

#### 4.5

#### *POTENTIAL ENVIRONMENTAL RISKS TO THE PROJECT*

Environmental factors can influence construction and operation of the Project. Some environmental factors may have minor impacts to the Project, such as windy conditions prohibiting road bitumen spraying or requiring additional resources to undertake dust control. However other environmental factors may have significant influences on the Project. These are discussed in further detail below.

#### 4.5.1 *Hydrology*

Currently, limited information is available on the hydrology and flood risk of the area, as there is a lack of long-term hydrologic data in the area. Flooding could have a number of impacts to the Project, including:

- Preventing access to construction sites;
- Damaging existing roads and partially-constructed roads;
- Damaging equipment; and
- Presenting a risk to human safety from floating debris, or materials and equipment that have been washed away.

##### *Mitigation Measures*

To limit impacts to the Project from flooding, the following measures should be taken:

- Emergency flood response plans (include response to flash flooding) will be prepared prior to the flood season, and implemented during flood events; and
- Construction materials must be secured and locked down during the flood season.

#### 4.5.2 *Geology*

Seismic investigations of the proposed dam site concluded that the investigated region is characterized by a geological structure with good stability and that seismic activities in the Nam Ngiep river basin are rare (ERIC 2007). However, there is potential in the region for landslides or rock movement, particularly along steep slopes around the construction site. Landslides could damage access roads and present a safety risk to personnel.

##### *Mitigation Measures*

The following measures should be implemented to manage the risk of landslides:

- The potential for landslides and rock movements around the Project site will be investigated during construction; and
- If there are any sections along the access road that have the potential for landslides or rock movement, the construction contractor must address the problem before construction activities can continue.

As described in *Section 2*, the purpose of the Access Road Project is to allow for the transport of construction materials and equipment from outside the Nam Ngiep1 Hydropower Project to support the construction of NNP1. The existing roads from Ban Nomsomboun to the Dam Site are dirt roads prone to flooding with pot holes, eroded areas, and standing water. Currently, these roads are not suitable to support project activities.

A number of alternative scenarios, including alternative routes and levels of rehabilitation/upgrades have been considered to identify the various scenarios that are financially and technically feasible, with the minimum environmental and social impact. In particular, alternatives were considered to minimize the length of road within protected areas.

### 5.1

#### *ALTERNATIVES FROM BAN NOMSOMBOUN TO BAN HAT GNIMUM*

Part of the proposed road ('Proposed Road') from Ban Nomsomboun to Ban Hat Gnum passes through the Huay Ngua PPA. Huay Ngua PPA was established in 2010, is categorized as Conservation Forest under Forestry law and is approximately 12 km length from south east to North West. In order to avoid impacts to the PPA, a preliminary study of re-routing outside the PPA was considered.

The main alternative considered ('Alternative Road') is an existing route which runs to the north side of the proposed road between Ban Sisavat and Ban Thafuea. The Alternative Road was constructed for use by French and US troops in the 1960s to access to Ban Hat Gnum. However, the Alternative Road is no longer in use.

The Proposed Road was developed in 1993, supported by French government and used as a transportation road for people and materials and agriculture, and collection of Non-Timber Forest Products by villagers residing along the Proposed Road.

The Alternative Road mostly consists of footpaths connecting to Ban Tahuea as very narrow passways. Passways are not accessible in wet seasons due to flooding, and villagers only use the Alternative Road for agricultural purposes. The Alternative Road is also located close to or within the boundary of Phou Ngou Provincial Protection Forest, though there is a buffer zone of about 50 to 100 m between Huay Ngua PPA and Phou Ngou Provincial Protection Forest according to the Provincial Department of Natural Resource and Environment.

An 'Alternative Route' has been considered which will use segments of both the Proposed Road and Alternative Road. A layout of the Proposed Road and Alternative Route are shown in *Figure 2.1*.

### 5.1.1









### *Comparison Proposed Road and Alternative Route*

The Alternative Route starts from Ban Nonsomboun along the same route of the Proposed Road, and branching at KP8.5 to the Alternative Road, connected to the Existing Access Road at KP16.0 again and reaching to Ban Hat Gniun through Ban Thafuea. The Alternative Road was checked by site reconnaissance on 2 and 3 October 2013. A comparison of specifications for each plan is shown in *Table 5-1*. Photos of the Proposed Road and Alternative Route are provided in *Table 5-2*.

**Table 5.1** *Specifications of Proposed Road and Alternative Route*

	<b>Proposed Road</b>	<b>Alternative Route</b>
Construction period	Built by French support in 1993 The road between Ban Sisavat and Ban Thafuea is often flooded during the rainy season and French improved accessibility to Ban Thafuea and shifted the road alignment, higher elevation than that of the Alternative Route constructed in 1960s.	Originally built by French and US troops in 1960s. After completion of the existing road, this road looks to be no longer used.
Existing road width	5 m to 10 m	1.0 m to 3.5m
Total length (Ban Nomsomboun to Ban Hat Gniun)	21.2 km [(PPA) 11.8 km + 10.4km]	22.7 km [(PPA) 8.7 km + 14.0 km]
Total length passing through PPA	11.8 km	8.7 km
Road condition	Dirt road	Dirt road and footpath
Accessibility during rainy season	Accessible by car	Inaccessible during the wet season
Road users	Villagers, collectors of wood and tree butcher	Villagers but for access to agricultural land only
Land use inside PPA	Forest	Forest and paddy field
UXO and land use survey	Conducted	Not yet conducted
Electricity	22 KV transmission line is under construction along the road	No plan
Method of access road construction	Improvement of existing dirt road by increasing road width and creating pavement.	Almost a new road and careful consideration of drainage is required

Table 5.2 *Photos of Proposed Road and Alternative Route.*

Proposed Road	Alternative Route
	
	
	
	

Source: NNP1 October 2013

The assessment of the Proposed Road and Alternative Route indicated that each scenario would have similar environmental and social impacts. These impacts are outlined in *Table 5.3*.

**Table 5.3** *Comparison of environment and social impacts, and feasibility of Proposed Road and Alternative Route*

<b>Proposed Road</b>	<b>Alternative Route</b>	<b>Conclusion</b>
<b>Natural Environment</b>		
Lands along the existing road alignment has already been developed with houses or agriculture lands. EA for was conducted and ESMMP-CP is prepared.	The road used by villagers is narrow and has only limited usage, mostly by people walking or riding a motorbike. Vegetation cover has almost recovered to the equivalent of natural conditions. EA and ESMMP-CP have not yet been completed.	Alternative Plan will be required more land/ forest clearance works.
<b>Affected area inside PPA</b>		
Road length within PPA: 11.8 km Affected area: 3.54 ha. This is calculated as: Road construction width 8m less Existing road width 5 m = 3m 3m x 11.8 km	Road length within PPA: 8.7 km Affected area: 3.91ha. This is calculated as: Expanded road width 8 m less existing road width 3.5 m = 4.5 m 4.5 m x 8.7 km	Alternative Route will require more forest clearance within PPA.
<b>Environmental Impacts</b>		
If an access road is constructed, there may be a negative impact to biodiversity in protected areas (for example, easy access to illegal logging) as well as a positive impact (improved management of protected areas through NNP1 offset program).	If an access road is constructed, there may be a negative impact to biodiversity in protected areas (for example, easy access to illegal logging) as well as a positive impact (improved management of protected areas through NNP1 offset program).	Each road passes through and near protected areas. Similar impacts for each scenario.
<b>Land acquisition</b>		
There is no private land between KM 8.3 and KM15.5 of Access Road "junction to Access Road"	Based on initial estimates of the road width, including backfilling to reach sufficient height of the road to protect it from flooding, would require the acquisition of approximately 46,000 m <sup>2</sup> of paddy rice fields and some areas of other privately held land along the alternative route.	Alternative Plan will require more land acquisition and thus affect more Project Peoples "PAPs" directly through the loss of paddy rice fields and other lands.
<b>Existing right of way inside PPA</b>		
Bolikhamxay Province has already set the right of way within the PPA with a width of 30 m along the Access Road.	Not yet set and Actual width of the road on site may be deemed as right of way.	Proposed Road preferred.



Proposed Road	Alternative Route	Conclusion
<b>Construction Approval</b>		
Approved its construction by GoL already	Not yet approved	Planning process for Proposed Road is further progressed.
<b>Construction cost (Ban Nomsomboun to Ban Hat Gnum)</b>		
USD 4.2M	Preliminary estimate Approximately USD 6.9 M Total road length is 1km longer than Proposed Road. The Alternative Road passes through lowland "paddy field" which is inundated during the wet season, and natural forest. A higher embankment, more soil improvement, box culvert, and pipe culvert will be needed.	The construction cost of Alternative Plan is much higher than that of Original Plan.

### 5.1.3 *Route Options Comparison - Biodiversity*

The proposed road and Alternative Road display similar biodiversity values with the key difference relating to the area of habitat disturbance. Baseline assessment did not identify species or habitat types unique to any particular route option. Comparison of land cover types within each of the route options is provided in *Table 5.8*. *Table 5.9* provides a comparison of vegetation condition (NDVI) for the route options.

**Table 5.4** *Access Road Route Comparative Analysis - Land Cover (Ban Nomsomboun and Ban Hat Gnum)*

Land Cover/Code	Habitat	Proposed Road (ha)	Alternative Road (ha)
Deciduous forest	N	11	11
Old fallow land	M	5	9
Young fallow land	M	0	0
Rice paddy	M	1	1
Slash and burn	M	<1	<1
Urban	M	<1	<1
Water	-	0	0
Shadow*	-	<1	1
Cloud*	-	<1	<1
<b>Total</b>		<b>18</b>	<b>22</b>

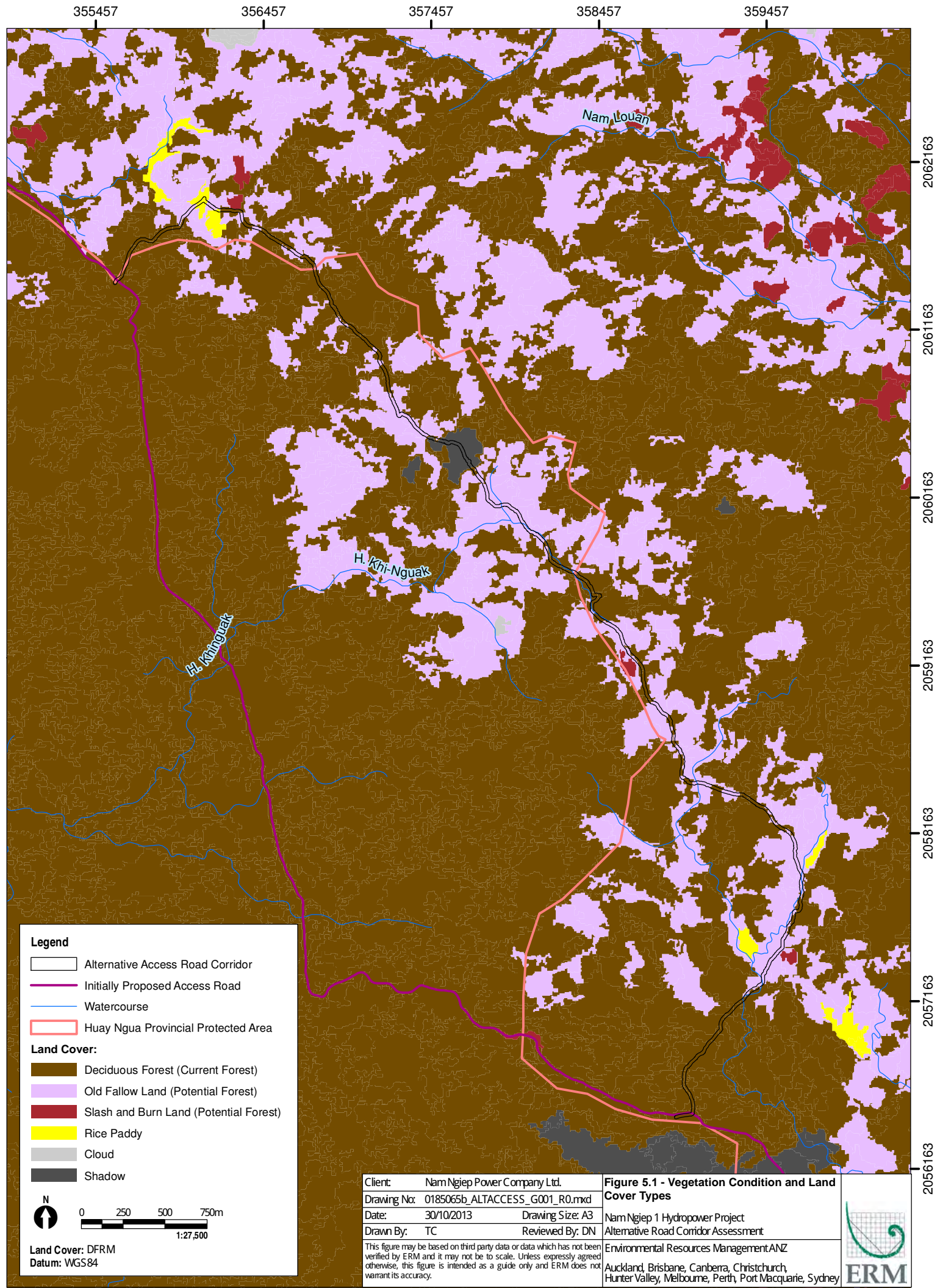
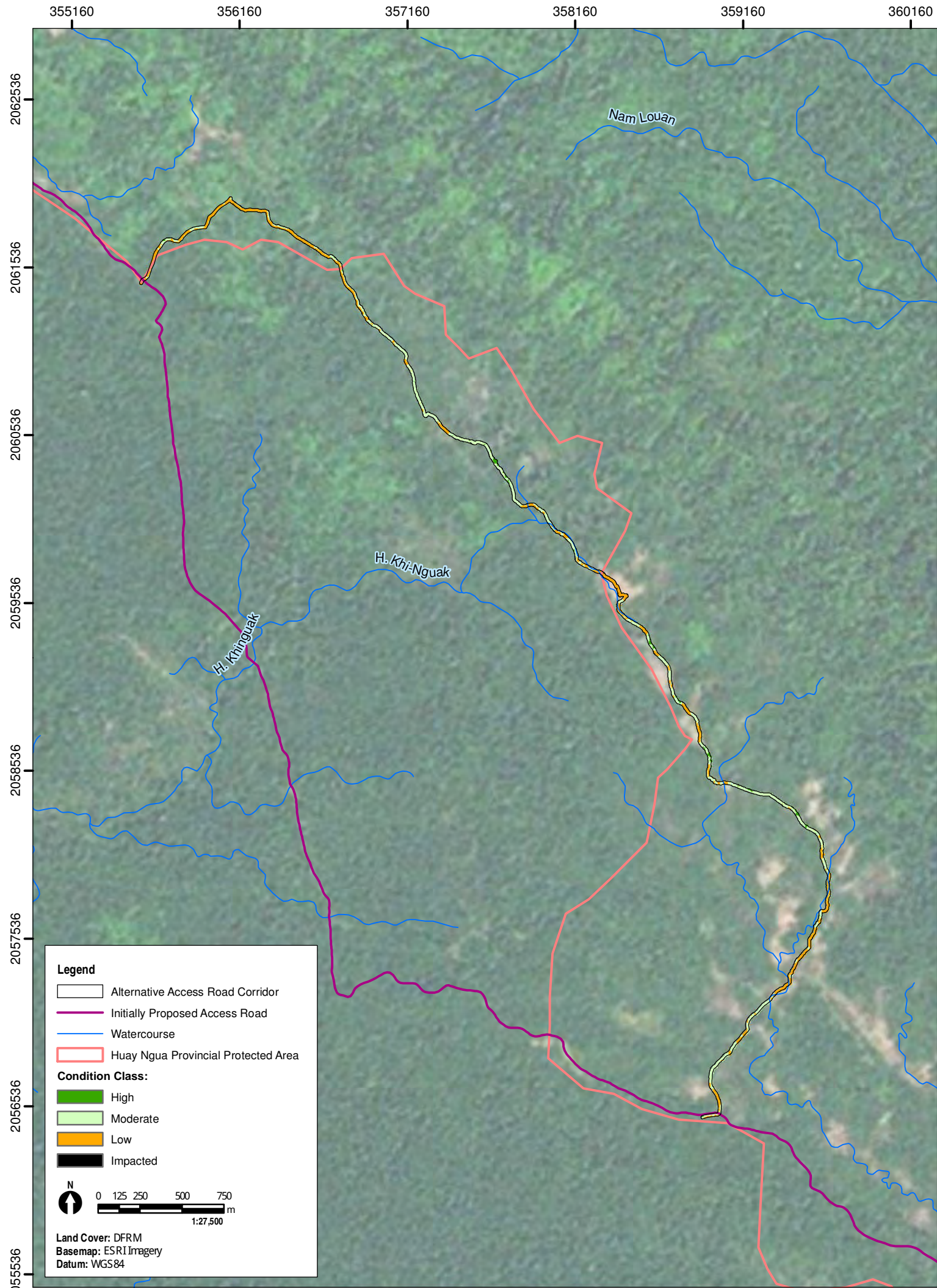
*N = natural habitat; M = modified habitat*

**Table 5.5** *Access Road Route Comparative Analysis - Vegetation Condition (Ban Nomsomboun and Ban Hat Gniun)*

Condition Category (NDVI range)	Proposed Road (ha)	Alternative Road (ha)
Impacted (- to 0)	<1	<1
Low (0 to 0.4)	11	13
Moderate (0.4 to 0.6)	6	8
High (0.6 to 0.8)	<1	<1

The area of disturbance for each of the route options is similar. Specific to natural habitat disturbance, both options are estimated to disturb 11 ha, though the overall disturbance area is smaller for the Proposed Road (18 ha).





Client:	Nam Ngiep Power Company Ltd.	<b>Figure 5.1 - Vegetation Condition and Land Cover Types</b>
Drawing No:	0185065b_ALTACCESS_G001_R0.mxd	
Date:	30/10/2013	Drawing Size: A3
Drawn By:	TC	Reviewed By: DN
<small>This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.</small>		Nam Ngiep 1 Hydropower Project Alternative Road Corridor Assessment Environmental Resources Management ANZ Auckland, Brisbane, Canberra, Christchurch, Hunter Valley, Melbourne, Perth, Port Macquarie, Sydney





## Flora and Fauna Species

Based on the similarity in land cover types and proximity to the proposed road, it is considered likely that the species identified during the baseline assessment of the proposed road corridor have potential to occur in the habitats of the Alternative Road. It is expected that the habitat values for the flora and fauna biodiversity will be similar. 10 compares the area of disturbance for each of the critical habitat candidate species for each alignment option. The outcomes suggest slightly less disturbance for one species (Asian elephant) at the Proposed Road option.

**Table 5.10** *Threatened Species Habitat Access Road Route Comparative Analysis - Land Cover (Ban Nomsomboun and Ban Hat Gnium)*

Species	Common Name	Habitat Type Codes	Proposed Road (ha)	Alternative Road (ha)
<b>Flora</b>				
<i>Azelia xylocarpa</i>		EF, DF	11	11
<i>Anisoptera costata</i>		EF, DF	11	11
<i>Dalbergia oliveri</i>		EF, DF	11	11
<i>Dipterocarpus alatus</i>		EF, DF	11	11
<i>Dipterocarpus turbinatus</i>		EF, DF	11	11
<i>Shorea roxburghii</i>	White meranti	EF, DF, B	11	11
<i>Vatica cinerea</i>		B, SB	<1	<1
<b>Mammals</b>				
<i>Elephas maximus</i>	Asian elephant	EF, DF, SB, OFL, YFL, B	17	21
<i>Panthera pardus</i>	Leopard	EF, DF	11	11
<i>Pardofelis temminckii</i>	Asiatic golden cat	EF, DF	11	11
<i>Prionailurus viverrinus</i>	Fishing cat	W	-	-
<b>Birds</b>				
<i>Buceros bircornis</i>	Great hornbill	EF, DF	11	11
<i>Cairina scutulata</i>	White winged duck	W	-	-
<i>Centropus sinensis</i>	Greater coucal	EF, DF, SB	12	12
<i>Lophura diardi</i>	Siamese fireback	EF, B, SB	<1	<1
<i>Pavo muticus</i>	Green peafowl	EF, DF, B, SB	12	12
<i>Polyplectron bicalcaratum</i>	Grey peacock pheasant	EF	-	-
<i>Psittacula alexandri</i>	Red-breasted parakeet	DF	11	11
<b>Reptiles</b>				
<i>Broghammerus reticulatus</i>	Reticulated python	EF, DF, SB	12	12
<i>Platysternon megacephalum</i>	Big-headed turtle	W	-	-
<b>Fish</b>				
<i>Catlocarpio siamensis</i>	Giant barb	W	-	-
<i>Pangasianodon hypophthalmus</i>	Striped catfish	W	-	-
<i>Probarbus labeamajor</i>	Thicklipped barb	W	-	-
<i>Wallago leeri</i>		W	-	-

#### 5.1.4 *Conclusions of Alternative Scenarios*

The study result of access road between Ban Nomsomboun and Ban Hat Gnum show no significant difference between the Original Plan and the Alternative Plan in terms of environmental and social impacts to Huay Ngua PPA.

Provided that in case the Alternative Route is selected, it must be paid attention that the Alternative Road is very close to Phou Ngoug PPA. Also, in a certain area of the Alternative Road, the environment circumstances are recovered to almost natural conditions because the route is no longer used so frequently.

The Alternative Road would also cause significant increase of construction cost for the Access Road. Considering additional time needed for re-survey, topographic and geological survey, UXO survey, land use survey, re-design, ESMMP-CP and re-approval process by GoL, the Alternative Road may cause delay of commencement of construction works and impact to project feasibility. Thus the Proposed Road is preferred.

#### 5.2 *ALTERNATIVES FOR ACCESS ROADS FROM BAN HAT GNium TO DAM SITE*

Due to the need to access multiple locations in the construction area between Ban Hat Gnum and the Dam Site, and geographic constraints, including steep topography, a requirement for access via each side of Nam Ngiep, and an objective to minimize watercourse crossings (in order to minimize impacts to water quality, hydrology and aquatic habitat), there are few available alternatives to consider in this stretch of the access road.

The use of JICA road only was considered, as this is an existing road. However, due to the steep and complex topography of the road, long-term use of the road would require substantial maintenance and repair costs. Therefore, it was determined that additional new roads were required.

During the design phase, base case and realignment alternatives were investigated more thoroughly. Comparisons of each alternative were carried out and discussed with local authorities in order to obtain consensus and agreement for the alignment finally selected.

There have been two alternatives of access road alignments adopted in the NNP1 as shown in *Figure 5.2 P* and *Figure 5.3*.

Figure 5.2 Previous proposed alignment (2008)

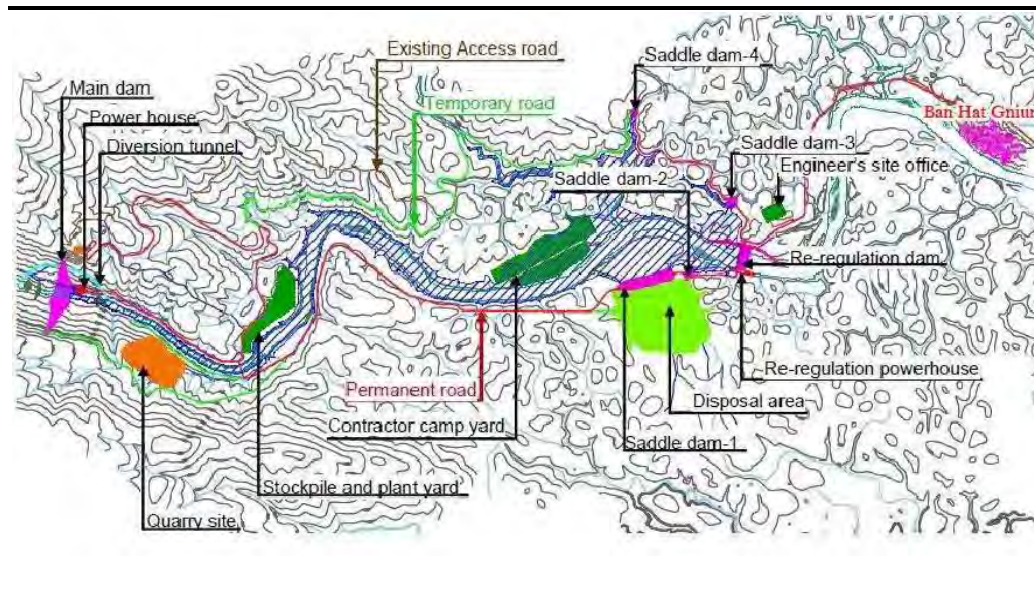
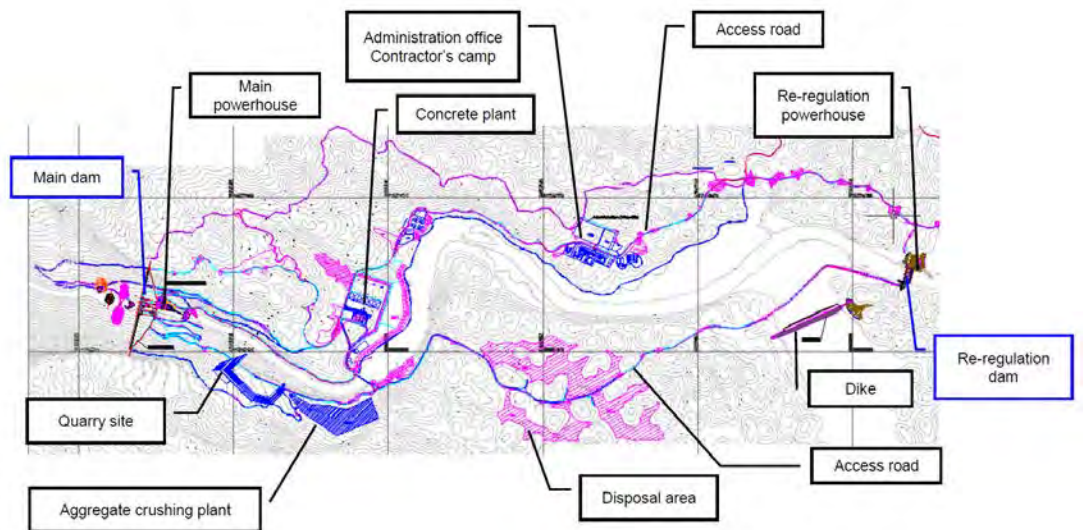


Figure 5.3 Current alignments (2013)





Key difference of current alignment of access road is the location of permanent road. The previous permanent road alignment had located in the right bank through the re-regulation power house. The current permanent road, which enables to access the power house of main dam and re-regulation dam at the left bank only, has shifted from the right bank to the left bank, because the re-regulation power house is shifted from the right bank to left bank in order to reduce construction cost for power house construction by omitting cost bridge for the access to power house. This alignment therefore is led less works in the river than the previous alignment.

There is also an alternative in term of schedule. The construction schedule shall avoid rainy season to minimize water resource and sediment impact. Moreover, to secure the COD at January 2019, the diversion tunnel works should be started from the beginning of July 2014. However the commencement of road construction works to approach the location of diversion tunnel works has been delayed from April to October 2013. Thus, the JICA road improvement is newly required in order to recover the construction schedule of road construction works. The upgrading works are to repair the muddy, damaged and eroded section by replacing gravels and soil, and to set side ditch as drainage without expanding the existing road width.

There will be a new temporary road to be constructed from JICA road to Dam Site. Construction methods to be adopted are cut and fill.

Public consultation has played a key role in development of the Project, and will continue to play an important in its implementation.

The goal has been to ensure opportunities exist for stakeholders to be involved in Project design, including potentially affected people. More specifically, the objectives are to:

- Ensure that stakeholders concerns are incorporated in the Project design and construction, including the access road;
- Increase stakeholder awareness and familiarity with the Project, including the access road;
- Ensure transparency in the decision-making process; and
- Enhance the potential benefits by directly involving relevant stakeholders.

These objectives are being met through a comprehensive public consultation and disclosure process, which has been ongoing for a number of years. This has included:

- Sharing relevant information at the earliest stages;
- Providing on-going opportunities to input;
- Receiving feedback from stakeholders; and
- Utilising outputs from the consultation process to inform the design and construction, including proposed management measures and corresponding management plans.

The following sections describe the consultation process that has been undertaken. Further details of consultation activities are contained in the Land Acquisition and Compensation Management Plan that has been prepared for the access road.

## 6.1

### *CONSULTATION TECHNIQUES*

The consultation techniques used have reflected the diversity of the stakeholders involved. Techniques included:

- Face-to-face communication, including focus group discussions and village meetings, during which participatory rural appraisal techniques were used. This has helped to address issues regarding literacy;
- Use of visual representations of information, including pictures, diagrams, posters and 3D visual representations. This has helped to address issues regarding literacy;

- Establishment of information centres;
- Direct contact with stakeholders, including electronic mail and telephone conversations;
- Dissemination of information; and
- Site visits, particularly for international stakeholders.

In selecting techniques particular attention has been given to:

- Women and other vulnerable groups. The participation of women and other vulnerable groups has been encouraged, for example by organising women's or vulnerable group only focus group discussions; and
- Language barriers. Consultation activities have largely been conducted in Loa. However, in villages with Hmong residents, the information presented was translated during the consultation activities into Hmong.

## 6.2

### CONSULTATION ACTIVITIES

A number of consultation activities have been undertaken to inform stakeholders about the Project as well as gain input on predicted impacts and corresponding management measures. With regards to the access road, this includes public meetings held in February 2013, April 2013 and December 2013.

The February meetings included representatives from Ban Hat Gniun, Ban Thahua, Ban Hat Nonsomboun and Ban Sisavath and the Bolikhan District. During the meetings, information about construction and ongoing management of the access road was provided (i.e. disclosed) to stakeholders. The stakeholders were then given an opportunity to ask questions and express their concerns. The stakeholder concerns largely focused on compensation. Summary notes from the meeting are contained in *Annex F*.

The April meetings were held in Ban Hat Gniun and Ban Nonsomboun, and included representatives from local villages and the Bolikhan District. During the meetings, stakeholders were provided an update about the Project. Summary notes from the meeting are contained in *Annex F*.

In addition to the information being disseminated, feedback was sought from stakeholders about the potential impacts associated with the construction of the access road, the compensation plan and the grievance redress mechanism (*Chapter 7*). *Table 6.1* provides a summary of the issues raised. This included a number of environmental issues, including concerns relating to noise, vibrations, air quality and water quality.

**Table 6.1 Concerns Raised during the April 2013 Meeting**

<b>Question, Concern, Recommendation</b>	<b>Response Provided</b>
<b>Project activity</b>	
The number of project affected people who will lose the Right of Way is unknown.	A land use survey was conducted along the existing road with 50m width. However, actual road width is less than 50m. Thus, according to land use survey, it has been confirmed that people might be potentially affected. The number of actual affected people depends on the final road design to be decided later.
Encroachment of indigenous land	Same as above.
Construction schedule should be promptly informed to communities.	The construction schedule of access road works was presented at the meeting.
<b>Environmental - surface water and groundwater</b>	
The Project should allocate budgets to assist the problem of inadequate water supply.	It depends on the entitlement matrix in the CA Annex C.
<b>Environmental - air quality</b>	
Dust generation resulted from access road construction.	A sub-plan has been developed and included in the ESMMP-CP to address air quality (SP03: Emissions Dust suppression measures will be implemented including: <ul style="list-style-type: none"> <li>• such as water roads and stockpiles,</li> <li>• covering loads,</li> <li>• sweeping and washing sealed roads,</li> <li>• and progressive rehabilitation of sealed areas.</li> </ul>
<b>Environmental - noise and vibration</b>	
Noise pollution generated from construction machine affects teaching activities.	A sub-plan has been developed and included in the ESMMP-CP to address noise and vibration (SP04: Noise and Vibration). The following measures will be implemented: <ul style="list-style-type: none"> <li>• The construction contractor will liaise with schools to identify specific times where noise generating activities, including blasting, should be avoided, such as during exam periods;</li> <li>• Blasting activities will be undertaken between 0600 and 1900, and will be scheduled to avoid school days;</li> <li>• Residents and schools will be provided at least 24 hours' notice prior to blasting; and</li> <li>• Measures defined in SP04 to minimise noise generation at the source will be implemented.</li> </ul>
<b>Social - local employment</b>	
The Project should provide local employment opportunities to local people.	Lao citizens will be employed in accordance with Concession Agreement. As for the local people, Construction Contractor will employ as much as practicable.

Question, Concern, Recommendation	Response Provided
<b>Road safety</b>	
Accident rate is likely to increase as a result of an improved road access.	A sub-plan has been developed and included in the ESMMP-CP to address public safety, including related to traffic (SP18: Public Safety). Strict speed limits will be imposed on Project drivers, and all drivers will receive road safety training;
Student safety during the road construction period should be implemented.	A sub-plan has been developed and included in the ESMMP-CP to address public safety, including related to traffic (SP18: Public Safety). Barriers and signage will be installed to keep pedestrians away from hazardous areas. Excavated areas will be backfilled/covered as soon as practicable to avoid potential accidents.
The Project should install road safety signage in the boundary of construction and access road to ensure safety for communities.	All necessary measures will be taken to prevent road accidents by installing traffic sign and setting limited speed zone, etc.

In addition to the February 2013 and April 2013 meetings, a number of meetings took place in December 2013 with stakeholders residing in villages along the access road. The primary focus of these meetings was on compensation. However, the meetings also provided an opportunity to update stakeholders on the Project (i.e. disclose relevant information) and the grievance redress mechanism.

#### 6.2.1 *Additional Activities*

In addition to meetings, information centres have been set-up in each of the districts within the Project area. The aim is to make available information and facilitate participation by stakeholders.

#### 6.2.2 *Ongoing Consultation*

Consultation will be ongoing throughout the Project. This includes interaction with stakeholders as part of the implementation of relevant environmental (and social) management plans.

## **GRIEVANCE REDRESS MECHANISM**

The Project has the potential to affect the interests of thousands of people, which may result in differences in perception and expectations. These differences may lead to conflicts between potentially affected persons (PAPs), including individuals, households or groups in the communities, on the one hand, and the government, the developer, and those hired to implement the Project on the other. A grievance redress mechanism (GRM) has therefore been established to achieve the following objectives:

- Promote productive relationships with local communities and identify community concerns through consultation, disclosures, participatory planning and decision making (as described in *Section 6*) with PAPs in order to prevent grievances wherever possible and maximize environmental and social benefits;
- Address and resolve differences or grievances associated with the Project through established GRM procedures, as outlined in the following sections.

The GRM will address all grievances raised by PAPs, specifically those related to environmental matters.

### **7.1**

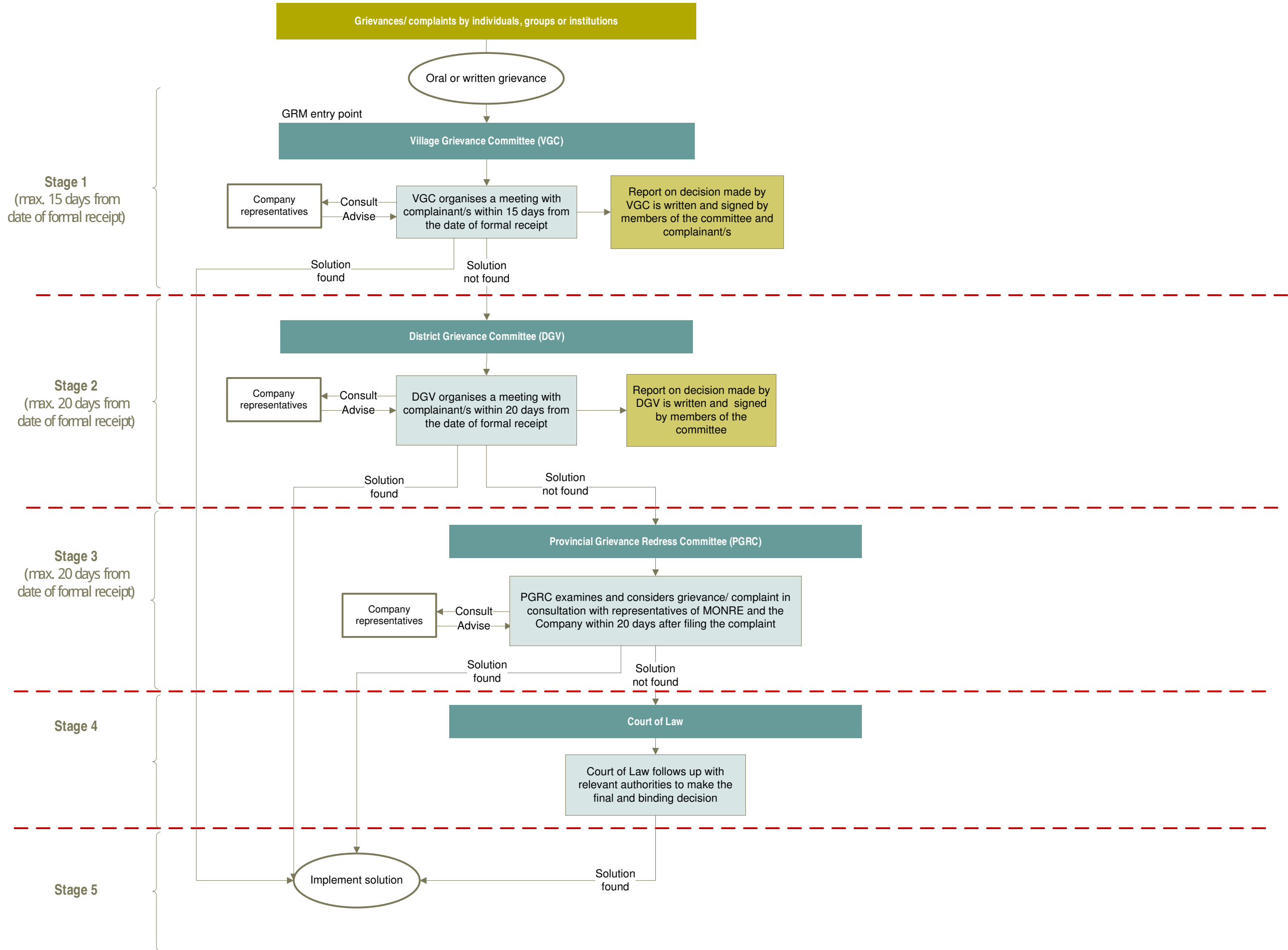
#### **GRIEVANCE REDRESS PROCEDURE**

The GRM, in the first instance, seeks to resolve disagreements or stakeholder concerns before they evolve into grievances. This is done through ongoing engagement with stakeholders throughout the Project, particularly the PAPs. The resulting informal negotiations and discussions will be conducted in a transparent manner and will be appropriately documented.

In cases where concerns or conflicts cannot be resolved through consultation and / or discussions, the GRM has established a hierarchy of grievance committees and procedures to receive and resolve grievances. These committees and procedures are summarized in *Figure 7.1*.



**Nam Ngiep 1 Hydropower Project  
Grievance Redress Mechanism (GRM)**



Stages and timeframes associated with the GRM procedures are as follows:

- Stage 1: PAPs will register grievances with the Village Grievance Committee. The Village Grievance Committee will organize a meeting within 15 days from the date of formal receipt of the grievance with the complainants to resolve the issue using its traditional methods of conciliation and negotiation; the meeting will be held in a public place and will be open to other PAPs and villagers to ensure transparency. The report on the decision of the Village Grievance Committee must be in writing and must be signed by all members of the committee. If any members of the committee dissent from the opinion of the majority, those members can note their dissent as part of the report of the decision. The aggrieved party and the Project representatives should also sign and indicate their agreement or disagreement with the decision.
- Stage 2: If either the PAP or the Company is not satisfied with the decision of the Village Grievance Committee, or if the Project does not abide with the decision of the Village Grievance Committee, an appeal can be made directly by the Project or by the PAP, or by the Village Grievance Committee on behalf of the PAP. Other persons or organizations, such as local NGOs, mass organizations like Lao Women's Union, or other representatives of the PAP, can ensure that the appeals are forwarded to the District Grievance Committee. The District Grievance Committee will keep a public log of all claims and grievances it receives, including a summary of the decisions made, and must also make public all reports on the decisions made by the committee. The meeting of the District Grievance Committee will be held in a public place, no more than 20 days from the date of formal receipt of the grievance. Representatives from the Company must be available to provide any necessary information to the committee on entitlements, compensation rates, mitigation measures, and any other relevant information concerning the grievance. The report on the decision of the District Grievance Committee must be in written and must be signed by the members of the committee.
- Stage 3: If the PAP is still not satisfied with the decision of the District Grievance Committee or if the Project does not abide by the decision of the District Grievance Committee, an appeal can be made to the Provincial Grievance Redress Committee. The Provincial Grievance Redress Committee will examine and consider the complaint or grievance in consultation with representatives of MONRE and the Company within 20 days after filing the complaint.
- Stage 4: If the PAP is still not satisfied with the decision of the Provincial Grievance Redress Committee, or in the absence of any response within the stipulated time, the grievance can be submitted to the Court of Law by the PAPs or a representative of a non-profit organizations or the Village Grievance Committee on behalf of the PAPs or at the request of the Project. The Court of Law will follow up with the relevant authorities to make the final and binding decision.

- Stage 5: In case that the Project is found responsible for negligence, the Project will cover in full all administrative and legal fees incurred by the PAPs in the GRM process at the district, provincial and MONRE levels and in the Court of Law. Complaints and grievances concerning impacts during construction will be considered up to and for no more than one year after the official date of completion of construction.

## 7.2 ESTABLISHMENT OF GRIEVANCE REDRESS COMMITTEES

The GRM procedures will be managed by a hierarchy of grievance redress committees, comprising the members outlined in *Table 7-1*.

**Table 7.1** *Grievance Redress Committee Members*

Committee	Committee Members
Village Grievance Committee	<ul style="list-style-type: none"> <li>• The village head (chairperson);</li> <li>• Representatives of local village authorities;</li> <li>• Village elders; and</li> <li>• Representatives from community organizations, including the Lao Women’s Union.</li> </ul>
District Grievance Committees	<ul style="list-style-type: none"> <li>• Representative of the District Authority (chairperson);</li> <li>• Local village leader(s)/ head(s);</li> <li>• Representatives from the PAPs, other than village leader(s)/head(s);</li> <li>• Local village elders and/or other local community organizations, including the Lao Women’s Union;</li> <li>• Representatives from local not-for-profit organizations; and</li> <li>• Representatives from the Project team.</li> </ul>
Provincial Grievance Redress Committee	<ul style="list-style-type: none"> <li>• Representative of the provincial authority. This individual will become the chairperson;</li> <li>• Representatives from the provincial or district authority’</li> <li>• Representatives from the PAP (eg a representative from a village directly affected by the Project);</li> <li>• Representatives from community organizations, including the Lao Women’s Union;</li> <li>• Representatives from a local not-for-profit organization; and</li> <li>• Representatives from the Project team.</li> </ul>

The various committees will be established prior to commencement of the Project, in particular the resettlement activities. This will be done by making a formal request to the GOL for the relevant authorities in each province to establish the Provincial and District Grievance Committees. The District

Grievance Committees will be given the authority to establish Village Grievance Committees in villages affected by the Project.

### 7.3

#### *GRIEVANCE REDRESS MECHANISM CONSULTATION*

Success of the GRM is dependent on stakeholders being aware of the GRM, including how to access the mechanism. Stakeholders have been informed on a number of occasions about the GRM. This includes meetings undertaken in April 2013 and December 2013 along the access road.

## 8.1

## INSTITUTIONAL ARRANGEMENT

During the pre-construction and construction stage of the access road, a specific project's Environmental and Social Team will be established. It is obligated to entail the appointment of new teams and responsibilities as follows:

- Environmental Management Office (EMO); and
- Social Management Office (SMO)

Both offices would be established as the Environmental and Social Division (ESD), managed by the ESD Manager who is responsible for the environmental and social implementation of Environmental Management Plan (EMP) on the site during construction stage. The ESD Manager would be supported by a Deputy Managing Director, Environment and Coordination.

Table 8.1 defines the roles and responsibilities of the Environment and Social Team, and an overview of the Project's management structure and environmental incorporation between the owner and the construction contractor is shown in Figure 8.1.

**Table 8.1** *Roles and Responsibilities for implementation of EMP*

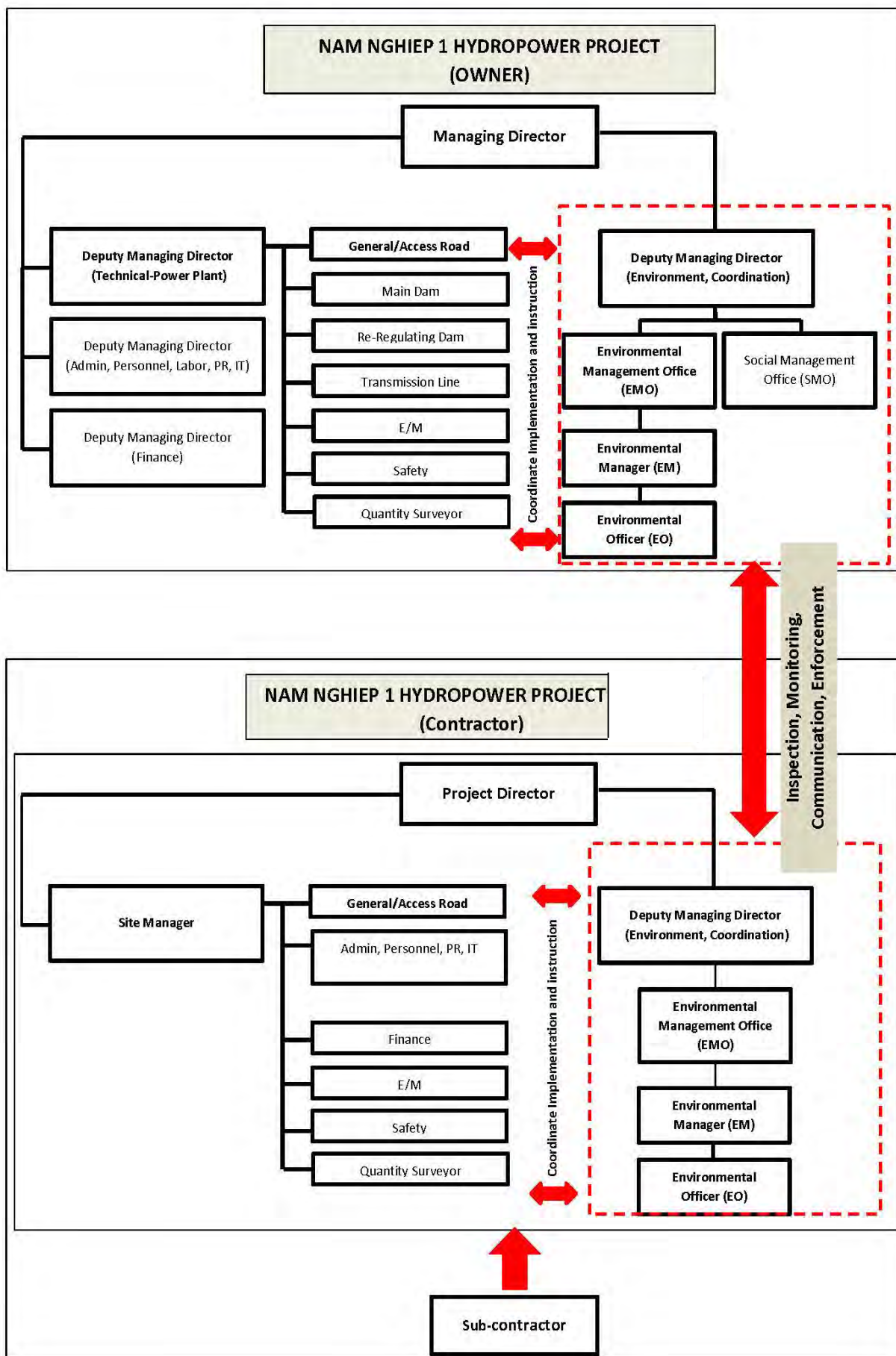
Role	Responsibilities
Deputy Managing Director (Environment, Coordination)	<ul style="list-style-type: none"> <li>• Have a working understanding of legal environmental obligations of the Project, and the requirements of the ESMMP-CP;</li> <li>• Implement the ESMMP-CP;</li> <li>• Confine the construction site to the demarcated area;</li> <li>• Provide adequate resources and capabilities to implement and maintain the ESMMP-CP;</li> <li>• Verify that sufficient funds are available to properly implement the ESMMP-CP;</li> <li>• Monitor site activities on a regular basis for compliance;</li> <li>• Conduct internal audits of the construction site against the ESMMP-CP;</li> <li>• Rectify transgressions through the implementation of corrective action; and</li> <li>• Submit periodic monitoring reports to ADB.</li> </ul>
Environment Manager and Environmental Officers	<ul style="list-style-type: none"> <li>• Have a working knowledge of the environmental impacts, mitigation measures and recommendations of the ESMMP-CP;</li> <li>• Supervise and provide budget for monitoring activities.</li> <li>• Verify that sufficient funds are available to properly implement the ESMMP-CP.</li> <li>• Review and approve the SS-ESMMP-CPs;</li> <li>• Act as main point of contact between the GOL authorities and the Project on environmental issues;</li> <li>• Review and improve method statements for environmental aspects</li> </ul>

Role	Responsibilities
	<p>prior to work starting;</p> <ul style="list-style-type: none"> <li>• Verify that tender documents and civil works contracts include the Project ESMMP-CP and specify requirement for preparation and implementation of construction SS-ESMMP-CP;</li> <li>• Identify environmental and health and safety competence requirements for all staff, including contractor personnel, working on the project and facilitate delivery of environmental training;</li> <li>• Monitor construction performance to verify that appropriate control measures are implemented to comply with the ESMMP-CP;</li> <li>• Recommend corrective action for any environmental non-compliance incidents on the construction site, and provide advice and liaison with the construction teams to ensure that environmental risks are identified and appropriate controls are developed;</li> <li>• Compile a regular report addressing environmental performance progress and any non-compliance issues to relevant parties, including submitting semi-annual monitoring reports to ADB through the ESD;</li> <li>• Provide the data and information to the lenders' environment specialist tasked to audit the environmental performance of the completed access road. This data and information include the approved ESMMP-CP, SS-ESMMP-CPs, proof of delivery of training program, environmental monitoring reports, engineer's logbook, records of compliance check, contractor's report on environmental performance and labour compliance and incidents, environmental register of all incidents that occurred on the site during construction.</li> <li>• Inform affected parties of any changes to the construction program. The contact numbers of the EO shall be made available to the affected parties. This will ensure open channels of communication and prompt response to queries and claims;</li> <li>• Establish an environmental grievance redress mechanism that is acceptable to ADB, to receive and facilitate resolution of affected peoples' concerns, complaints, and grievances about the Project's environmental performance;</li> <li>• Liaise and cooperate with GOL authorities responsible in arranging for adequate meeting and reporting to GOL authorities on a regular basis; and</li> <li>• Verify that employment practices comply with relevant labour standards. Act as the main point of contact for labour issues, including monitoring compliance with national labour laws and the CLS.</li> </ul>
Construction Contractor	<ul style="list-style-type: none"> <li>• Recruit a qualified Environmental Officer on a full-time basis to manage compliance with contractual environmental obligations and implementation of the SSESMP-CP;</li> <li>• Develop and implement the Construction Contractor's Environmental Management Plan (Construction Contractor's EMP) and SSESMP-CPs to comply with Project commitments (i.e. Owner's EMP and ESMMP-CP);</li> <li>• Plan and direct construction activities to minimize environmental impacts and comply with environmental management procedures, license and approval requirements;</li> <li>• Verify the implementation of all applicable mitigation measures defined in the SSESMP-CP during construction of road, bridges and culverts, and associated facilities;</li> <li>• Liaise with EMO to facilitate implementation of environmental mitigation measures;</li> <li>• Provide adequate resources to implement the Construction</li> </ul>



Role	Responsibilities
	<p>Contractor's ERM and SSES MMP-CP;</p> <ul style="list-style-type: none"> <li>• Implement routine inspection and monitoring program, including undertaking the contractor's weekly environmental monitoring;</li> <li>• Implement a process of corrective and preventive action for non-compliance identified through internal and external inspections and audits;</li> <li>• Implement additional environmental mitigation measures where monitoring or other observations indicate opportunities for improved environmental management;</li> <li>• Submit monthly reports to ESD/EMO on the implementation of environmental mitigation measures and environmental monitoring results;</li> <li>• Maintain an environmental and labour register which keeps a record of all incidents which occur on the site during construction and report environmental incidents to Owner;</li> <li>• Manage safety of construction workers and local people during construction;</li> <li>• Receive and manage complaints from the public in accordance with the GRM;</li> <li>• Facilitate the restoration of community facilities and provision of temporary canals/irrigation channels to avoid disruption of water supply to farmlands; and</li> <li>• Comply with national labour laws and CLS. Report on labour compliance incidents to the Owner.</li> </ul>
All Project personnel	<ul style="list-style-type: none"> <li>• Protecting the environment by implementing relevant aspects of the EMP and ESMMP-CP</li> </ul>

Figure 8.1 Project Institutional Structure



The primary document to guide the management and monitoring of environmental impacts of the Project during the construction phase is the ESMMP-CP. The ESMMP-CP defines mitigation and monitoring actions to be implemented during the construction phase of the Project, and defines the roles and responsibilities and institutional arrangements of environmental management. The ESMMP-CP contains a range of sub-plans which address specific environmental and social issues. The ESMMP-CP and all sub plans were submitted to MoNRE together with the EIA report in April 2012. These plans were approved in June 2012.

Based on the ESMMP-CP, a suite of Site-specific ESMMP-CPs (SS-ESMMP-CPs) is being prepared by the contractor, and will be implemented during civil works.

This EA guided the formation of the ESMMP-CP, and the subsequent SS-ESMMP-CPs. The ESMMP-CP is a live document that will continue to be updated throughout the life of the Project.

Environmental management for the Project aims to minimize the negative impacts of access road construction and at the same time, enhance the positive and beneficial impacts.

Most of the mitigation measures are fairly standard methods of minimizing disturbance, minimizing threats to population and enhancing the socio-economic benefits during construction to communities along the road alignment.

Access road construction shall take place in an orderly manner and all required environmental controls and measures shall be implemented at construction site. Monitoring of the mitigation measures will entail site inspections, interview of roadside residents as well as checking of reports, plans, records and other aspects.

Prior to access road construction, site clearing must take place in a phased manner, as and when required. Areas which are not to be constructed on within the scope must not be cleared to reduce erosion risks. The dust and noise must not cause nuisance or disturbance to the communities along the road sections being worked on. Exceedance as observed by project's environmental and social team or complained by affected people shall be addressed immediately. The Project's environmental and social team shall inform the construction supervisor of the exceedance who in turn shall be responsible for instructing the contractor to take corrective action.

Incidents of exceedance and corresponding corrective measures taken shall be reported by the contractor and shall be included in the regular reporting to Owner.

*Table 8.2* presents the mitigation measures of access road construction. These mitigation measures are an overview only. Detailed mitigation measures are provided in the ESMMP-CP and related sub-plans.

**Table 8.2 Environmental Management Measures**

Environmental Aspect	Impacts, Causes and Locations of Impacts	Mitigation Measures	Location	Timeframe	Responsibility to implement	Responsibility to audit
<b>Design Phase</b>						
Hydrology	The presence of impermeable bitumen roads in place of vegetated areas or dirt roads will prevent infiltration at the road and may increase the velocity of surface runoff.	<ul style="list-style-type: none"> <li>Road drainage will be designed to safely convey runoff at non-erosive volumes and velocities away from the road.</li> <li>Where existing construction (completed prior to finalization of this EA) has not achieved appropriate drainage, measures will be taken to rectify poor drainage.</li> </ul>	Sealed Roads	At commencement of design phase	Civil Engineers	Deputy Managing Director (EC)
Hydrology	If poorly designed, the presence of bridges has the potential to disrupt stream flows.	<ul style="list-style-type: none"> <li>River diversion and bridges will be designed to maintain pre-construction flows, including by designing the bridge to: minimize the use of pylons to retain the existing channel section; operate with a freeboard between the flood level and bridge deck, avoid encroachment of bridge abutments into the channel.</li> </ul>	Bridges and in-stream works	At commencement of design phase	Civil Engineers	Deputy Managing Director (EC)
Hydrology	Naturally occurring flooding may cause a risk to the Project, and the presence of construction equipment and materials may exacerbate the risk to surrounding communities. Since the flood flow is fast and high volume, loose materials and equipment might get swept downstream and potentially cause some damage to structures and harm local people.	<ul style="list-style-type: none"> <li>A Flood Response Plan will be prepared to address the risk of flash flooding. Measures in the Flood Response Plan will be communicated in site inductions.</li> </ul>	Contractor and Owner offices	Prior to commencement of wet season construction	CC	EM/EO
Biodiversity	Loss of natural and modified habitat due to vegetation clearing	<ul style="list-style-type: none"> <li>The design and layout plan will be prepared to minimise tree cutting and protected area disturbance where possible.</li> </ul>	All construction areas	Design phase	Civil Engineers, Deputy Managing Director (EC)	Deputy Managing Director (EC)

Environmental Aspect	Impacts, Causes and Locations of Impacts	Mitigation Measures	Location	Timeframe	Responsibility to implement	Responsibility to audit
Biodiversity	Some residual impacts will not be able to be avoided through the measures outlined in this EMP. These impacts are to be offset.	<ul style="list-style-type: none"> <li>Implement the recommended offset package outlined in the Biodiversity Offset Design Report (ERM 2013).</li> </ul>	Offset areas designated in Biodiversity Offset Design Report (ERM 2013)	Beginning in design phase.	Deputy Managing Director (EC)	Deputy Managing Director (EC)
<b>Construction Phase</b>						
Capacity of Personnel	Project workers fail to implement EMP due to lack of understanding and competencies in environmental skills and awareness.	<ul style="list-style-type: none"> <li>Development and provision of environmental induction and regular training for all workers.</li> <li>A training register containing details and name of training session; date of training session; list of attendees; and signatures and name of trainer will be properly maintained.</li> <li>The key messages of each training session will be communicated to workers via poster and leaflet form in proper language. In addition, posters will be displayed prominently in construction work camps and construction areas and leaflets will be distributed to staff on a regular basis.</li> </ul>	Training and Induction Centre	Prior to personnel commencing work	EM/EO	Deputy Managing Director (EC)
Hydrology	Naturally occurring flooding may cause a risk to the Project, and the presence of construction equipment and materials may exacerbate the risk to surrounding communities. Since the flood flow is fast and high volume, loose materials and equipment might get swept downstream and potentially cause some damage to structures and harm local people.	<ul style="list-style-type: none"> <li>The Flood Response Plan will be communicated as part of the Training and Awareness Program (Refer SP16 ESMMP-CP).</li> <li>Construction materials and chemicals will be secured and locked down during flooding season.</li> <li>If stream diversion, or flow inhibition is required during in-stream works, the construction contractor must understand the emergency flood plan, and be aware of increased waterway capacity in order to release the excess volume of water.</li> </ul>	Construction site - all components	Wet season	CC	EM/EO
Hydrology	Temporary diversion of rivers for bridge construction impacting	<ul style="list-style-type: none"> <li>If river diversion is expected to alter flows to an extent that would lower the downstream</li> </ul>	Construction site - bridges	Prior to river diversion	CC	EM/EO

Environmental Aspect	Impacts, Causes and Locations of Impacts	Mitigation Measures	Location	Timeframe	Responsibility to implement	Responsibility to audit
	hydrology, aquatic biota, and potentially access of villagers to water resources.	water level, local people will be informed of changes to water levels, including expected extent and duration of change.				
Hydrology	Extraction of material from the quarry and borrow area affecting hydrology.	<ul style="list-style-type: none"> <li>Quarries and borrow areas will be contoured to avoid surface water collecting.</li> <li>Following completion of extraction, quarries and borrow areas will be rehabilitated to reinstate contours as similar as possible to the original contours. Rehabilitation will aim to reproduce surface water flows and groundwater flows and levels as similar as possible to the original state.</li> </ul>	Quarries (STA 9+400km, STA 15+900km, STA16+000km) and Borrow areas (STA 21+400km, STA 22+300km and STA 23+700 (P1)).	Quarry opening, during extraction of materials and following completion of extraction	CC	EM/EO
Water Quality	Erosion and sediment run off from construction activities that expose or move soil	<ul style="list-style-type: none"> <li>Clearing and earthworks will be undertaken in the dry season to minimize erosion and subsequent release of sediment;</li> <li>The period of soil exposure will be minimized through by phasing clearing and construction activities, and covering exposed areas (for example by planting fast growing ground cover or covering with riprap, sand bags, erosion mats, bale dikes, mulch, or excelsior blankets) at the earliest time possible. Exposed areas of stream banks will be covered immediately, and preferably be replanted with locally native herbaceous and woody vegetation.</li> <li>For areas in direct runoff path to a watercourse, sediment and erosion control devices will be installed and maintained until vegetation replanting can occur to stabilise disturbed surfaces;</li> <li>Stockpile materials (excavated soil, quarry materials etc.) will be located at least 30 m away from steep slopes, watercourses or</li> </ul>	All construction areas	Throughout construction	CC	EM/EO



Environmental Aspect	Impacts, Causes and Locations of Impacts	Mitigation Measures	Location	Timeframe	Responsibility to implement	Responsibility to audit
		<p>drainage paths.</p> <ul style="list-style-type: none"> <li>• Sediment trap will be installed in between the stream and the stockpile to control runoff where necessary.</li> <li>• Water quality will be monitored regularly, and if found to exceed standards defined in the ESMMP-CP, additional water quality measures will be implemented.</li> </ul>				
Erosion	Erosion of quarry face	<ul style="list-style-type: none"> <li>• The risk of quarry face instability and failure will be stabilized using the appropriate method such as implementation of slope drainage measures, benching of slopes and de-scaling of excess material.</li> </ul>	Quarry (STA 9+400km, STA 15+900km, STA16+000km)	During construction	CC	EM/EO
Water Quality	Erosion and sediment released from stream bed and bank disturbance during bridge construction	<ul style="list-style-type: none"> <li>• If vegetation clearing is required on stream banks, cut vegetation near or at ground level to leave root mass in the ground. This helps to reinforce soil stability and reduce erosion.</li> <li>• If in-stream diversion is required during bridge construction, any diversion infrastructure must be clean and made of suitable materials that will not contribute to turbidity or salinity.</li> <li>• At watercourse crossings, machinery will operate from stream bank, not the stream channel, whenever practicable with minimal streambed disturbance. All disturbed streambeds will be returned to their original condition or better as soon as possible.</li> <li>• Water quality will be monitored regularly, and if found to exceed standards defined in the ESMMP-CP, additional water quality measures will be implemented.</li> </ul>	Bridge construction site	During bridge construction	CC	EM/EO
Water Quality	Discharge of bitumen overspray or wastewater from equipment clearing during road surfacing (diffuse)	<ul style="list-style-type: none"> <li>• Bitumen spraying will not be carried out in windy or rainy conditions, or when rainy conditions are imminent.</li> </ul>	Construction site -Sealed Roads	During road surfacing	CC	EM/EO

Environmental Aspect	Impacts, Causes and Locations of Impacts	Mitigation Measures	Location	Timeframe	Responsibility to implement	Responsibility to audit
		<ul style="list-style-type: none"> <li>• Pollution prevention techniques such as drip pans and absorbent materials for all paving machines will be used to limit leaks of paving materials.</li> <li>• Water quality will be monitored regularly, and if found to exceed standards defined in the ESMMP-CP, additional water quality measures will be implemented.</li> </ul>				
Water quality	Pollution in effluent from construction sites (point source).	<ul style="list-style-type: none"> <li>• Wastewater from site activities such as concrete or bitumen cutting, drilling or excavation will be appropriately treated prior to discharge.</li> <li>• Sediment or retention ponds will be installed to receive drainage water and runoff water from plant before discharge.</li> <li>• Discharge will be immediately stopped if the quality is not compliant with requirements.</li> <li>• Spill respond kit will be provided to prevent spilling and contamination</li> </ul>	All construction areas.	During construction	CC	EM/EO
Water Quality	Deterioration in surface water quality when effluent untreated.	<ul style="list-style-type: none"> <li>• Septic tanks will be installed to treat domestic wastewater generated from camp.</li> <li>• To avoid water pollution caused by the rubbish and waste, regular waste collection will be provided.</li> <li>• Separate wastewater from runoff water drainage.</li> <li>• Sediment or retentions ponds will be installed to receive runoff water from worker camp before being discharge off-site.</li> <li>• Effluent water monitoring program will be routinely conducted and sampling locations, parameters specified in applicable standards will be identifies.</li> </ul>	Worker camp (STA 4+000 km, STA 20+250 km, STA 23+500 km and STA 27+500 km (P1))	Throughout operation of worker camp	CC	EM/EO

Environmental Aspect	Impacts, Causes and Locations of Impacts	Mitigation Measures	Location	Timeframe	Responsibility to implement	Responsibility to audit
Water Quality	Increase in potential soil erosion and subsequent water pollution due to activities related to material excavation at the spoil and borrow areas which cause change in physical properties of soil and sediment transport	<ul style="list-style-type: none"> <li>• Soil and spoil removed during the construction process will be stockpiled separately and stabilization measures implemented. The stockpiles will be constructed with smooth slopes and free drainage patterns.</li> <li>• Stockpiles will be located away from drainage lines and sited to avoid interference with surface flows.</li> <li>• Ridges may be created on topsoil stockpiles to provide for the moisture retention to assist re-growth and slow runoff.</li> <li>• Sediment trap or other measure will be established to capture sediment runoff.</li> <li>• Sediment or retention ponds will be installed to receive leaching from the spoil at the end of the drainage lines prior to discharge to the watercourse.</li> </ul>	Spoil area (P1: STA 25+800km, STA26+400km, STA27+700km, STA28+100km, STA29+300km, STA28+500km; T8: STA1+500km)  Borrow Areas (P1: STA 21+400km, STA 22+300km, STA 23+700km)	Throughout use of spoil and borrow area.	CC	EM/EO
Air quality	Dust emissions from exposed soils, transport of materials and increased traffic.	<ul style="list-style-type: none"> <li>• Restricting vehicle movement to designated access routes;</li> <li>• Covering all loads;</li> <li>• Watering exposed surfaces during windy conditions;</li> <li>• Daily monitoring of dust levels through visual inspection; and</li> <li>• Implementing measures to limit vehicle speeds, particularly around sensitive receptors, for example by installing speed bumps.</li> <li>• All vehicles will be washed or cleaned before leaving the site, when appropriate. .</li> <li>• Choose the appropriate location of stockpiles to place under the wind direction.</li> <li>• Blasting will be avoided in windy conditions.</li> </ul>	All construction areas	Throughout construction period	CC	EM/EO
Air quality	Chemical pollutants from road vehicles and equipment.	<ul style="list-style-type: none"> <li>• Maintaining the condition of the vehicle fleet;</li> <li>• All vehicles engines will be switched off when</li> </ul>	Vehicles and all construction	Throughout construction	CC, EM/EO	EM/EO

Environmental Aspect	Impacts, Causes and Locations of Impacts	Mitigation Measures	Location	Timeframe	Responsibility to implement	Responsibility to audit
		<p>stopped, and vehicles will not be left idling.</p> <ul style="list-style-type: none"> <li>• Monitor emission in sensitive areas</li> <li>• Air monitoring program will be routinely conducted and sampling locations, parameters specified in applicable standards will be identified.</li> <li>• Provide PPE for emission protection to workers working in activities generating emission or any workers who requests PPE.</li> </ul>	<p>areas where vehicles and equipment are operating</p>	<p>period</p>		
Noise and Vibration	<p>Increased noise and vibration levels may disturb local residents and fauna, and can present a risk to personnel.</p>	<ul style="list-style-type: none"> <li>• All noise and vibration generating construction equipment shall be operated with appropriate sound dampening equipment;</li> <li>• Construction equipment and vehicles will be subjected to regular inspections to check noise emissions and noise control equipment;</li> <li>• Stationary noise sources will be positioned to avoid impacts to sensitive receptors;</li> <li>• Hearing protection will be made available for all construction personnel and required for personnel working in areas with noise above 80dB; and</li> <li>• High noise activities, such as blasting, will be carried out only within the hours of 6am to 7pm, and residents should be informed of these activities.</li> </ul>	<p>All construction areas</p>	<p>Throughout construction period</p>	<p>CC</p>	<p>EM/EO</p>
Geology	<p>Landslide and rock movement may be induced, particularly along steep slopes around the construction site along riverbank, borrow areas, spoil disposal areas and quarry.</p>	<ul style="list-style-type: none"> <li>• The potential for and monitoring of landslides and rock movements around the Project site will be investigated during construction.</li> <li>• If there are any sections along the access road that may have landslide and rock movement problems, the construction contractor will address the problem before further construction.</li> <li>• Routine inspection of the access road and</li> </ul>	<p>Steep areas</p>	<p>Throughout construction period</p>	<p>CC, Owner</p>	<p>Owner</p>

Environmental Aspect	Impacts, Causes and Locations of Impacts	Mitigation Measures	Location	Timeframe	Responsibility to implement	Responsibility to audit
		bridges during construction will be undertaken.				
UXO	Any UXO events result in injury or death, and causes serious loss and destruction of property.	<ul style="list-style-type: none"> <li>UXO clearance and certificate shall be implemented for the whole construction area.</li> <li>All construction activities shall be commenced within the UXO clearance boundary.</li> </ul>	All construction areas	Prior to construction	Owner	GOL's representative
Hazardous management	Storage of materials including hazardous materials may cause risk due to improper management.	<ul style="list-style-type: none"> <li>Hazardous waste will be disposed of according to the most appropriate and practical best practices.</li> <li>Hazardous materials will be stored in the suitable storage location such as close area, bund, water trap with open-close valve.</li> <li>Clean up any spillage as soon as practicable applied.</li> </ul>	All construction areas	Throughout construction period.	CC	EM/EO
Terrestrial Biodiversity	General	<ul style="list-style-type: none"> <li>Training will be provided to personnel to raise awareness of the values of natural habitat to construction personnel and communicate rules regarding the management of biodiversity.</li> </ul>	Induction and training area	For each employee prior to commencing work	EM/EO	Deputy Managing Director (EC)
Biodiversity	Loss of natural and modified habitat due to vegetation clearing	<ul style="list-style-type: none"> <li>The design and layout plan will be prepared to minimise tree cutting and protected area disturbance where possible.</li> <li>Clearing activities will be strictly controlled by site marking, fencing off significant trees/habitat, etc.</li> <li>In natural habitat areas to be cleared, microhabitat features such as hollow logs will be relocated to adjacent natural habitat areas rather than being destroyed where possible.</li> <li>No vegetation clearing will occur in natural habitat until further biodiversity assessments, including specialist input, are completed.</li> </ul>	All construction areas	Design phase	Civil Engineers, Deputy Managing Director (EC)	Deputy Managing Director (EC)
Terrestrial Biodiversity	Loss of habitat in Huay Ngua PPA	<i>Schedule</i> <ul style="list-style-type: none"> <li>No vegetation clearing will occur in the Huay Ngua PPA until further assessments of critical</li> </ul>	Huay Ngua PPA (STA5+720km - STA23+700km)	Applicable until studies completed and	EM/EO	Deputy Managing Director (EC)

Environmental Aspect	Impacts, Causes and Locations of Impacts	Mitigation Measures	Location	Timeframe	Responsibility to implement	Responsibility to audit
		<p>habitat are completed.</p> <p><i>Site Preparation</i></p> <ul style="list-style-type: none"> <li>• Owner and the Contractor shall walk over or drive through the Protected Area with PONRE representatives prior to commencing construction activities to confirm the extent of the area to be utilised, the type and duration of construction activities, and the associated environmental management measures that will be implemented.</li> <li>• The extent of all works shall be surveyed and clearly pegged prior to the commencement of any related construction activities. Owner and the Contractor shall then jointly inspect the pegged works. Once approval has been granted by the Owner, the Contractor shall install any management measures as early as possible.</li> <li>• All staff involved in construction activities within Protected Areas shall be walked through the on-site layout of control measures to familiarise themselves with the functioning of controls and to avoid the removal or damage of these measures.</li> </ul> <p><i>Vegetation Protection</i></p> <ul style="list-style-type: none"> <li>• If clearing in Huay Ngua PPA is deemed appropriate and agreed with ADB, works will occur in a manner consistent with the Huay Ngua PPA Management Plan, consultation will occur with local communities, ADB, DFRM and PAFO, and an appropriate biodiversity offset strategy will be implemented.</li> <li>• Any specified individual trees to be retained</li> </ul>		agreement reached with ADB.		

Environmental Aspect	Impacts, Causes and Locations of Impacts	Mitigation Measures	Location	Timeframe	Responsibility to implement	Responsibility to audit
		<p>shall be clearly marked prior to the commencement of vegetation clearance or other project works with 50 m of these trees.</p> <ul style="list-style-type: none"> <li>All machinery and tools will be thoroughly washed down prior to use within a Protected Area to help prevent the spread of weeds and plant pathogens.</li> <li>Weed control will be regularly undertaken using the best available practice/s.</li> </ul> <p><i>Wildlife Protection</i></p> <ul style="list-style-type: none"> <li>The Contractor shall develop a construction procedure that allows/encourages wildlife to move off-site before and during construction activities to avoid deaths.</li> <li>All heavy vehicles are only permitted to use the section of the main Project access road through Huay Ngua PPA during daylight hours to minimize the disturbance of wildlife in the Protected Area and the potential for wildlife deaths from traffic.</li> <li>A speed limit of 30 km/hr shall apply to all project vehicle movements through the Protected Areas.</li> </ul> <p><i>General Provisions</i></p> <ul style="list-style-type: none"> <li>Project works and associated management measures in Protected Areas shall be inspected one month prior to the commencement of the monsoon season to identify any required works and prepare a maintenance program to be conducted prior to the monsoon.</li> <li>No storage of fuels, chemicals or other hazardous materials shall occur within Protected Areas.</li> </ul>				



Environmental Aspect	Impacts, Causes and Locations of Impacts	Mitigation Measures	Location	Timeframe	Responsibility to implement	Responsibility to audit
		<ul style="list-style-type: none"> <li>Construction wastes will be removed from site each day, with no waste stored within a Protected Area.</li> <li>No chemicals will be used within a protected Area unless essential to construction.</li> <li>No burning will be undertaken within Protected Areas.</li> </ul> <p><i>Supervision and Remedial Action</i></p> <ul style="list-style-type: none"> <li>Inspect construction activities with a Protected Area at least twice a week, advising the Contractor or its nominated sub-contractor of any non-conformances against permit conditions or SSES MMP-specified measures, and specifying any required remedial action.</li> <li>The Contractor or its nominated sub-contractor shall implement the remedial action/s specified by the Owner Environment Officer within the time frame advised.</li> </ul>				
Terrestrial Biodiversity	Degradation of habitat	<ul style="list-style-type: none"> <li>The measures outlined in this document relating to hydrology, water quality, air quality and noise and vibration, will be implemented.</li> <li>For construction and operation areas requiring night-time lighting, lights will be used only where necessary and will be directed toward the subject area and away from habitat areas where possible.</li> <li>Weed and pest management measures will be implemented in accordance with a Project weed and pest management plan to avoid introduction of weeds to natural and modified habitat areas.</li> <li>Domestic, construction and hazardous wastes be stored, and handled and disposed of by</li> </ul>	All construction areas.	Throughout construction period.	CC, EM/EO	EM/EO

Environmental Aspect	Impacts, Causes and Locations of Impacts	Mitigation Measures	Location	Timeframe	Responsibility to implement	Responsibility to audit
		<p>appropriately licensed waste management contractors.</p> <ul style="list-style-type: none"> <li>Construction materials and chemicals will be appropriately secured and locked down during flood season to avoid accidental release to the natural environment.</li> <li>In natural habitat areas to be cleared, microhabitat features such as hollow logs will be relocated to adjacent natural habitat areas rather than being destroyed where possible.</li> </ul>				
Terrestrial Biodiversity	Fauna mortality	<ul style="list-style-type: none"> <li>The Contractor will develop a construction procedure that allows/encourages wildlife to move off-site before and during construction activities to avoid deaths.</li> <li>A speed limit of 40 km/hr will apply to all project vehicle movements and 30 km/hr through the Protected Areas.</li> <li>All project staff prohibited from harvesting any forest products and hunting wildlife within Protected Areas.</li> </ul>	Rules apply to all personnel in any location while working for the Project.	Throughout construction period.	CC, EM/EO	Deputy Managing Director (EC)
Terrestrial Biodiversity	Edge effects	<ul style="list-style-type: none"> <li>The extent of all works shall be surveyed and clearly pegged prior to the commencement of any construction activities.</li> <li>Measures in the ESMMP-CP relating to hydrology, water quality, air quality and noise and vibration will be implemented.</li> </ul>	All construction areas.	Throughout construction period.	CC, EM/EO	EM/EO
Terrestrial Biodiversity	Disturbance to fauna behaviour	<ul style="list-style-type: none"> <li>The Contractor shall develop a construction procedure that allows/encourages wildlife to move off-site before and during construction activities to avoid deaths/disturbance.</li> <li>Measures in the ESMMP-CP relating to hydrology, water quality, air quality and noise and vibration will be implemented.</li> </ul>	All construction areas.	Throughout construction period.	CC, EM/EO	EM/EO
Terrestrial	Impacts to threatened species	<ul style="list-style-type: none"> <li>Liaison with species specialists to confirm</li> </ul>	All construction	Throughout	CC, EM/EO	EM/EO

Environmental Aspect	Impacts, Causes and Locations of Impacts	Mitigation Measures	Location	Timeframe	Responsibility to implement	Responsibility to audit
Biodiversity		<p>presence or absence of critical habitat of ICUN-listed and nationally-listed species will be completed.</p> <ul style="list-style-type: none"> <li>Design and layout will avoid identified threatened species in proposed project footprint, including <i>Dipterocarpus alatus</i> and <i>Vatica cinerea</i>.</li> <li>Awareness of the protection of threatened species to trade, poaching and hunting will be raised through training and awareness program (SP16).</li> <li>Any project activities that involve disturbance of native vegetation will be preceded by an on-ground survey to assess presence of threatened species and other flora values that might be impacted. Results of the on-ground survey will be used to guide the clearing footprint (where possible).</li> </ul>	areas.	construction period.		
Terrestrial Biodiversity	Some residual impacts will not be able to be avoided through the measures outlined in this EMP. These impacts are to be offset.	<ul style="list-style-type: none"> <li>The recommended offset package outlined in the Biodiversity Offset Design Report (ERM 2013) will be implemented.</li> </ul>	Offset areas designated in Biodiversity Offset Design Report (ERM 2013)	Beginning in design phase.	Deputy Managing Director (EC)	Deputy Managing Director (EC)
Aquatic Biodiversity	Degradation of habitat	<ul style="list-style-type: none"> <li>Water quality and hydrology measures will be implemented.</li> </ul>	All construction areas, and specific measures for bridges.	Throughout construction period.	CC, EM/EO	EM/EO
Aquatic Biodiversity	Mortality	<ul style="list-style-type: none"> <li>Fishing and using of illegal fishing gear anywhere along the river will be prohibited.</li> </ul>	Rules apply to all personnel in any location while working for the Project.	Throughout construction period.	EM/EO	Deputy Managing Director (EC)
Cultural	Increase in adverse impacts on cultural	<ul style="list-style-type: none"> <li>Construction activities will be undertaken in</li> </ul>	All construction	Throughout	EM/EO	Deputy

Environmental Aspect	Impacts, Causes and Locations of Impacts	Mitigation Measures	Location	Timeframe	Responsibility to implement	Responsibility to audit
heritage and archaeology	heritage and archaeological sites found in areas where access road is under construction.	<p>such manner as to avoid any physical effect on known sites of cultural or religious significance.</p> <ul style="list-style-type: none"> <li>• ESOs will be trained to identify potential sites or items of cultural significance. Construction workers will be trained in the appropriate reporting and communication procedures to be followed if they identify any potential sites or items and the importance of implementing these procedures</li> <li>• The Owner will employ a head of village who is familiar with cultural resources.</li> <li>• The following steps will be implemented in the event that previously unidentified artifacts are identified: <ul style="list-style-type: none"> <li>i. The contractor shall immediately cease operations on road section where artifacts/archaeological finds are unearthed and immediately inform NNP1 Site Manager.</li> <li>ii. The Owner will consult the Head of Village and Culture and Tourism Administration Office to obtain advice regarding the next steps.</li> </ul> </li> <li>• The contractor to recommence work only after the Culture and Tourism Office has provided official notification accordingly.</li> </ul>	areas.	construction period.		Managing Director (EC)
Health and safety	Health Risks due to lack of health and sanitation conditions through disposal of sewage on open land which may cause mosquito nuisance, water borne diseases, etc. Chances of spread of sexually transmittable diseases like AIDS.	<ul style="list-style-type: none"> <li>• Construction of toilet facilities and sewage collection system for treatment.</li> <li>• Provision of treatment for sewage before its disposal, meeting the effluent standard.</li> <li>• First aid equipment or facilities.</li> <li>• Awareness programs on infectious diseases.</li> <li>• Mosquito wire screen and net will be applied for important places such as office, canteen,</li> </ul>	Worker camp and all construction areas	Throughout construction period.	CC	EM/EO

Environmental Aspect	Impacts, Causes and Locations of Impacts	Mitigation Measures	Location	Timeframe	Responsibility to implement	Responsibility to audit
		<ul style="list-style-type: none"> <li>bed room etc.</li> <li>Hygienic drinking water will be provided.</li> <li>Construction worker will be trained in the health and safety issue relating to the camp.</li> <li>First aid equipment and facilities to be provided adequately. Construction worker will be trained in the health and safety issue.</li> </ul>				
Traffic and access	Hazards associated with the traffic movement in working areas during construction phase leading to property/equipment damage and injury to workers or nearby villagers.	<ul style="list-style-type: none"> <li>Transportation schedules will be arranged to avoid peak hours of road usage.</li> <li>Heavy equipment transportation will be managed to minimise impacts to sensitive areas or communities.</li> <li>Traffic signs will be installed for all roads throughout construction areas.</li> <li>Relevant traffic regulations will be implemented throughout construction areas.</li> </ul>	All Project roads and public roads.	Throughout construction	CC	EM/EO
Labour Compliance	Non-compliance with national labour laws and CLS.	<ul style="list-style-type: none"> <li>Introduce contractors/ subcontractors to the Lao Labour Union (LLU)</li> <li>LLU to establish labour unions</li> <li>Labour unions will work to resolve grievances between workers and their employers</li> </ul>				
<b>Operation Phase</b>						
Air Quality	Dust emissions from the use of unsealed roads	<ul style="list-style-type: none"> <li>Unsealed roads will be watered during windy conditions;</li> <li>Measures to limit vehicle speeds will be implemented, particularly around sensitive receptors, for example by installing speed bumps.</li> </ul>	All roads in Project site	Throughout operation period.	CC	EM/EO
Terrestrial Biodiversity	Mortality of animals due to vehicle strike	<ul style="list-style-type: none"> <li>Speed limits to maximum of 40 km/hr through all project areas and 30 km/hr in Protected Areas for construction vehicles will be enforced to minimise potential for fauna strike</li> <li>Education will be provided to all personnel to</li> </ul>	All roads in Project site, and training at induction and training location.	Throughout operation period	EM/EO	Deputy Managing Director (EC)

Environmental Aspect	Impacts, Causes and Locations of Impacts	Mitigation Measures	Location	Timeframe	Responsibility to implement	Responsibility to audit
		raise awareness of value of biodiversity and risks, including vehicle strike.				
Terrestrial Biodiversity	Potential increased levels of hunting due to improved access to natural areas, including the Huay Ngua PPA.	<ul style="list-style-type: none"> <li>• Strict rules against logging outside the approved construction areas and against wildlife hunting and poaching will be imposed on project staff, workers, and all contractors and personnel engaged in or associated with NNP1. Penalties will be levied for anyone caught carrying and using fire arms, or using animal snares and traps, including fines and dismissal, and prosecution under the laws of the Lao PDR.</li> <li>• Commitment will be made to raise awareness of values of natural habitat areas to construction and operation work force and arrangements will be made for restriction of poaching and forest product collection.</li> <li>• The Biodiversity Offset Plan will consider improved enforcement and security of offset areas.</li> </ul>	Rules apply to all personnel in any location while working for the Project. Offset areas discussed in Biodiversity Offset Plan.	Throughout operation period.	EM/EO	Deputy Managing Director (EC)
<b>Rehabilitation Phase</b>						
Topography and Hydrology	Landform and landscaping around the Project area may be affected significantly such as slope of access road along Land Use Right, borrow areas spoil disposal areas and stock pile areas.	<ul style="list-style-type: none"> <li>• Upon completion of construction, any disturbed areas outside the limits of dams, reservoir pools, permanent roads, and other permanent facilities will be graded to provide proper drainage and blend with natural contour with the land.</li> </ul>	All construction areas.	Areas are to be rehabilitated as soon as they are no longer required for construction or operation.	CC, EM/EO	Deputy Managing Director (EC)
Terrestrial Biodiversity	Loss or degradation of habitat	<ul style="list-style-type: none"> <li>• Landscaping and re-vegetation will be undertaken after completion of construction using native species where possible, and based on advice provided by a suitably qualified botanist/ecologist;</li> </ul>	All construction areas no longer required	Areas are to be rehabilitated as soon as they are no longer required for	CC, EM/EO	Deputy Managing Director (EC)

Environmental Aspect	Impacts, Causes and Locations of Impacts	Mitigation Measures	Location	Timeframe	Responsibility to implement	Responsibility to audit
		<ul style="list-style-type: none"> <li>• Following grading, rehabilitation areas will be vegetated using plants native to the area, suitable for the site condition, and beneficial to wildlife.</li> <li>• Following abandonment, all yards, offices, and construction buildings, including concrete footings and slabs, will be removed from the site.</li> <li>• All construction roads above high-water mark will be obliterated and restored to the original contour. Roads will be made impassible to vehicle traffic when no longer needed by the contractors. Culverts will be removed as appropriate. Road escarpment will be contoured and vegetated, and all road surfaces will be scarified to establish conditions appropriate for reseeding, drainage, and erosion prevention. All access roads will be temporarily or permanently blocked to permit establishment of planted vegetation.</li> <li>• Where applicable, the following agencies will be consulted to determine the recommended plant species composition, seeding rates, and planting dates: Department of Natural Resources and Environment, Department of Agriculture and Rural Development.</li> <li>• Grasses, forbs, shrubs, and trees appropriate for site conditions and surrounding vegetation will be included in the plant list. Species chosen for a site will be matched for site drainage, climate, shading, resistance to erosion, soil type, slope, aspect, and vegetation management goals. Wetland and riparian species will be used in re-vegetating disturbed</li> </ul>		construction or operation.		



<b>Environmental Aspect</b>	<b>Impacts, Causes and Locations of Impacts</b>	<b>Mitigation Measures</b>	<b>Location</b>	<b>Timeframe</b>	<b>Responsibility to implement</b>	<b>Responsibility to audit</b>
		wetlands. Upland re-vegetation shall match the plant list to the site's soil type, topographic position, elevation, and surrounding natural communities.				
Terrestrial Biodiversity	Loss or degradation of habitat within Huay Ngua PPA	In addition to the general mitigation measures for rehabilitation prescribed above, rehabilitation of Huay Ngua PPA				

Monitoring is an integral part of the environmental management system as it establishes how the Project performs against environmental commitment. A schedule and procedures for monitoring should be developed at the outset in order to:

- Identify any negative impacts from construction activities;
- Assess the effectiveness of control measures;
- Demonstrate compliance with regulatory conditions; and
- Identify if further controls/corrective action is required.

Monitoring programs will be implemented for the duration of the construction phase of the Project. It includes:

- Routine monitoring and inspection conducted by the Environmental Officer; and
- Compilation of monitoring and inspection report with non-compliance.

The monitoring program to be implemented is described in *Table 8.3*. Each compliance report consisting of all description of compliances and their levels, photographic documentation and/or checklists, will be available and will be provided by Construction Contractor to Owner with a readily accessible record of construction progress, photographic documentation, and documentation of compliance with the Project environmental requirements.

A schedule of regular inspections, monitoring and reporting is specified in the ESMMP-CP and related SSESMP-CPs. The schedule, checklists, inspections and reports should be undertaken and kept at each site office and should be updated and used in the day to day operation of the site.

Monitoring in the construction period can be categorized in the following.

At Contractor level, monitoring to ensure on a day to day basis that mitigation measures are fully implemented with construction activities, and that results observed comply with the contractual obligations and Contractor's EMP;

At Owner level, routine inspections to ensure that monitoring results provided by the Construction Contractor are corrected, to provide the necessary environmental coordination and interface with the Contractors, and to provide a comprehensive picture of the current environmental situation and efforts at site level. This includes monitoring compliance and non-compliance with national labour laws and CLS.

#### 8.4.1 *Monitoring and Inspection by Construction Contractor*

For Construction Contractor, the internal organization requires the Inspector team with environmental skills or trained personnel. Each Inspector will conduct routine inspection of sites and activities in their area of responsibility to evaluate compliance with commitments defined in the ESMMP-CP, Construction Contractor's EMP, and SSESMMMP-CP.

Results of field observations, either documenting compliance or non-compliance with environmental requirements will be reported on standard forms. The use of these standard forms will help to ensure that compliance-related observations are recorded in a consistent manner and in a standard format. The information can be entered into the database that will be used to track the status of and allow analysis of non-compliance situations.

Monitoring activities complying with the applicable standards/guidelines will primarily concern i.e. water quality, air quality, noise and vibration. For ambient air, noise and water quality, sampling and analysis shall be carried out relying on certified equipment and/or laboratory.

#### 8.4.2 *Monitoring and Inspection by Owner*

The Inspector or EO of the Owner will visit and inspect each of the construction sites on a weekly/monthly basis. Information collected during each visit is reported on a standard form, which provides a checklist of issues to control, depending on the degree of compliance or non-compliance observed. The Inspector or EO of the Owner may join inspection with Construction Contractor and relevant agencies e.g. GOL, and as agreed in order to observe and follow up any event or significant issues that have been reported. Visits to a site will be increased if the site presents a higher environmental risk potential.

Likewise, monitoring activities complying with the applicable standards/guidelines will be conducted. Ambient air, noise and water quality, sampling and analysis shall be carried out relying on certified equipment and/or laboratory.

#### 8.5 *INTERNAL AUDIT*

Regular audits shall be carried out internally by auditors who can be the Owner's qualified staffs with experience in the following:

- Expertise in environmental science and technology;
- Expertise in the technical and environmental aspects of construction phase of the project;
- Expertise in environmental law and regulation;
- Expertise in environmental management systems;

- An understanding of national labour laws and CLS; and
- Expertise in auditing process.

The auditor will initiate scheduled audits of the construction activities of access road, construction sites and Construction Contractor's organization against the requirement established in the Contract Documents and in this ESMMP-CP.

Internal Audit will be carried out every six months. Non-conformances or observations identified during audits will be subject to the provisions of corrective action and will be implemented for closure.

## 8.6

### *EXTERNAL AUDIT*

GOL's representative i.e. independent Monitoring Agency will regularly audit the Owner's management system and construction activities to ensure compliance with the contractual obligations. It is responsibility of the Owner to provide available documentation, information and data requested by the auditor.

Non-conformances or observations identified during audits will be subject to the provisions of corrective action. The audit report will be submitted to the Owner for implementation and action.

**Table 8.3 Environmental Monitoring Program**

Environmental Aspect/Area to be concerned	Mitigation Measures	Monitoring method	Monitoring frequency	Responsible Unit		Location <sup>(3)</sup>
<b>Design Phase</b>						
Hydrology	Road drainage will be designed to safely convey runoff at non-erosive volumes and velocities away from the road.	Confirm details in design specifications and contracts.	Once	Deputy Managing Director (EC)	Deputy Managing Director (EC)	Project office
Hydrology	Bridges design to maintain hydrology	Confirm details in design specifications and contracts.	Once	Deputy Managing Director (EC)	Deputy Managing Director (EC)	Project office
Hydrology	Flood Response Plan prepared to address the risk of flash flooding. This plan should be provided to all construction personnel.	Audit adequacy of Flood Response Plan	Once	Deputy Managing Director (EC)	Deputy Managing Director (EC)	Project office
Terrestrial Biodiversity	Design and layout plan to minimise tree cutting and protected area disturbance where possible.	Audit design and layout. Examine design and contract documents to confirm sufficient protection of biodiversity.	All construction areas	Deputy Managing Director (EC), environmental consultant	Deputy Managing Director (EC), environmental consultant	Project office
<b>Construction Phase</b>						
Drinking water and water supply	As defined in: SP14 Construction of work camps	Visual inspection of treatment facilities	Once	Construction Contractors	EMO	All camps where drinking water and water supply is produced.
Effluents	As defined in: SP02 Water availability and pollution control SP14 Construction of work camps	Visual observation of sedimentation/ effluent pond design, capacity, maintenance, etc.	Monthly	Construction Contractor /EMO	EMO	All effluent discharge points to natural water source.
	As defined in: SP05 Waste management	Visual observation of registration of sludge movements	When required	Construction Contractor	EMO	Refer to specific plan, if any

Environmental Aspect/Area to be concerned	Mitigation Measures	Monitoring method	Monitoring frequency	Responsible Unit		Location <sup>(3)</sup>
Worker camp management	As defined in: SP14 Construction of work camps	Visual observation of cleanliness of camps and maintenance of drainage and sanitation facilities	Monthly	Construction Contractor	EMO	All worker camps
	As defined in: SP14 Construction of work camps	Visual observation of camps' wastewater and rainstorm water drainage	Monthly	Construction Contractor	EMO	All worker camps
Maintenance areas (workshops, garages)	As defined in: SP05 Waste management	Visual observation of repair area, re-fuelling area and practice, storage area for HM as waste engine oil, grease, hydraulic oil	Routine	Construction Contractor	EMO	Contractor's workshop area
	As defined in: SP05 Waste management	Visual observation to ensure presence and maintenance of spill response equipment kit according to products stored, including registration of used oil	Monthly	Construction Contractor	EMO	All workshop area
Non-hazardous waste	As defined in: SP14 Construction of work camps SP05 Waste management	Visual observation of sufficient bin and residual waste to ensure regular collection of garbage	Monthly	Construction Contractor	EMO	All construction area
Hazardous waste and chemicals	As defined in: SP06 Hazardous material management	Visual observation of containers, labels, collection register, drainage water control, etc.	Monthly	Construction Contractor	EMO	All construction area
Spoil disposal and borrow area	As defined in: SP01 Erosion and sediment control SP11 Spoil disposal SP07 Vegetation clearing	<p>Visual observation</p> <ul style="list-style-type: none"> <li>• Ensure spoil disposal and borrow areas located and designed in accordance with hydrological requirements</li> <li>• Ensure natural drainage respected or mitigated during earthworks</li> </ul>	Once	Construction Contractor	EMO	Spoil disposal and borrow area

Environmental Aspect/Area to be concerned	Mitigation Measures	Monitoring method	Monitoring frequency	Responsible Unit	Location <sup>(3)</sup>	
		and site development				
Soil Erosion	As defined in: SP01 Erosion and sediment control	Visual observation <ul style="list-style-type: none"> <li>• Ensure erosion and sedimentation controls are implemented without impact to environment</li> </ul>	Monthly	Construction Contractor	EMO	All construction area
Top soil protection	As defined in: SP11 Spoil disposal SP07 Vegetation clearing SP08 Landscaping and re-vegetation	Visual observation <ul style="list-style-type: none"> <li>• Ensure top soil properly managed and preserved for eventual use in restoration</li> </ul>	Once during large excavation works; as requested thereafter	Construction Contractor	EMO	All construction area
		Visual observation <ul style="list-style-type: none"> <li>• Monitor application of design standards for erosion control and topsoil protection</li> </ul>	Once	Construction Contractor	EMO	All construction area
Wildlife conservation and management	As defined in: SP07 Vegetation clearing SP08 Landscaping and re-vegetation SP09 Protected area management SP10 Biodiversity management	Visual observation <ul style="list-style-type: none"> <li>• Ensure all staff attended environmental awareness program</li> <li>• Weed monitoring</li> </ul>	Random observation and review of training attendance register	Construction Contractor	EMO	All construction area
Cultural resource	As defined in: SP21 Cultural resources	Visual observation <ul style="list-style-type: none"> <li>• Ensure no cultural site, when notified prior to works, is disturbed without community agreement.</li> <li>• Ensure procedure implemented if heritage or cultural site discovered</li> </ul>	When required	Construction Contractor	EMO	All construction area



Environmental Aspect/Area to be concerned	Mitigation Measures	Monitoring method	Monitoring frequency	Responsible Unit	Location <sup>(3)</sup>	
Traffic and Access	As defined in: SP16 Training and awareness SP15 Traffic and access	Visual observation <ul style="list-style-type: none"><li>• Ensure implementation of road signs and speed reduction bumps</li><li>• Ensure trucks and vehicles appropriately maintained Ensure truck load not overweight, stabilized and covered if bulk</li><li>• Ensure watering of roads is provided in residential areas and in dusty road sections to limit dust emission</li><li>• Registration of driving training attendance</li></ul>	Monthly	Construction Contractor	EMO	All construction area
Health and safety program	As defined in: SP16 Training and awareness SP14 Construction of work camps SP17 Project personal health program	Visual observation <ul style="list-style-type: none"><li>• Number of pre-employment and annual physical health checks;</li><li>• Statistics of disease incidence;</li><li>• Registration of training attendance for awareness program i.e. STD and AIDS prevention program;</li><li>• Posters, Leaflet printed and posted;</li><li>• Medical facilities to ensure implemented, equipped and appropriately staff;</li><li>• Vector control e.g. mosquito net provided in camp, water stagnant, etc.</li></ul>	When required	Construction Contractor	EMO	All construction area
First Aid Management	As defined in: SP17 Project personal health	Visual observation of First Aid equipment and facilities	Once	Construction Contractor	EMO	First Aid Unit

Environmental Aspect/Area to be concerned	Mitigation Measures	Monitoring method	Monitoring frequency	Responsible Unit	Location <sup>(3)</sup>	
	program					
Personal Safety Equipment (PPE)	As defined in: SP17 Project personal health program	Visual observation • Ensure all workers adequately equipped with PPE.	Routine	Construction Contractor	EMO	All construction area
Labour Compliance	Contractors/ subcontractors to comply with national labour laws and CLS	Confirm if contractors are compliant through discussions with LLU Report labour related issues or complaints raised by workers	Quarterly	Construction Contractor	EMO	All construction area
<b>Operation Phase</b>						
Air Quality	Dust suppression measures	Daily visual inspection of dust.	Daily	Construction Contractor	EM/EO	All construction area
Terrestrial Biodiversity	Speed limits to maximum of 40 km/hr for construction vehicles will be enforced to minimise potential for fauna strike	Confirm appropriate mitigation measures are practiced.	Monthly	Construction Contractor	EM/EO	All roads
Terrestrial Biodiversity	Education will be provided to all personnel to raise awareness of value of biodiversity and risks, including vehicle strike.	Refer to training register to confirm all personnel have received training.	Quarterly	Construction Contractor	EM/EO	All personnel
Terrestrial and aquatic Biodiversity	Strict rules against logging, hunting, fishing	EM/EO and construction supervisors to be alert to any signs of hunting or fishing.	Ongoing	CC, EM/EO	CC, EM/EO	Applies to all personnel
<b>Rehabilitation Phase</b>						
Topography and Hydrology	Upon completion of construction, grade any disturbed outside the limits of dams, reservoirs pools, permanent roads, and other permanent facilities to provide	Assessment of slope stability, hydrology and ecology to be undertaken prior to completion of rehabilitation and hand over.	Once prior to completion of rehabilitation and hand over.	Owner	Deputy Managing Director (EC)	All disturbed areas

<b>Environmental Aspect/Area to be concerned</b>	<b>Mitigation Measures</b>	<b>Monitoring method</b>	<b>Monitoring frequency</b>	<b>Responsible Unit</b>	<b>Location <sup>(3)</sup></b>
	proper drainage and blend with natural contour with the land.				
Terrestrial Biodiversity	Landscaping and re-vegetation will be undertaken after completion of construction using native species where possible.	Assessment of vegetation establishment, confirmation of removal of disused infrastructure/materials and other mitigation measures to be undertaken.	Once prior to completion of rehabilitation and hand over.	Owner Deputy Managing Director (EC)	All disturbed areas

The budget provided in *Table 9.1* covers the implementation of, and compliance with, NNP1PC's environmental obligations for Access Road construction and operation. The budget includes environmental monitoring undertaken by NNP1PC (both internally and outsourced). The budget is indicative only, and NNP1PC may fund any additional measures required from changes to the ECC, EMP, ESMMP-CP and ESMMP-OP; or other measures required to prevent or mitigate impacts to the environment which for any reason were not included in the initial budget.

Implementation of environmental controls during construction is the responsibility of the construction contractor. A budget for environmental measures implemented by the construction contractor will be provided in the contractor's EMP.

**Table 9.1** *Indicative EMP budget*

Items	Tasks	Expenses	Labour
<i>Implementation of EMP</i>			
<b>Design Phase</b>			
Hydrology	Drainage Control Bridge Design Flood Response Plan	\$15,000	\$10,000
Biodiversity	Habitat Protection	\$15,000	\$10,000
<b>Construction Phase</b>			
Capacity of Personnel	Environmental Induction Orientation on labour rights and conditions Training Preparation of Posters and Leaflets Provision of PPE	\$5000	\$20,000
Hydrology	Securing of hazardous materials Re-contouring of Quarries and barrow pits	\$5000	\$20,000
Water Quality and Erosion	Sediment and Erosion Control Controls for preventing spillage and clean-up of hazardous materials Septic Tank installation Design for Management of rubbish and waste	\$35,000	\$60,000
Air quality	Watering of exposed soil surfaces Washing and cleaning of vehicles	\$30,000	\$15,000
Noise and Vibration	Inspections of vehicles Provision of PPE	\$5,000	\$5000

Items	Tasks	Expenses	Labour
Geology	Monitoring of landslides	\$1000	\$5000
UXO	UXO Clearance	\$15,000	\$25,000
Hazardous management	Storage and handling od hazardous waste	\$5000	\$5000
Terrestrial Biodiversity	Training and Awareness Inspection of vehicles Wildlife protection procedure Speed signage Marking of habitats for retention	\$10,000	\$15,000
Cultural heritage and archaeology	Training and Awareness Employment of Head of Village Inspections for artifacts	\$5000	\$10,000
Health and safety	Construction of toilet facilities Sewage Treatment Awareness Program Mosquito Control Drinking Water First Aid equipment	\$35,000	\$10,000
Traffic and access	Education and Awareness Traffic signs	\$15,000	\$10,000
<b>Operation Phase</b>			
Air Quality	Road watering	\$25,000	\$5000
Terrestrial Biodiversity	Education and awareness on fauna strike Inspection of vehicles for fauna trafficking	\$4000	\$7500
<b>Rehabilitation Phase</b>			
Topography and Hydrology	Rehabilitation of disturbed areas Removal of all equipment and buildings	\$150,000	\$10,000
Terrestrial Biodiversity	Replanting of disturbed areas with native species	\$15,000	\$10,000
<b>SUB TOTAL</b>		<b>\$390,000</b>	<b>\$252,500</b>
<i>Environmental Monitoring Program (Calculated over the life of the project)</i>			
<b>Design Phase</b>			
Hydrology	Confirm details of design specifications	\$1000	\$2500
Terrestrial Biodiversity	Audit Design layout		\$2500
<b>Construction Phase</b>			
Capacity of Personnel	Review training register during weekly site audit		\$15,000
Hydrology	Audit of Flood Plan during weekly site audit		\$15,000

Items	Tasks	Expenses	Labour
Water Quality	Audit of planning documentation		
	Water quality monitoring Audit of sediment and erosion control measures	\$18,000	\$15,000
Air quality	Audit of dust control measures during weekly site audit	\$5000	\$15,000
Noise and Vibration	Noise control monitoring	\$5000	\$15,000
Geology	Geologist/engineer inspection		\$5000
UXO	Audit of UXO clearance		\$5000
Hazardous management	Audit of hazardous materials storage and waste		\$5000
Terrestrial & Aquatic Biodiversity	Audit of clearance works Confirm vehicle inspections		\$15,000
Health and safety	Audit hygiene and PPE adherence by all personnel		\$15,000
Traffic and access	Audit use of signage and traffic controls		\$15,000
<b>Operation Phase</b>			0
Air Quality	Daily dust audit		\$25,000
Terrestrial and aquatic Biodiversity	Audit of clearance works Confirm vehicle inspections		\$15,000
<b>Rehabilitation Phase</b>			0
Topography and Hydrology	Audit of slope stability by geologist/engineer		\$5000
Terrestrial Biodiversity	Audit of vegetation establishment and removal of plant and equipment/buildings/waste		\$20,000
<b>SUB TOTAL</b>		<b>\$29,000</b>	<b>\$205,000</b>
<b>TOTAL</b>		<b>\$419,000</b>	<b>\$457,000</b>

## **CONCLUSION AND RECOMMENDATION**

This EA was prepared in conjunction with the preliminary design phase, and has been updated with results of ongoing biodiversity and social assessments.

This document provides a description of the baseline social and environmental conditions, a discussion of potential impacts and measures to minimize and mitigate those impacts. The document also introduces the Grievance Redress Mechanism and Consultation Process.

The EA identified risks to the environment and local communities, including impacts to biodiversity, water quality, traffic and community health and safety. Management actions outlined in this document and defined in the ESMMP-CP will be implemented to avoid and minimize the identified impacts. In the case of biodiversity, including threatened species, some impacts may be unavoidable and these will be offset through the approach provided in the BODR.



Annex A

Photolog of Road Condition -  
Ban Nomsomboun to Ban Hat  
Gnium

Photo and video record

A Frequency

Once a month, between 1<sup>st</sup> and 5<sup>th</sup> of each month

B Location taking photo (to be added)

1 Access road, 2 JICA road, 3 Permanent road, 4 left bank temporary access road, 5 left bank additional temporary road, 6 Right bank soil disposal road, 7 Temporary bridge.




C Detailed format for record

[1 Access road] Nonsomboun to B Hat Gniun and Nam Miang

No	Location	Photo before construction (8/10/2013)	Photo on the month (21-24/10/2013)	Photo of the previous month
1.	B Nonsomboun KM 0km+000m To the direction of B Hat Gniun			
2.	B Nonsomboun KM 0km+150 m To the direction of B Hat Gniun			

No	Location	Photo before construction (8/10/2013)	Photo on the month (21-24/10/2013)	Photo of the previous month
3.	B Nonsomboun Sta. 0km+300 m To the direction of Nonsomboun	 A dirt road with a reddish-brown surface, showing some erosion and unevenness. There are houses and utility poles in the background.	 The same dirt road, but now it appears much smoother and more uniform in color, indicating recent construction or grading work.	
4.	B Nonsomboun Sta. 0km+300 m To the direction of B Hat Gniun	 A dirt road with a yellowish-tan surface, showing some erosion and unevenness. There are houses and utility poles in the background.	 The same dirt road, but now it appears much smoother and more uniform in color, indicating recent construction or grading work.	
5.	B Nonsomboun Sta. 0km+600m to the direction of Nonsomboun	 A dirt road with a reddish-brown surface, showing some erosion and unevenness. A white SUV is parked on the left side. There are trees in the background.	 The same dirt road, but now it appears much smoother and more uniform in color, indicating recent construction or grading work. A white SUV is parked on the left side. There are trees in the background.	



No	Location	Photo before construction (8/10/2013)	Photo on the month (21-24/10/2013)	Photo of the previous month
6.	B Nonsomboun Sta. 0km+600m to the direction of B Hat Gniun			
7.	B Nonsomboun Sta. 0km+900m to the direction of Nonsomboun			
8.	B Nonsomboun Sta. 0km+900m to the direction of B Hat Gniun			

No	Location	Photo before construction (8/10/2013)	Photo on the month (21-24/10/2013)	Photo of the previous month
9.	B Nonsomboun Sta. 1km+250m to the direction of Nonsomboun	 A dirt road with a slight curve to the right, surrounded by trees and a clear sky. A small structure is visible in the distance.	 The same dirt road, but with a more defined and wider surface, indicating recent construction work.	
10.	B Nonsomboun Sta. 1km+250m to the direction of B Hat Gniun	 A dirt road with a slight curve to the right, surrounded by trees and a clear sky. A small structure is visible in the distance.	 The same dirt road, but with a more defined and wider surface, indicating recent construction work.	
11.	B Nonsomboun Sta. 1km+500m to the direction of Nonsomboun	 A dirt road with a slight curve to the right, surrounded by trees and a clear sky. A small structure is visible in the distance.	 The same dirt road, but with a more defined and wider surface, indicating recent construction work.	









No	Location	Photo before construction (8/10/2013)	Photo on the month (21-24/10/2013)	Photo of the previous month
12.	B Nonsomboun Sta. 1km+500m to the direction of B Hat Gniun			
13.	B Nonsomboun Sta. 1km+650m to the direction of Nonsomboun			
14.	B Nonsomboun Sta. 1km+650m to the direction of B Hat Gniun			

No	Location	Photo before construction (8/10/2013)	Photo on the month (21-24/10/2013)	Photo of the previous month
15.	B Nonsomboun Sta. 1km+900m to the direction of Nonsomboun			
16.	B Nonsomboun Sta. 1km+900m to the direction of B Hat Gniun			
17.	B Nonsomboun Sta. 2km+100m to the direction of Nonsomboun			



No	Location	Photo before construction (8/10/2013)	Photo on the month (21-24/10/2013)	Photo of the previous month
18.	B Nonsomboun Sta. 2km+100m to the direction of B Hat Gniun			
19.	B Nonsomboun Sta. 2km+250m to the direction of Nonsomboun			
20.	B Nonsomboun Sta. 2km+250m to the direction of B Hat Gniun			



No	Location	Photo before construction (8/10/2013)	Photo on the month (21-24/10/2013)	Photo of the previous month
21.	B Nonsomboun Sta. 2km+400m to the direction of Nonsomboun	 A dirt road with a cracked surface, surrounded by dense green vegetation and trees.	 A dirt road with a smoother surface, showing tire tracks, surrounded by dense green vegetation and trees.	
22.	B Nonsomboun Sta. 2km+400m to the direction of B Hat Gniun	 A dirt road with a rough surface, surrounded by dense green vegetation and trees.	 A dirt road with a smoother surface, showing tire tracks, surrounded by dense green vegetation and trees.	
23.	B Nonsomboun Sta. 2km+625m to the direction of Nonsomboun	 A dirt road with a rough surface, surrounded by dense green vegetation and trees.	 A dirt road with a smoother surface, showing tire tracks, surrounded by dense green vegetation and trees.	

No	Location	Photo before construction (8/10/2013)	Photo on the month (21-24/10/2013)	Photo of the previous month
24.	B Nonsomboun Sta. 2km+625m to the direction of B Hat Gniun	 A dirt road with a light brown surface, flanked by dense green vegetation and trees. The road appears to be in an early stage of construction or is a natural path.	 The same dirt road as in the previous photo, but the surface is now more compact and shows some tire tracks, indicating recent use or further construction progress.	
25.	B Nonsomboun Sta. 2km+850m to the direction of Nonsomboun	 A dirt road with a light brown surface, flanked by dense green vegetation and trees. The road appears to be in an early stage of construction or is a natural path.	 The same dirt road as in the previous photo, but the surface is now more compact and shows some tire tracks, indicating recent use or further construction progress.	
26.	B Nonsomboun Sta. 2km+850m to the direction of B Hat Gniun	 A dirt road with a light brown surface, flanked by dense green vegetation and trees. The road appears to be in an early stage of construction or is a natural path.	 The same dirt road as in the previous photo, but the surface is now more compact and shows some tire tracks, indicating recent use or further construction progress.	



No	Location	Photo before construction (8/10/2013)	Photo on the month (21-24/10/2013)	Photo of the previous month
27.	B Nonsomboun Sta. 2km+975m to the direction of Nonsomboun	 A dirt road winding through a rural area with trees and vegetation. The road surface is uneven and appears to be in an early stage of construction.	 The same dirt road as in the previous photo, but now with a more defined and smoother surface, indicating recent construction work.	
28.	B Nonsomboun Sta. 2km+975m to the direction of B Hat Gniun	 A dirt road with a white SUV parked on the right side. The road surface is rough and uneven.	 The same dirt road with the white SUV, but the road surface is now smoother and more uniform.	
29.	B Nonsomboun Sta. 3km+150 m to the direction of Nonsomboun	 A dirt road surrounded by dense vegetation and trees. The road surface is uneven and appears to be in an early stage of construction.	 The same dirt road as in the previous photo, but now with a more defined and smoother surface, indicating recent construction work.	







No	Location	Photo before construction (8/10/2013)	Photo on the month (21-24/10/2013)	Photo of the previous month
30.	B Nonsomboun Sta. 3km+150 m to the direction of B Hat Gniun	 A dirt road winding through dense green vegetation, showing a clear path before any construction work.	 The same dirt road, but now with a white car in the distance and a person in a red shirt and white helmet in the foreground, indicating construction activity.	
31.	B Nonsomboun Sta. 3km+200 m to the direction of Nonsomboun	 A dirt road with visible tire tracks, surrounded by lush green trees and bushes.	 The dirt road is shown from a different angle, with utility poles visible on the right side, suggesting infrastructure work.	
32.	B Nonsomboun Sta. 3km+200 m to the direction of B Hat Gniun	 A dirt road with shadows cast across it, indicating a sunny day, with dense vegetation on the sides.	 The dirt road is shown with utility poles and wires visible, indicating ongoing construction or infrastructure development.	



No	Location	Photo before construction (8/10/2013)	Photo on the month (21-24/10/2013)	Photo of the previous month
33.	B Nonsomboun Sta. 3km+300 m to the direction of Nonsomboun	 A dirt road with visible tire tracks, surrounded by green vegetation and trees. The road surface is uneven and appears to be in an early stage of construction.	 A dirt road similar to the previous photo, showing some changes in the surrounding area and the road's condition.	
34.	B Nonsomboun Sta. 3km+300 m to the direction of B Hat Gniun	 A dirt road with tire tracks, showing a different section of the construction site with more exposed earth.	 A dirt road showing further progress in the construction work, with more defined tracks and some vegetation clearing.	
35.	B Nonsomboun Sta. 3km+500 m to the direction of Nonsomboun	 A dirt road with tire tracks, showing a different section of the construction site with more exposed earth.	 A dirt road showing further progress in the construction work, with more defined tracks and some vegetation clearing.	

No	Location	Photo before construction (8/10/2013)	Photo on the month (21-24/10/2013)	Photo of the previous month
36.	B Nonsomboun Sta. 3km+500 m to the direction of B Hat Gniun	 A dirt road with a slight curve to the right, surrounded by green vegetation and trees under a clear blue sky.	 A dirt road with a slight curve to the right, showing some tire tracks, surrounded by green vegetation and trees under a clear blue sky.	
37.	B Nonsomboun Sta. 3km+675 m to the direction of Nonsomboun	 A dirt road curving to the right, with a utility pole visible on the right side, surrounded by green vegetation.	 A dirt road curving to the right, with a utility pole visible on the right side, showing some tire tracks and a small vehicle in the distance.	
38.	B Nonsomboun Sta. 3km+675 m to the direction of B Hat Gniun	 A dirt road curving to the right, with a steep embankment on the left and mountains in the background.	 A dirt road curving to the right, with a steep embankment on the left and mountains in the background, showing some tire tracks.	



No	Location	Photo before construction (8/10/2013)	Photo on the month (21-24/10/2013)	Photo of the previous month
39.	B Nonsomboun Sta. 3km+900 m to the direction of Nonsomboun			
40.	B Nonsomboun Sta. 3km+900 m to the direction of B Hat Gniun			
41.	B Nonsomboun Sta. 4km+025 m to the direction of Nonsomboun			



No	Location	Photo before construction (8/10/2013)	Photo on the month (21-24/10/2013)	Photo of the previous month
42.	B Nonsomboun Sta. 4km+025 m to the direction of B Hat Gniun			
43.	B Nonsomboun Sta. 4km+240 m to the direction of Nonsomboun			
44.	B Nonsomboun Sta. 4km+240 m to the direction of B Hat Gniun			


No	Location	Photo before construction (8/10/2013)	Photo on the month (21-24/10/2013)	Photo of the previous month
45.	B Nonsomboun Sta. 4km+400 m to the direction of Nonsomboun	 A dirt road with a single lane, flanked by dense green vegetation and trees. The road surface is uneven and appears to be in its natural state.	 The same dirt road, but now with a more defined and smoother surface, showing signs of recent grading or construction work.	
46.	B Nonsomboun Sta. 4km+400 m to the direction of B Hat Gniun	 A dirt road with a white van parked on the left side. A person is standing near the van. The road is flanked by trees and vegetation.	 The same dirt road, but with a more uniform and compacted surface. The white van is no longer visible.	
47.	B Nonsomboun Sta. 4km+650 m to the direction of Nonsomboun	 A wide dirt road with a rough, uneven surface, showing significant tire tracks and loose soil. The road is flanked by trees and vegetation.	 The same wide dirt road, but with a much smoother and more uniform surface, indicating recent construction or grading work. A small white car is visible in the distance.	



No	Location	Photo before construction (8/10/2013)	Photo on the month (21-24/10/2013)	Photo of the previous month
48.	B Nonsomboun Sta. 4km+650 m to the direction of B Hat Gniun	 A dirt road winding through a lush green area with many trees and bushes. The road is light brown and appears to be in an early stage of construction or clearing.	 A dirt road similar to the previous photo, but with more visible tire tracks and some shadows cast across it, suggesting a slight change in the road's surface or lighting.	
49.	B Nonsomboun Sta. 4km+950 m to the direction of Nonsomboun	 A dirt road winding through a landscape with scattered trees and dense vegetation. The road is light brown and shows some initial clearing work.	 A dirt road similar to the previous photo, but with more visible tire tracks and some shadows cast across it, suggesting a slight change in the road's surface or lighting.	
50.	B Nonsomboun Sta. 4km+950 m to the direction of B Hat Gniun	 A dirt road winding through a landscape with scattered trees and dense vegetation. The road is light brown and shows some initial clearing work.	 A dirt road similar to the previous photo, but with more visible tire tracks and some shadows cast across it, suggesting a slight change in the road's surface or lighting.	

No	Location	Photo before construction (8/10/2013)	Photo on the month (21-24/10/2013)	Photo of the previous month
51.	B Nonsomboun Sta. 5km+300 m to the direction of Nonsomboun			
52.	B Nonsomboun Sta. 5km+300 m to the direction of B Hat Gniun			
53.	Houay Ngua PPA Sta. 5km+450 m to the direction of Nonsomboun			



No	Location	Photo before construction (8/10/2013)	Photo on the month (21-24/10/2013)	Photo of the previous month
54.	B Nonsomboun Sta. 5km+450 m to the direction of B Hat Gniun			
55.	B Nonsomboun Sta. 5km+650 m to the direction of Nonsomboun			
56.	B Nonsomboun Sta. 5km+650 m to the direction of B Hat Gniun			

No	Location	Photo before construction (8/10/2013)	Photo on the month (21-24/10/2013)	Photo of the previous month
57.	B Nonsomboun Sta. 5km+775 m to the direction of Nonsomboun			
58.	Houay Ngua PPA Sta. 5km+775 m to the direction of B Hat Gniun			
59.	Houay Ngua PPA Sta. 5km+875 m to the direction of Nonsomboun			



60.	<p>Houay Ngua PPA  Sta. 5km+875 m  to the direction of B Hat Gniun</p>			
61.	<p>Houay Ngua PPA  Sta. 6km+040 m  to the direction of B Nonsomboun</p>			
62.	<p>Houay Ngua PPA  Sta. 6km+040 m  to the direction of B Hat Gniun</p>			




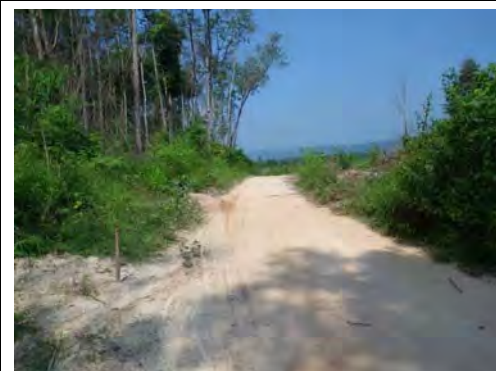
63.	<p>Houay Ngua PPA Sta. 6km+175 m to the direction of B Nonsomboun</p>			
64.	<p>Houay Ngua PPA Sta. 6km+175 m to the direction of B Hat Gniun</p>			
65.	<p>Houay Ngua PPA Sta. 6km+425 m to the direction of B Nonsomboun</p>			



66.	<p>Houay Ngua PPA Sta. 6km+425 m to the direction of B Hat Gniun</p>			
67.	<p>Houay Ngua PPA Sta. 6km+525 m to the direction of B Nonsomboun</p>			
68.	<p>Houay Ngua PPA Sta. 6km+525 m to the direction of B Hat Gniun</p>			

69.	<p>Houay Ngua PPA Sta. 6km+775 m to the direction of B Nonsomboun</p>			
70.	<p>Houay Ngua PPA Sta. 6km+775 m to the direction of B Hat Gniun</p>			
71.	<p>Houay Ngua PPA Sta. 7km+000 m to the direction of B Nonsomboun</p>			



72.	<p>Houay Ngua PPA Sta. 7km+000 m to the direction of B Hat Gniun</p>			
73.	<p>Houay Ngua PPA Sta. 7km+150 m to the direction of B Nonsomboun</p>			
74.	<p>Houay Ngua PPA Sta. 7km+150 m to the direction of B Hat Gniun</p>			

75.	<p>Houay Ngua PPA Sta. 7km+300 m to the direction of B Nonsomboun</p>			
76.	<p>Houay Ngua PPA Sta. 7km+300 m to the direction of B Hat Gniun</p>			
77.	<p>Houay Ngua PPA Sta. 7km+425 m to the direction of B Nonsomboun</p>			



78.	<p>Houay Ngua PPA Sta. 7km+425 m to the direction of B Hat Gniun</p>			
79.	<p>Houay Ngua PPA Sta. 7km+540 m to the direction of B Nonsomboun</p>			
80.	<p>Houay Ngua PPA Sta. 7km+540 m to the direction of B Hat Gniun</p>			

81.	<p>Houay Ngua PPA Sta. 7km+625 m to the direction of B Nonsomboun</p>			
82.	<p>Houay Ngua PPA Sta. 7km+625 m to the direction of B Hat Gniun</p>			
83.	<p>Houay Ngua PPA Sta. 7km+750 m to the direction of B Nonsomboun</p>			



84.	<p>Houay Ngua PPA Sta. 7km+750 m to the direction of B Hat Gniun</p>			
85.	<p>Houay Ngua PPA Sta. 7km+950 m to the direction of B Nonsomboun</p>			
86.	<p>Houay Ngua PPA Sta. 7km+950 m to the direction of B Hat Gniun</p>			

87.	<p>Houay Ngua PPA Sta. 8km+200 m to the direction of B Nonsomboun</p>			
88.	<p>Houay Ngua PPA Sta. 8km+200 m to the direction of B Hat Gniun</p>			
89.	<p>Houay Ngua PPA Sta. 8km+375 m to the direction of B Nonsomboun</p>			



90.	<p>Houay Ngua PPA Sta. 8km+375 m to the direction of B Hat Gniun</p>			
91.	<p>Houay Ngua PPA Sta. 8km+575 m to the direction of B Nonsomboun</p>			
92.	<p>Houay Ngua PPA Sta. 8km+575 m to the direction of B Hat Gniun</p>			

93.	<p>Houay Ngua PPA Sta. 8km+750 m to the direction of B Nonsomboun</p>			
94.	<p>Houay Ngua PPA Sta. 8km+750 m to the direction of B Hat Gniun</p>			
95.	<p>Houay Ngua PPA Sta. 9km+000 m to the direction of B Nonsomboun</p>			



96.	<p>Houay Ngua PPA Sta. 9km+000 m to the direction of B Hat Gniun</p>			
97.	<p>Houay Ngua PPA (Quarry) Sta. 9km+300 m to the direction of B Nonsomboun</p>			
98.	<p>Houay Ngua PPA (Quarry) Sta. 9km+300 m to the direction of quarry</p>			

99.	Houay Ngua PPA (Quarry) Sta. 9km+300 m to the direction of quarry			
100.	Houay Ngua PPA (Quarry) Sta. 9km+300 m to the direction of quarry			
101.	Houay Ngua PPA (Quarry) Sta. 9km+300 m to the direction of quarry			



102.	<p>Houay Ngua PPA (Quarry)  Sta. 9km+300 m  to the direction of quarry</p>			
103.	<p>Houay Ngua PPA (Quarry)  Sta. 9km+300 m  to the direction of B Hat Gniun</p>			
104.	<p>Houay Ngua PPA  Sta. 9km+450 m  to the direction of B Nonsomboun</p>			

105.	<p>Houay Ngua PPA Sta. 9km+450 m to the direction of quarry</p>			
106.	<p>Houay Ngua PPA Sta. 9km+450 m to the direction of quarry</p>			
107.	<p>Houay Ngua PPA Sta. 9km+450 m to the direction of B Hat Gniun</p>			



108.	<p>Houay Ngua PPA Sta. 9km+540 m to the direction of B Nonsomboun</p>			
109.	<p>Houay Ngua PPA Sta. 9km+540 m to the direction of B Hat Gniun</p>			
110.	<p>Houay Ngua PPA Sta. 9km+790 m to the direction of B Nonsomboun</p>			



111.	<p>Houay Ngua PPA Sta. 9km+790 m to the direction of B Hat Gniun</p>			
112.	<p>Houay Ngua PPA Sta. 9km+950 m to the direction of B Nonsomboun</p>			
113.	<p>Houay Ngua PPA Sta. 9km+950 m to the direction of B Hat Gniun</p>			

114.	<p>Houay Ngua PPA Sta. 10km+040 m to the direction of B Nonsomboun</p>			
115.	<p>Houay Ngua PPA Sta. 10km+040 m to the direction of B Hat Gniun</p>			
116.	<p>Houay Ngua PPA Sta. 10km+250 m to the direction of B Nonsomboun</p>			



117.	<p>Houay Ngua PPA Sta. 10km+250 m to the direction of B Hat Gniun</p>			
118.	<p>Houay Ngua PPA Sta. 10km+400 m to the direction of B Nonsomboun</p>			
119.	<p>Houay Ngua PPA Sta. 10km+400 m to the direction of B Hat Gniun</p>			

120.	<p>Houay Ngua PPA  Sta. 10km+550 m  to the direction of B Nonsomboun</p>			
121.	<p>Houay Ngua PPA  Sta. 10km+550 m  to the direction of B Hat Gniun</p>			
122.	<p>Houay Ngua PPA  Sta. 10km+675 m  to the direction of B Nonsomboun</p>			



123.	<p>B Thafuea          Sta. 10km+675 m          to the direction of B Hat Gniun</p>			
124.	<p>Houay Ngua PPA          Sta. 10km+825 m          to the direction of B Nonsomboun</p>			
125.	<p>Houay Ngua PPA          Sta. 10km+825 m          to the direction of B Hat Gniun</p>			



126.	<p>Houay Ngua PPA  Sta. 10km+950 m  to the direction of B Nonsomboun</p>			
127.	<p>Houay Ngua PPA  Sta. 10km+950 m  to the direction of B Hat Gniun</p>			
128.	<p>Houay Ngua PPA  Sta. 11km+175 m  to the direction of B Nonsomboun</p>			

129.	<p>Houay Ngua PPA  Sta. 11km+175 m  to the direction of B Hat Gniun</p>			
130.	<p>Houay Ngua PPA  Sta. 11km+500 m  to the direction of B Nonsomboun</p>			
131.	<p>Houay Ngua PPA  Sta. 11km+500 m  to the direction of B Hat Gniun</p>			



132.	<p>Houay Ngua PPA  Sta. 11km+600 m  to the direction of B Nonsomboun</p>			
133.	<p>Houay Ngua PPA  Sta. 11km+600 m  to the direction of B Hat Gniun</p>			
134.	<p>Houay Ngua PPA  Sta. 11km+800 m  to the direction of B Nonsomboun</p>			

135.	<p>Houay Ngua PPA  Sta. 11km+800 m  to the direction of B Hat Gniun</p>			
136.	<p>Houay Ngua PPA  Sta. 12km+150 m  to the direction of B Nonsomboun</p>			
137.	<p>Houay Ngua PPA  Sta. 12km+150 m  to the direction of B Hat Gniun</p>			



138.	<p>Houay Ngua PPA  Sta. 12km+275 m  to the direction of B Nonsomboun</p>			
139.	<p>Houay Ngua PPA  Sta. 12km+275 m  to the direction of B Hat Gniun</p>			
140.	<p>Houay Ngua PPA  Sta. 12km+325 m  to the direction of B Nonsomboun</p>			



141.	<p>Houay Ngua PPA Sta. 12km+325 m to the direction of B Hat Gniun</p>			
142.	<p>Houay Ngua PPA Sta. 12km+425 m to the direction of B Nonsomboun</p>			
143.	<p>Houay Ngua PPA Sta. 12km+425 m to the direction of B Hat Gniun</p>			

144.	<p>Houay Ngua PPA  Sta. 12km+600 m  to the direction of B Nonsomboun</p>			
145.	<p>Houay Ngua PPA  Sta. 12km+600 m  to the direction of B Hat Gniun</p>			
146.	<p>Houay Ngua PPA  Sta. 12km+840 m  to the direction of B Nonsomboun</p>			



147.	<p>Houay Ngua PPA  Sta. 12km+840 m  to the direction of B Hat Gniun</p>			
148.	<p>Houay Ngua PPA  Sta. 13km+000 m  to the direction of B Nonsomboun</p>			
149.	<p>Houay Ngua PPA  Sta. 13km+000 m  to the direction of B Hat Gniun</p>			

150.	<p>Houay Ngua PPA  Sta. 13km+075 m  to the direction of B Nonsomboun</p>			
151.	<p>Houay Ngua PPA  Sta. 13km+075 m  to the direction of B Hat Gniun</p>			
152.	<p>Houay Ngua PPA  Sta. 13km+225 m  to the direction of B Nonsomboun</p>			



153.	<p>Houay Ngua PPA  Sta. 13km+225 m  to the direction of B Hat Gniun</p>			
154.	<p>Houay Ngua PPA  Sta. 13km+425 m  to the direction of B Nonsomboun</p>			
155.	<p>Houay Ngua PPA  Sta. 13km+425 m  to the direction of B Hat Gniun</p>			



156.	<p>Houay Ngua PPA  Sta. 13km+600 m  to the direction of B Nonsomboun</p>			
157.	<p>Houay Ngua PPA  Sta. 13km+600 m  to the direction of B Hat Gniun</p>			
158.	<p>Houay Ngua PPA  Sta. 13km+750 m  to the direction of B Nonsomboun</p>			

159.	<p>Houay Ngua PPA Sta. 13km+750 m to the direction of B Hat Gniun</p>			
160.	<p>Houay Ngua PPA Sta. 14km+000 m to the direction of B Nonsomboun</p>			
161.	<p>Houay Ngua PPA Sta. 14km+000 m to the direction of B Hat Gniun</p>			



162.	<p>Houay Ngua PPA  Sta. 14km+340 m  to the direction of B Nonsomboun</p>			
163.	<p>Houay Ngua PPA  Sta. 14km+340 m  to the direction of B Hat Gniun</p>			
164.	<p>Houay Ngua PPA  Sta. 14km+650 m  to the direction of B Nonsomboun</p>			

165.	<p>Houay Ngua PPA  Sta. 14km+650 m  to the direction of B Hat Gniun</p>			
166.	<p>Houay Ngua PPA  Sta. 14km+950 m  to the direction of B Nonsomboun</p>			
167.	<p>Houay Ngua PPA  Sta. 14km+950 m  to the direction of B Hat Gniun</p>			



168.	<p>Houay Ngua PPA  Sta. 15km+100 m  to the direction of B Nonsomboun</p>			
169.	<p>Houay Ngua PPA  Sta. 15km+100 m  to the direction of B Hat Gniun</p>			
170.	<p>Houay Ngua PPA  Sta. 15km+300 m  to the direction of B Nonsomboun</p>			



171.	<p>Houay Ngua PPA  Sta. 15km+300 m  to the direction of B Hat Gniun</p>			
172.	<p>Houay Ngua PPA  Sta. 15km+600 m  to the direction of B Nonsomboun</p>			
173.	<p>Houay Ngua PPA  Sta. 15km+600 m  to the direction of B Hat Gniun</p>			

174.	<p>Houay Ngua PPA  Sta. 15km+800 m  to the direction of B Nonsomboun</p>			
175.	<p>Houay Ngua PPA  Sta. 15km+800 m  to the direction of B Hat Gniun</p>			
176.	<p>Houay Ngua PPA  Sta. 16km+000 m  to the direction of B Nonsomboun</p>			



177.	<p>Houay Ngua PPA  Sta. 16km+000 m  to the direction of B Hat Gniun</p>			
178.	<p>Houay Ngua PPA  Sta. 16km+000 m  to the direction of B Nonsomboun</p>			
179.	<p>Houay Ngua PPA  Sta. 16km+000 m  to the direction of B Hat Gniun</p>			

180.	<p>Houay Ngua PPA  Sta. 16km+000 m  to the direction of B Nonsomboun</p>			
181.	<p>Houay Ngua PPA  Sta. 16km+250 m  to the direction of B Nonsomboun</p>			
182.	<p>Houay Ngua PPA  Sta. 16km+250 m  to the direction of B Hat Gniun</p>			



183.	<p>Houay Ngua PPA  Sta. 16km+400 m  to the direction of B Nonsomboun</p>			
184.	<p>Houay Ngua PPA  Sta. 16km+400 m  to the direction of B Hat Gniun</p>			
185.	<p>Houay Ngua PPA  Sta. 16km+600 m  to the direction of B Nonsomboun</p>			



186.	<p>Houay Ngua PPA Sta. 16km+600 m to the direction of B Hat Gniun</p>			
187.	<p>Houay Ngua PPA Sta. 16km+900 m to the direction of B Nonsomboun</p>			
188.	<p>Thaheua Sta. 16km+900 m to the direction of B Hat Gniun</p>			

189.	<p>Thaheua Sta. 17km+150 m to the direction of B Nonsomboun</p>			
190.	<p>Thaheua Sta. 17km+150 m to the direction of B Hat Gniun</p>			
191.	<p>Thaheua Sta. 17km+350 m to the direction of B Nonsomboun</p>			



192.	Thaheua Sta. 17km+350 m to the direction of B Hat Gniun			
193.	Thaheua Sta. 17km+475 m to the direction of B Nonsomboun			
194.	Thaheua Sta. 17km+475 m to the direction of B Hat Gniun			

195.	Thaheua Sta. 17km+750 m to the direction of B Nonsomboun			
196.	Thaheua Sta. 17km+750 m to the direction of B Hat Gniun			
197.	Thaheua Sta. 17km+900 m to the direction of B Nonsomboun			



198.	Thaheua Sta. 17km+900 m to the direction of B Hat Gniun			
199.	Thaheua Sta. 18km+050 m to the direction of B Nonsomboun			
200.	Thaheua Sta. 18km+050 m to the direction of B Hat Gniun			



201.	Thaheua Sta. 18km+175 m to the direction of B Nonsomboun			
202.	Thaheua Sta. 18km+175 m to the direction of B Hat Gniun			
203.	Thaheua Sta. 18km+275 m to the direction of B Nonsomboun			

204.	Thaheua Sta. 18km+275 m to the direction of B Thaheua			
205.	Thaheua Sta. 18km+275 m to the direction of B Thaheua			
206.	Thaheua Sta. 18km+275 m to the direction of B Thaheua			



207.	Thaheua Sta. 18km+275 m to the direction of B Hat Gniun			
208.	Thaheua Sta. 18km+450 m to the direction of B Hat Gniun			
209.	Thaheua Sta. 18km+450 m to the direction of B Nonsomboun			

210.	<p>Thaheua Sta. 18km+450 m to the direction of B Hat Gniun</p>			
211.	<p>Thaheua Sta. 18km+450 m to the direction of B Nonsomboun</p>			
212.	<p>Thaheua Sta. 18km+450 m to the direction of B Hat Gniun</p>			



213.	<p>Hat Gniun Sta. 18km+650 m to the direction of B Nonsomboun</p>			
214.	<p>Hat Gniun Sta. 18km+650 m to the direction of B Hat Gniun</p>			
215.	<p>Hat Gniun Sta. 18km+900 m to the direction of B Nonsomboun</p>			

216.	<p>Hat Gniun Sta. 18km+900 m to the direction of B Hat Gniun</p>			
217.	<p>Hat Gniun Sta. 19km+200 m to the direction of B Nonsomboun</p>			
218.	<p>Hat Gniun Sta. 19km+200 m to the direction of B Hat Gniun</p>			



219.	<p>Hat Gniun Sta. 19km+340 m to the direction of B Nonsomboun</p>			
220.	<p>Hat Gniun Sta. 19km+340 m to the direction of B Hat Gniun</p>			
221.	<p>Hat Gniun Sta. 19km+500 m to the direction of B Nonsomboun</p>			

222.	<p>Hat Gniun Sta. 19km+500 m to the direction of B Hat Gniun</p>			
223.	<p>Hat Gniun Sta. 19km+675 m to the direction of B Nonsomboun</p>			
224.	<p>Hat Gniun Sta. 19km+675 m to the direction of B Hat Gniun</p>			



225.	<p>Hat Gniun Sta. 19km+875 m to the direction of B Nonsomboun</p>			
226.	<p>Hat Gniun Sta. 19km+875 m to the direction of B Hat Gniun</p>			
227.	<p>Hat Gniun Sta. 20km+050 m to the direction of B Nonsomboun</p>			

228.	<p>Hat Gniun Sta. 20km+050 m to the direction of B Hat Gniun</p>			
229.	<p>Hat Gniun Sta. 20km+300 m to the direction of B Nonsomboun</p>			
230.	<p>Hat Gniun Sta. 20km+300 m to the direction of B Hat Gniun</p>			



231.	<p>Hat Gniun Sta. 20km+475 m to the direction of B Nonsomboun</p>			
232.	<p>Hat Gniun Sta. 20km+475 m to the direction of B Hat Gniun</p>			
233.	<p>Hat Gniun Sta. 20km+650 m to the direction of B Nonsomboun</p>			

234.	Hat Gniun Sta. 20km+650 m to the direction of B Hat Gniun			
235.	Hat Gniun Sta. 20km+850 m to the direction of B Nonsomboun			
236.	Hat Gniun Sta. 20km+850 m to the direction of B Hat Gniun			



237.	<p>Hat Gniun Sta. 21km+000 m to the direction of B Nonsomboun</p>			
238.	<p>Hat Gniun Sta. 21km+000 m to the direction of B Hat Gniun</p>			
239.	<p>Hat Gniun Sta. 21km+000 m to the direction of B Hat Gniun</p>			

240.	<p>Hat Gniun Sta. 21km+000 m to the direction of B Hat Gniun</p>			
241.	<p>Hat Gniun Sta. 21km+000 m to the direction of Dam site</p>			
242.	<p>Hat Gniun Sta. 21km+325 m to the direction of B Hat Gniun</p>			

243.	Hat Gniun Sta. 21km+325 m to the direction of B Nonsomboun			
244.	Hat Gniun Sta. 21km+325 m to the direction of B Hat Gniun			
245.	Hat Gniun Sta. 21km+325 m to the direction of B Hat Gniun			



246.	<p>Hat Gniun Sta. 21km+325 m to the direction of Dam site</p>			
247.	<p>Hat Gniun Sta. 21km+325 m to the direction of B Hat Gniun</p>			
248.	<p>Hat Gniun Sta. 21km+325 m to the direction of B Hat Gniun</p>			



249.	<p>Hat Gniun Sta. 21km+500 m to the direction of B Nonsomboun</p>			
250.	<p>Hat Gniun Sta. 21km+500 m to the direction of Dam site</p>			
251.	<p>Hat Gniun Sta. 21km+600 m to the direction of B Nonsomboun</p>			

252.	<p>Hat Gniun Sta. 21km+600 m to the direction of Dam site</p>			
253.	<p>Hat Gniun Sta. 21km+725 m to the direction of B Nonsomboun</p>			
254.	<p>Hat Gniun Sta. 21km+725 m to the direction of Dam site</p>			



255.	<p>Hat Gniun Sta. 21km+950 m to the direction of B Nonsomboun</p>			
256.	<p>Hat Gniun Sta. 21km+950 m to the direction of Dam site</p>			
257.	<p>Hat Gniun Sta. 22km+300 m to the direction of B Nonsomboun</p>			

258.	Hat Gniun Sta. 22km+300 m to the direction of Dam site			
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C Video record

- From a car taking a video of the road from Nonsomboun to Hat Gniun and Nam Miang



Annex B

## Photolog of Jica Road Condition

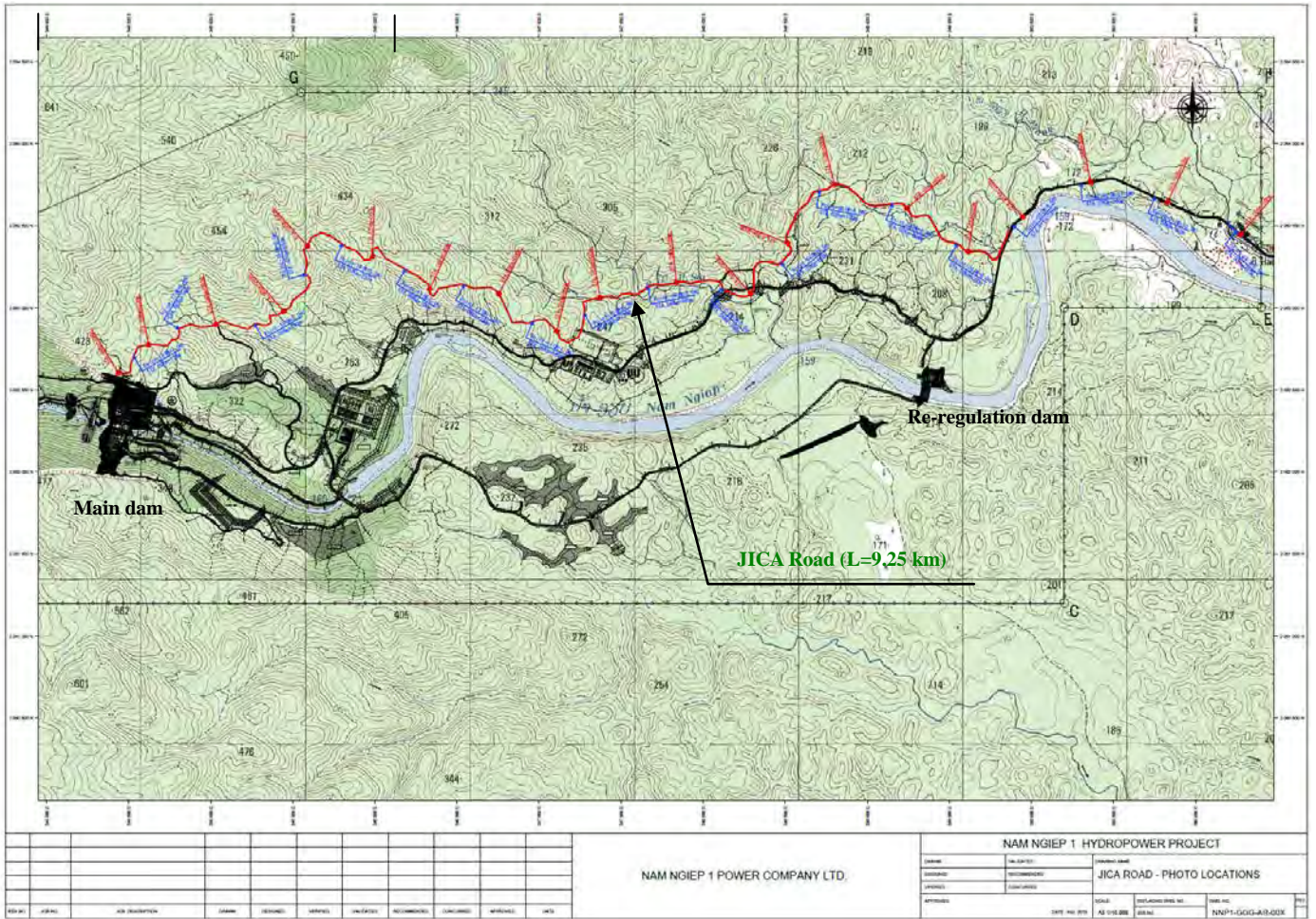
# Road Width of JICA Road (Photo Record)

## Typical photograph of JICA Road

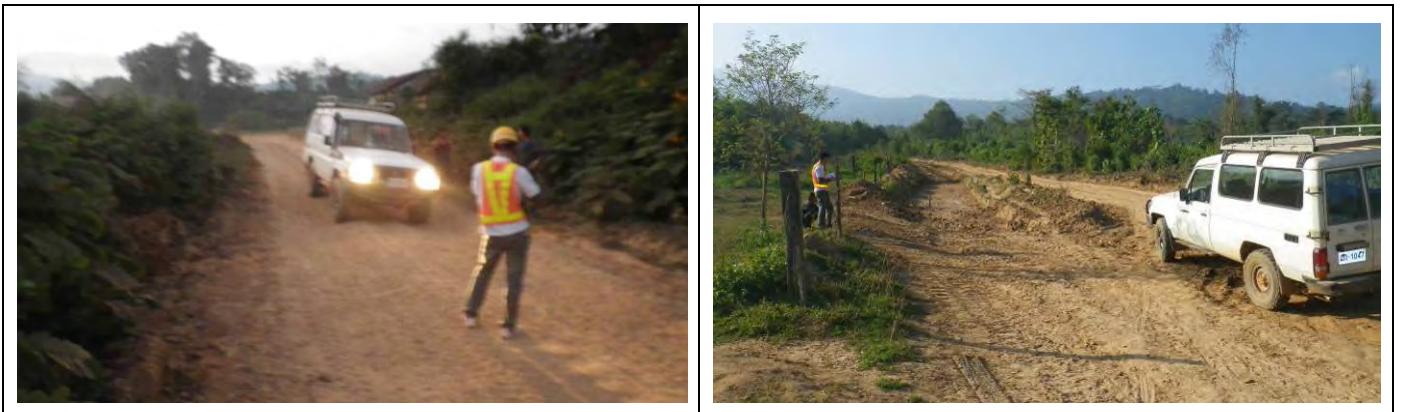
### 1. Date:

5<sup>th</sup> November 2013

### 2. Location of Photograph record



### 3. Photo Record





**Road Width of JICA Road (Photo Record)**

<p>Point-0 (KM0+030m, W=6.5 m)</p>	<p>Point-1 (KM0+580m, W=13.5 m)</p>
	
<p>Point-2 (KM1+060m, W=11.5 m)</p>	<p>Point-3 (KM1+580m, W=4.5 m)</p>
	
<p>Point-4 (KM2+080m, W=6.0 m)</p>	<p>Point-5 (KM2+600m, W=6.5 m)</p>
	
<p>Point-6 (KM3+100m, W=4.5 m)</p>	<p>Point-7 (KM3+650m, W=5.5 m)</p>






**Road Width of JICA Road (Photo Record)**

	
<p>Point-8 (KM4+190m, W=5.5 m)</p>	<p>Point-9 (KM4+680m, W=5.0 m)</p>
	
<p>Point-10 (KM5+180m, W=6.0 m)</p>	<p>Point-11 (KM5+680m, W=7.0 m)</p>
	
<p>Point-12 (KM6+230m, W=7.0 m)</p>	<p>Point-13 (KM6+700m, W=6.0 m)</p>
	
<p>Point-14 (KM7+230m, W=5.5 m)</p>	<p>Point-15 (KM7+690m, W=6.0 m)</p>



**Road Width of JICA Road (Photo Record)**

	
Point-16 (KM8+240m, W=5.0 m)	Point-17 (KM8+740m, W=6.0 m)
	
Point-18 (KM9+130m, W=7.0 m)	

[Summary of Coordinates and Width]

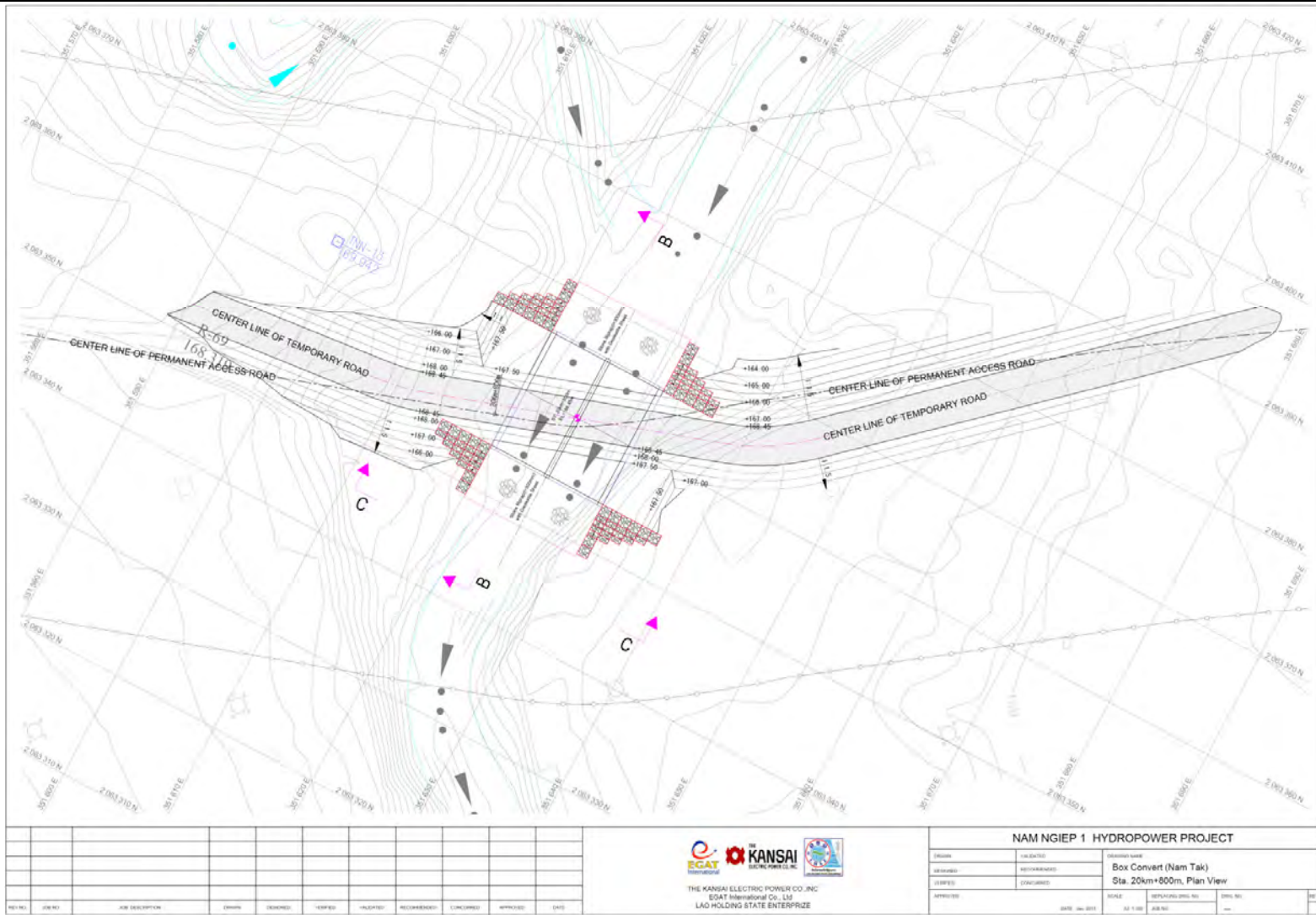
Name	Sta. No.	Coordinate		Width [m]	Name	Sta. No.	Coordinate		Width [m]
		X	Y				X	Y	
Point-0	KM0+030m	351,258	2,063,476	6.5	Point-10	KM5+180m	347,286	2,062,959	6.0
Point-1	KM0+580m	350,756	2,063,671	13.5	Point-11	KM5+680m	346,959	2,062,920	7.0
Point-2	KM1+060m	350,300	2,063,756	11.5	Point-12	KM6+230m	346,560	2,063,175	7.0
Point-3	KM1+580m	349,904	2,063,491	4.5	Point-13	KM6+700m	346,197	2,063,268	6.0
Point-4	KM2+080m	349,550	2,063,392	6.0	Point-14	KM7+230m	345,822	2,063,416	5.5
Point-5	KM2+600m	349,155	2,063,628	6.5	Point-15	KM7+690m	345,610	2,063,220	6.0
Point-6	KM3+100m	348,706	2,063,694	4.5	Point-16	KM8+240m	345,273	2,062,916	5.0
Point-7	KM3+650m	348,487	2,063,266	5.5	Point-17	KM8+740m	344,827	2,062,859	6.0
Point-8	KM4+190m	348,142	2,063,121	5.5	Point-18	KM9+130m	344,530	2,062,710	7.0
Point-9	KM4+680m	347,667	2,063,121	5.0	-	-	-	-	-
Maximum Road Width		13.5 m							
Minimum Road Width		4.5 m							
Average Road Width		6.6 m							

Annex C

## Plans of Permanent Bridges and Culverts



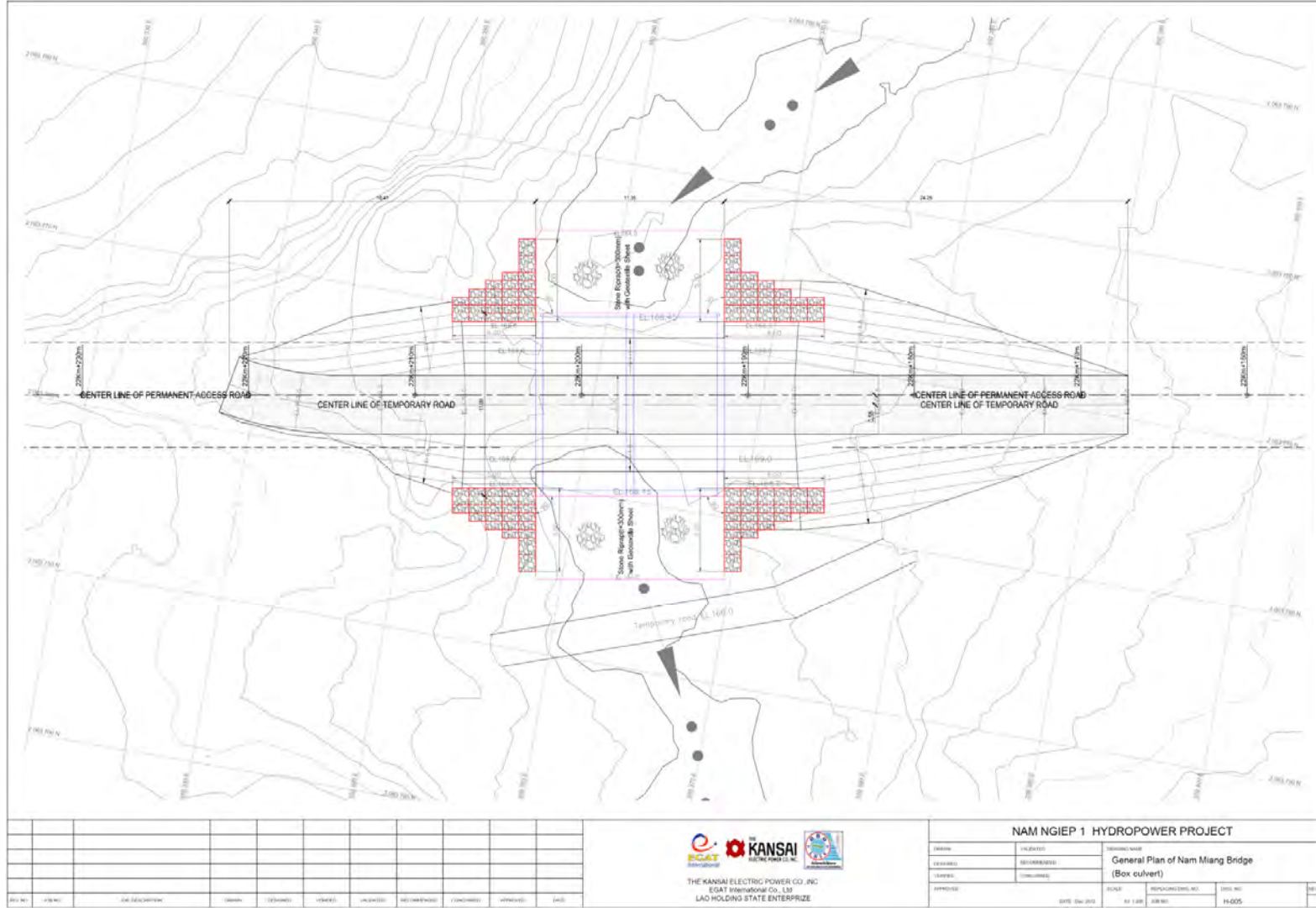
Figure 2 Layout of Box Convert Construction at Nam Tak



Source: NNP1PC (August 2013)



Figure 3 Layout of Box Convert Construction at Nam Miang



Source: NNP1PC (August 2013)

Annex D

## Construction Report - February to September 2013

**Revised Explanation for concerns related rehabilitation  
works raised during the site visit by ADB mission  
on 24 September 2013  
- Nam Ngiep 1 Hydropower Project -**

**December 2013**

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[Attachment]

*Attachment-1 Certification of EIA including EMP and IEE for access road certified by MoNRE on 16th July 2012*

*Attachment-2 Consultation meeting for B Hat Gniun and Ban Thafuea on 8 February 2013*

*Attachment-3 Approval for the construction of the road rehabilitation works on Bolikhamxay province on 18 Feb 2013*

*Attachment-4 Hydrological design documents*

*Attachment-5 Timeline and back ground of Houay Ngua Provincial Preservation Area (Houay Ngua PPA)*



**1 General**

**1.1 Purpose of the Works**

Road Rehabilitation works of the existing road between B Nonsomboun and B Hat Gniun (“the Works”) was started from 14 February 2013 and completed on 30 Sep 2013 for the purpose of securing the accessibility to the site in the rainy season for survey purpose. Details of location of the Works are shown in the figure below.

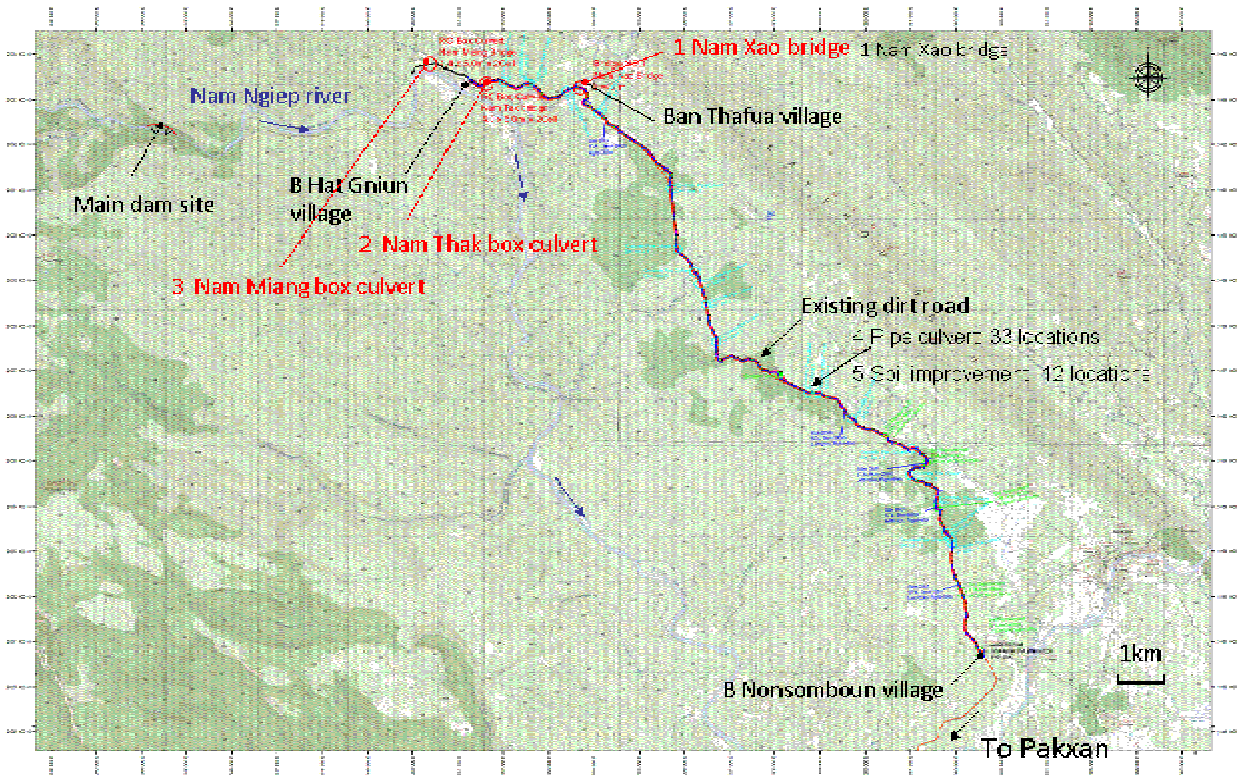


Figure-1 Location of the project

At that time, the project was also under geological survey, land use survey, UXO survey, and pilot village activities for resettlement people and project preparation. It was necessary to access the site in last rainy season for studying the feasibility of the project as same works of any other hydropower projects.

The existing road between B. Nonsomboun and B. Hat Guinn was a dirt road without any treatments for the protection for soil erosion and had no bridges in the small river of Nam Xao, Nam Thak and Nam Miang and few pipe culverts in small streams which are almost broken and have no protection for soil erosion. Thus the Works including installation of one plate girder bridge across Nam Xao and two box culverts across Nam Miang and Nam Thak, pipe culverts installation for small streams and soil improvement were implemented.

From local villager’s perspective, before now every year villagers had repaired the existing road with installing a timber and dumping soil in small streams for crossing rivers as shown in the photos below. Children at Ban

Thafuea village sometimes had crossed the Nam Xao River by swimming in rainy season to go to school at B Hat Gniun. It was very difficult and not safe situation for villagers to access the public services (e.g. school and hospital) in rainy season by using the existing road.



Figure-2 Road conditions in rainy season before the Works



Figure-3 Road conditions in dry season before the Works



Figure-4 Nam Xao, Nam Thak and Nam Miang (from left side) before the Works



Figure-5 Small stream in dry season before the Works

**1-2. Summary of the Works**

The summary of the salient feature of the Works is as below.

Owner	The KANSAI ELECTRIC Co.,Inc "KANSAI" <i>Notes; On 12 April 2013, Nam Ngiep 1 Power Co.ltd "NNP1PC" was established. The Contract was transferred from KANSAI to NNP1PC on 28 June 2013.</i>
Contractor	Road Construction No.8 Enterprise "Contractor"
Construction period	From February 2013 to September 2013
Date of starting the Works	18 <sup>th</sup> February 2013
Section of the road	From B Nonsomboun to B Hat Gniun and Hat saykham (L = 21.2 km)
Road categorization	Rural road (Bolikham district, unpaved dirt road)
Major work volume	1. Nam Xao bridge: Length 40 m, width 5.5 m 2. Nam Thak box culvert: Length 11.3 m, width 12.0 m 3. Nam Miang box culvert: Length 11.3 m, width 11.0 m 4. Pipe culvert installation: 33 locations 5. Soil improvement 12 locations

When the Works was planned and started, the Nam Ngiep 1 Power Company had not established yet. The project sponsor (Kansai) directly made a contract with a local contractor and managed the Works such as construction supervision, environmental and social monitoring.

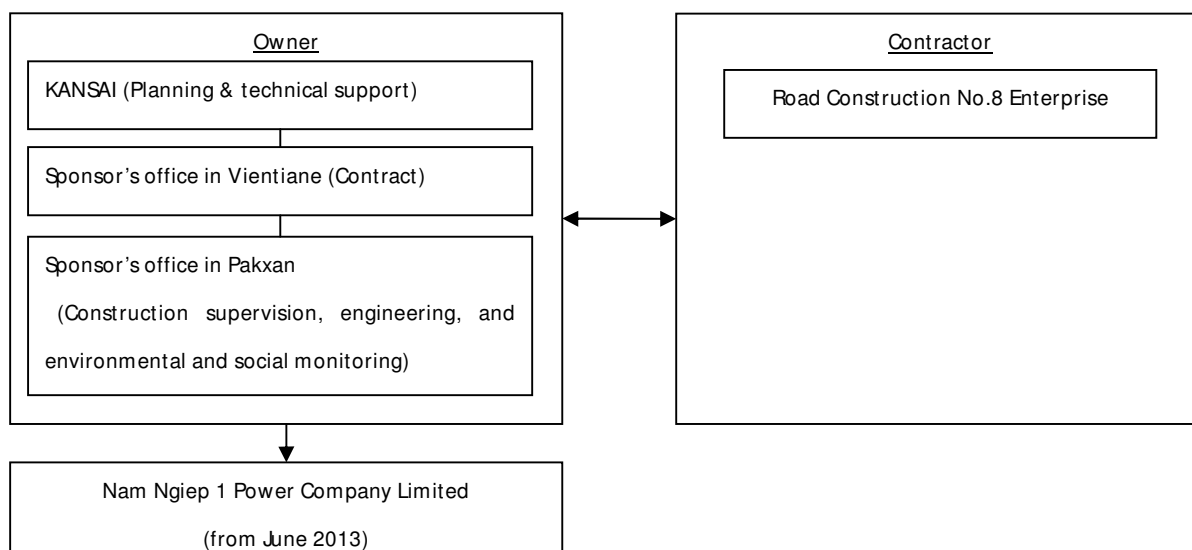


Figure-6 Organization chart during the works

## **2 Environmental and Social mitigation measures**

### **2-1 Permissions and Approvals**

Required permissions and approvals for the Works are shown in below, EIA including EMP and IEE for Access road was certified on 16<sup>th</sup> July 2012 by MoNRE while EIA and IEE were not required for the Works under applicable laws in the Lao PDR and it was confirmed by the Lao government.

16 July 2012 : IEE for access road was approved by MoNRE (**Attachment-1**).

24 December 2012 : Design approval for the Works

8 February 2013 : The consultation meeting with villagers at Ban Nonsomboun, Ban Sisavath, Ban Thafuea, and Ban Hat Gniun was conducted (**Attachment-2**).

18 February 2013 : Permission for the Works was issued by Bolikhamxay province within PPA (**Attachment-3**)

28 February 2013 : Submission of environmental mitigation plan for the Works to MoNRE


11 October 2013 : Inspection for completion of the Works

### **2-2 E&S mitigation plan**

As the Works did not change the existing road alignment and affected area by earthworks was very limited, the EIA including ESMMPCP and IEE was not required for the Works for survey works under applicable laws of the Lao PDR and it was confirmed by Lao government. However the environmental mitigation measures were planned, submitted to GoL and conducted as shown in the table below.




[Physical and biological environment during construction submitted to MoNRE on March 2013]

No	Potential Impact	Mitigation Measure	Responsibility	Means of Verification	
1	<u>Atmosphere</u> Vehicle and heavy machinery make a dust along the road	- Spraying water by water tank truck 	Contractor	- Weekly observation by the Owner - Monthly report on the activity to the Owner by the Contractor	- To be confirmed in daily and monthly report by including date and location of spraying water.
2	<u>Surface Water and ground water quality</u> Contamination by oil, grease, fuel, and etc	- Collect, store and dispose of material - Oil, grease, fuel and etc shall be stored on an appropriate place - To avoid accidental spills and prepare clear up emergency procedure	Contractor	- Weekly observation by the Owner - Monthly report on the activity to the Owner by the Contractor	- To be confirmed appropriate location of storage with photos in monthly report. - To be confirmed whether the spillage of fuel is occurred or not in daily report.
3	<u>Geology</u> Erosion of slope by excavation	- To minimize extracting of construction materials. - To choose the borrow site carefully - To design cut slope to minimize instability - To minimize major earthwork during the rainy season - To install appropriate slope protection	Owner/Contractor or	- Design document - Monthly report on the activity to the Owner by the Contractor	- To be confirmed location of borrow pit in monthly report to show no impact on erosion owing to appropriate distance from river.

No	Potential Impact	Mitigation Measure	Responsibility	Means of Verification	
		works.			
4	<u>Hydrology</u> Bridge pier makes water flow area smaller and then water level upstream increase	- To design adequate bridge length with considering water flow area to make river water flow smoothly	Owner	- Hydrological design documents by the Owner <b>(Attachment - 4)</b>	
5	<u>Water quality</u>	- When excavating foundation in the river bed, occurrence of turbid water is minimized as much as practicably possible.	Contractor	- Monthly report on the activity to the Owner by the Contractor	- To be confirmed river diversion activity in advance with photo in monthly report.
6	<u>Terrestrial ecology</u> Increasing hunting of wildlife and cutting tree in local area	- To prohibit hunting on construction site - To prohibit use of green timber cut from forest or fuel wood by the Contractor	Contractor	- Monthly report on the activity to the Owner by the Contractor	- To be confirmed rules on behaviors of labor, especially foreigners in monthly report.

[Social environment during construction submitted to MoNRE on March 2013]

No	Potential Impact	Mitigation Measure	Responsibility	Means of Verification	
1	<u>Local Community</u> Social disruption from construction camps	- To employ local people as much as possible - To minimize impact from construction and operation of site camp - To explain related villager the	Contractor	- Weekly observation by the Owner - Monthly report on the activity to the Owner by the Contractor	- To be confirmed the following points in daily and monthly report. - Number of employed local people (Daily and Monthly)

No	Potential Impact	Mitigation Measure	Responsibility	Means of Verification	
		construction works - To educate labor from trouble with villagers, malaria control, and prevention of HIV/AIDS - To plan weekly site clean up activity. 			report) - Rule on behaviors of labor (Monthly report) - Check of clean up activity (Dairy and Monthly report) - Photo of pegs and ropes to demarcate construction area (Monthly report)
2	<u>Existing infrastructure</u> Damage to/ loss of vegetation, important trees, and agricultural land.	- To design and survey the land use of the area carefully. - To restrict clearing and grubbing the area as much as possible - To coordinate adequately among concerned parties.	Owner / Contractor	- Design documents by the Owner - Weekly observation by the Owner - Monthly report on the activity to the Owner by the Contract	- To be confirmed result of joint survey activity in monthly report
3	<u>Noise and vibration</u> Night time construction works by using heavy machinery	- During night time from 10 pm to 6 am, earthwork is reduced as much as practicably possible.	Contractor	- Weekly observation by the Owner - Monthly report on the activity to the Owner by the Contract	- To be confirmed actual working time in daily and monthly report

No	Potential Impact	Mitigation Measure	Responsibility	Means of Verification	
<u>4</u>	<u>Traffic disturbance</u>	<ul style="list-style-type: none"> <li>- To conduct traffic diversion during construction of culverts and bridges</li> <li>- To implement necessary measure for prevent endangering the local vehicle pass through the construction site.</li> </ul>	Contractor	Weekly observation by the Owner - Monthly report on the activity to the Owner by the Contract	<ul style="list-style-type: none"> <li>- Check of working time of security staff in daily report</li> <li>- To be confirmed the appropriate measures to prevent from traffic disturbance including security staff with working time (on the basis of 24 hours) in monthly report.</li> </ul>
<u>5</u>	<u>UXO danger</u>	<ul style="list-style-type: none"> <li>- To survey and clearing UXO in the construction area</li> </ul>	Owner		



**2-3 Monitoring results on Environmental and Social mitigation**

2-3-1 Example of Daily monitoring

The daily implementation of these mitigation plans was checked through the daily and monthly report and weekly site observation by the NNP1PC. The actual practice for daily report on the road rehabilitation works is shown in figure below.

**Record on daily report of environmental activities**

- Spray water on the road; (Location, Frequency)
- Check on Spillage of fuel (confirmation at least once a week)
- Check on Number of employed local people
- Check on clean up activity (at least once a week)
- Record on working time of security staff

Daily Report of Activities	
Date:	5-Apr-2013
Weather:	Sunny
Reported By:	Kheungshom
Position:	Site Engineer
Item	Description
1	<b>Nam Xeo Bridge, Working time: 7:00 ~ 17:30hrs</b> *P1-Continue Form work support installation for wall #1 (completed) *P2-Form work support installation for column #2 * P3_Clean head, keep concrete curing * P4_Form work support installation for "Cross head" (completed) * P5_No Activity
2	<b>Nam Tak Box culvert, Working time: 7:00 ~ 18:45 hrs</b> *Concrete placement for wall No1 (LHS), started from 9:45 ~ 18:30hrs, volume 22.5m <sup>3</sup> (C-14-3)
3	<b>Nam Mieng Box culvert, Working time: 7:00 ~ 17:30 hrs</b> *Continue Reinforcement installation for sub-wall (top slab still bare)
4	<b>RE Pipes culvert</b> *Site Sta. 4+740, RC pipe installation, Sta 19+730, 19+780, 20+365, RC pipe delivery to site
5	<b>Road Rehabilitation Work</b> Joint survey to design additional soil improvement location (Owner+RBLI)
6	<b>Re-bar yard</b> *Fabricate rebar for Nam Mieng, stump wall
7	<b>Mobilization and Material delivery</b> *Delivery appropriate and consent to site
8	<b>Other issue</b> - None
9	<b>Environment mitigation measures</b> * Spray water on the road, Ban Haijau, five times * Spillage of fuel, 0/1 No * Number of employed local people, min 20 percontemporary * Clean up activity, 0/1 Yes * Working time of security staff, 24 hrs

1

Equipment						
Exc.	Mixer	RT	Crane	Crane (30t)	Generator	Water pump
3	2	2	1	1	3	5
Pick up						
4						
Manpower						
Engineer	Surveyor	Foreman	Welder/Electrician	Worker		
5	2	3	5	48		
Driver/Inspector						
9						

**Photos of activities**



Nam Tak Box culvert  
Concrete placement for wall (LHS) ongoing



Access road-survey for design of additional soil improvement location

2

Figure-7 Daily reports during the Works

2-3-2 Example on prevention of the traffic disturbance

The traffic safety control such for protecting the accident by installing sign board, holding safety meetings with villagers, and distribution of a traffic safety text book for students was carried out.

Rehabilitation Work of rural road between Ban Nonsomboun and Ban Hat Gnium\_Nam Gai-up 1 Hydropower project

Road No.1 Construction Enterprise

**Safety control Report**

**1. Object for safety control**

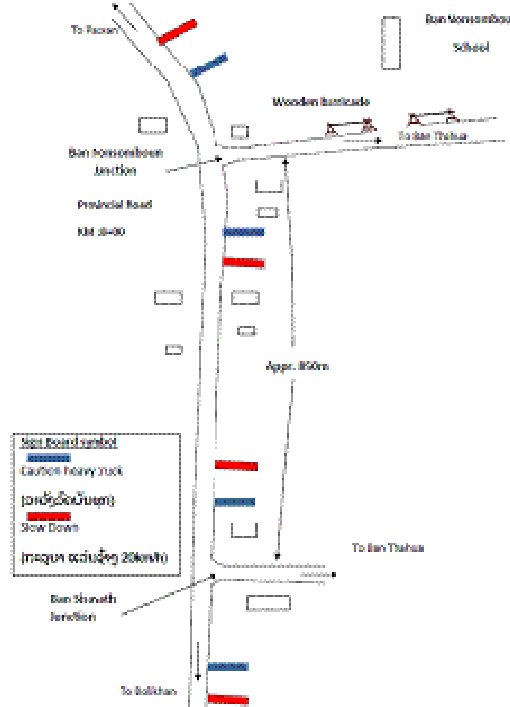
To prevent accident along the provincial road and access road between Ban Non Somboun to Ban Hat Gnium which could be occurred with public traffic, villager and children, especially junction road at Ban Nonsomboun will be improved for safety protection during traffic turning to access road. The main construction site at Ban Thahua and there also need to protect accident.

**2. Proposed improvement for safety control**

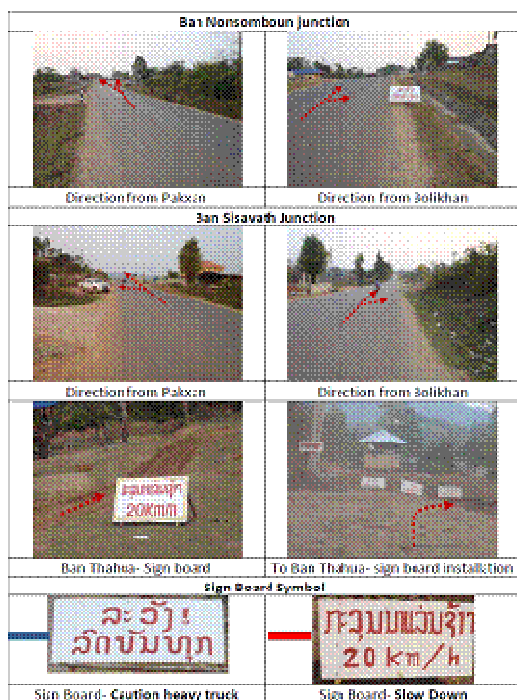
There are two junctions of access road to Ban Thahua such as Ban Nonsomboun junction (Main) and Ban Sisavath junction (Minor). Warning boards will installed before turning to these junctions as following details:

- **Ban Nonsomboun Junction - Main access road entrance**  
Install sign board at both side Bolikhan and Pakxan side "caution heavy truck" and "Slow Down" in Lao language
- **Ban Sisavath - The 2<sup>nd</sup> junction road (Bolikhan side)**  
Install sign board at both side Bolikhan and Pakxan side "caution heavy truck" and "Slow Down" in Lao language
- **Instruct to children at Ban Nonsomboun school,**
- **Explain about traffic situation during rehabilitation work conduction as well as-for NNIP1 construction work**
- **Ban Thahua**  
Install sign board Slow down and Caution within 20km/h at the both side entrance to the site

Sketch of Safety Control - install sign board along the Road



**Photos for improvement**



**Photos of activities**



Safety meeting with Ban Nonsomboun villager

Figure-8 Practice on prevention of the traffic disturbance

**2-3-3 Example on the prevention of soil erosion and discharging soil**

For prevention of soil erosion and discharging soil from road surface to sensitive areas such as paddy field, gravel was placed on road surface and outlet of drainage, and settling pond was installed.



Sta. 15+200  
Road improvement by Gravel filling



Sta. 17+200\_Drainage improvement by gravel filling



Sta. 22+200  
Road improvement by gravel filling



Km 16+00 Quarry  
Settlement pond installation

Figure-9 Practice on the prevention of the soil erosion and discharging soil

**2-3-4 Example of Water quality monitoring**

Water quality monitoring have been implemented at downstream and upstream of Nam Xao rive, Nam Thak river, and Nam Miang river respectively once a two week during the Works.

Nam Xao														
Unit	Date	Time	Location	Climate	Humidity	Air temperature	Water temperature	pH	DO	Turbidity	BOD	COD	Total coliform	Remark
	dd/mm/yyyy	hh:mm	Nam Xao/river	Fine Cloudy Rain	%	°C	°C	-	mg/l	FTU	mg/l	mg/l	MPN/100	
<b>Area C / Appendix 2 / Effluent Standard</b>														
<b>Downstream of Nam xao river</b>														
1	08/04/2013	12:26		sunny	42%	27.1	20.3	8.4	7.9	20	0	2	24	
2	09/04/2013	11:52		sunny	44%	28.2	20.7	7	8.5	20	-	4	26	
3	05/05/2013	11:30		fine	85%	31.1	23.1	7.1	8.1	20	2	4	42	
4	17/05/2013	10:53		partly/sandy	88%	31.1	21.1	7.3	8.7	20	2	4	10	
5	31/05/2013	14:20		fine	59%	35.3	20.3	7.4	8.4	20	2	6	24	
6	13/06/2013	14:11		fine	50%	31.5	23.9	9	8.1	20	4	-	40	
7	27/06/2013	15:13		cloudy/fine	74%	31.8	23.4	8.8	8.1	20	3	3	150	
<b>Downstream of Nam xao river</b>														
1	08/04/2013	12:40		sunny	31%	32.4	21.3	8.3	8.2	20	3	8	65	
2	09/04/2013	11:12		sunny	61%	30.2	23.1	7	8.5	60	-	4	73	
3	05/05/2013	11:00		fine	86%	32.8	20.5	7	8.6	20	2	4	51	
4	17/05/2013	11:23		sunny	33%	28.3	23.8	7.2	7.2	30	3	8	24	
5	31/05/2013	14:00		fine	75%	26.8	20.4	7.2	8.7	280	2	8	81	
6	13/06/2013	14:01		fine	50%	32.3	23.2	7.9	8	20	3	-	33	
7	27/06/2013	14:54		fine/slightly	85%	30.5	28.7	8.5	8.4	20	3	3	161	

**Nam Thiê**

Unit	Date	Time	Location	Climate	Humidity	Air temperature	Water temperature	pH	DO	Turbidity	BOC	COD	Total coliform	remark
	dd/mm/yyyy	hh:mm	Nam Thiê river	Fine Cloudy Rain	%	°C	°C	-	FTU	FTU	mg/l	mg/l	MPN/100	
<b>Annex C / Appendix 2 / Effluent Standard</b>														
<b>Upstream of Nam Thiê river</b>														
1	08.04.2013	14:04		sunny	41%	35.3	29.8	7.8	7.5	29	3	8	22	
2	10.04.2013	13:05		sunny	45%	37.3	29.3	6.9	4.7	30	-	4	7	
3	03.05.2013	10:10		fine	52%	36.4	29.1	6.4	3.1	29	2	4	47	
4	17.05.2013	12:01		sunny	39%	44	31.7	6.4	7.3	29	4	4	10	
5	31.05.2013	12:54		fine	78%	29.9	29.6	7	8.8	20	2	10	28	
6	13.06.2013	13:20		fine	48%	32	29.0	7.1	8.1	29	9	-	43	
7	27.06.2013	14:03		cloudy&fine	82%	30.3	25.9	6.8	9.9	160	-	3	631	
<b>Downstream of Nam Thiê river</b>														
1	08.04.2013	14:30		sunny	44%	37.3	29.9	7.4	7.9	29	4	2	90	
2	10.04.2013	13:30		sunny	44%	38.1	29.3	6.5	4.9	30	-	4	13	
3	03.05.2013	13:38		sunny	45%	38.8	29.5	6.3	8	29	3	10	63	
4	17.05.2013	12:32		sunny	55%	39	34.3	6.4	6.6	20	4	6	26	
5	31.05.2013	13:23		fine	57%	36.3	30.6	7	8.8	145	3	10	61	
6	14.06.2013	13:09		fine&wind	49%	32	26.5	7.2	8.1	30	8	-	83	
7	27.06.2013	13:40		cloudy&fine	89%	29.7	26.6	6.9	8	180	-	1	231	

**Nam Mông**

Unit	Date	Time	Location	Climate	Humidity	Air temperature	Water temperature	pH	DO	Turbidity	BOC	COD	Total coliform	remark
	dd/mm/yyyy	hh:mm	Nam Mông river	Fine Cloudy Rain	%	°C	°C	-	FTU	FTU	mg/l	mg/l	MPN/100	
<b>Annex C / Appendix 2 / Effluent Standard</b>														
<b>Upstream of Nam Mông river</b>														
1	08.04.2013	14:58		sunny	38%	36.3	27.9	6.7	7.2	29	4	6	29	
2	10.04.2013	14:55		sunny	48%	37.5	28.1	6.4	6.3	30	-	4	44	
3	03.05.2013	14:44		sunny	35%	34.1	26.7	6.1	6.5	29	3	8	46	
4	17.05.2013	12:54		sunny	51%	36.9	28.5	6.2	6	29	1	10	21	
5	31.05.2013	11:29		cloudy	67%	26.7	26.1	6.8	6.1	29	5	10	29	
6	13.06.2013	11:08		fine	59%	32	26.8	6.8	6.8	20	4	-	62	
7	27.06.2013	11:40		cloudy	61%	27	24.4	5.8	6.5	220	-	4	179	
<b>Downstream of Nam Mông river</b>														
1	08.04.2013	15:21		sunny	43%	38.8	27.2	7.3	7.7	29	2	4	31	
2	10.04.2013	14:18		cloudy	65%	34.8	28.4	6.5	6	35	-	4	39	
3	03.05.2013	15:12		sunny	33%	34	26.7	6.4	7.4	20	4	10	39	
4	17.05.2013	14:23		sunny	56%	40.4	33.1	6.2	6.3	265	2	10	28	
5	31.05.2013	10:46		Rain	81%	23.8	25.9	6.7	6.1	30	4	10	37	
6	13.06.2013	10:37		fine	53%	25	26.5	6.9	6.9	20	4	-	96	
7	27.06.2013	11:15		cloudy	68%	26	24.7	6.5	6.3	205	-	3	163	



Figure-10 Practice of Water quality monitoring



## 2-3-5 Example on mitigation measures on the design features


Design features of the bridge and culverts to avoid or minimize environmental damage by the Works are contemplated in table below.

	Nam Xao bridge, Nam Thak box culvert, and Nam Miang box culvert	Pipe culvert	Soil improvement
Geology Soil erosion	<ul style="list-style-type: none"> <li>- Gabion box installation mitigates the erosion of the embankment</li> <li>- Installation of bridge and box culvert minimizes the turbidity occurrence when the vehicles and motorbikes pass the river.</li> </ul>	<ul style="list-style-type: none"> <li>- Installation of the pipe culvert minimizes the turbidity occurrence when the vehicles and motorbikes pass the river.</li> </ul>	Place 100 % of gravel for road surface for protect soil erosion of road surface
Hydrology	<ul style="list-style-type: none"> <li>- Designing adequate water flow area to make river stream flow smoothly</li> </ul>	<ul style="list-style-type: none"> <li>- Setting the pipe culver elevation equivalent to river bed elevation to prevent the water level increase upstream of the pipe culvert and minimize the amount of earthwork.</li> <li>- Enough discharged capacity of pipes is selected during normal conditions.</li> </ul>	No consideration

**2-4 Summary of environmental and social mitigation measures**

Improved status by each construction is assessed and summarized in the table below. The NNP1PC applied certain environmental mitigation measures for the Works, however it was found that there are still adverse impacts to be improved in each section as ADB suggested even if the facilities are under construction and will be completed soon as an access road construction by the main civil contractor. Details of the proposed mitigation measure are discussed in the section 3 to 5.

**2-4-1 Nam Xao bridge**

	Before construction	After improvement
Photograph		
Improvement	<ul style="list-style-type: none"> <li>- No turbid water due to vehicle passage inside the river</li> <li>- No soil erosion from road surface in the bridge section</li> <li>- Becoming accessible during rainy season not only for project survey but villagers to access public services such as hospital and school.</li> </ul>	

**2-4-2 Nam Thak and Nam Miang box culvert**

	Before construction	After improvement
Photograph	 Nam Thak box culvert	 Nam Thak box culvert
Improvement	<ul style="list-style-type: none"> <li>- No turbid water due to vehicle passage inside the river</li> <li>- Becoming accessible during rainy season not only for project survey but villagers to access public services such as hospital and school.</li> </ul>	

2-4-3 Pipe culvert

	Before construction	After improvement
Photograph		
Improvement	<ul style="list-style-type: none"> <li>- No turbid water due to vehicle passage in the river</li> <li>- Becoming accessible during rainy season not only for project survey but villagers to access public services such as hospital and school.</li> <li>- In some parts of the existing pipe culvert section was already broken and very dangerous situation, however by its replacement, it become safer condition.</li> </ul>	

2-4-4 Soil improvement

	Before construction	After improvement
Photograph		
Improvement	<ul style="list-style-type: none"> <li>- No turbid water due to vehicle passage in the section</li> <li>- Becoming accessible during the rainy season not only for project survey but villagers to access public services such as hospital and school.</li> </ul>	

**3 ADB suggestions for the Works**

Asian Development Bank mission (ADB Mission) visited the planned construction site on Nam Ngiep 1 Hydropower Project including roads between Ban Nonsomboun and Ban Hat Gniun on 24 September 2013. NNP1PC were informed that ADB Mission conveyed their message to ADB that no sufficient environmental mitigation measures were taken at some road sections during the Works as shown in Figure 11.

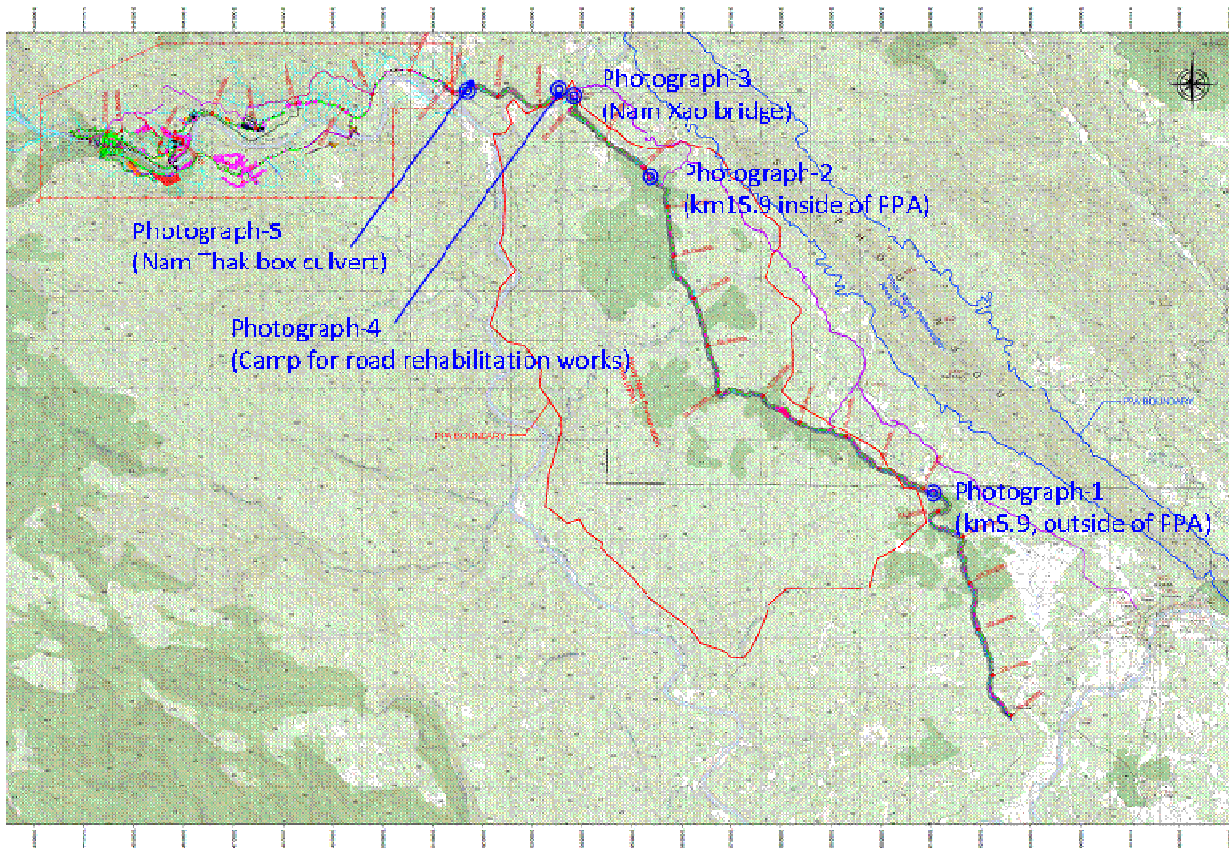


Figure-11 Location of Points commented by ADB



**4 Surrounding conditions of the Works**

The Works from Ban Nonsomboun and Ban Hat Gniun was conducted from February to September 2013. At that time NNP1PC planned to start the permanent road construction works (Road Construction Works) from October 2013 following the Road Rehabilitation Works.

The Works was designed to improve the existing road as temporary use for survey purpose rather than permanent use. The existing road after the Works will be widened, embanked or cut to be mobilized for construction works including operation as the permanent road. The permanent protection measures against soil erosion including stone masonry were not applied to the Works because NNP1PC plans to implement embankment and extension of the pipe culverts during the road construction works by the main civil contractor as shown in figure below.

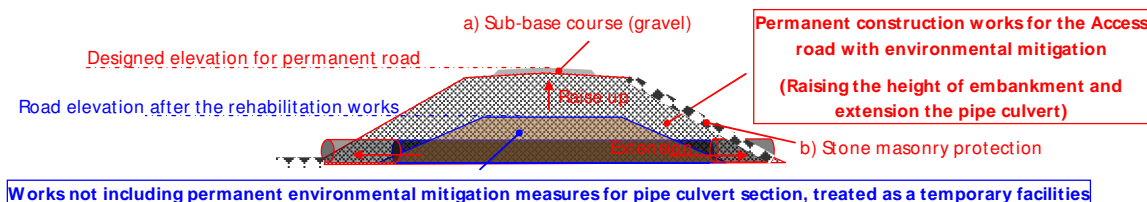


Figure-12 Extension of pipe culvert with mitigation measures by permanent road construction works

During the Works, not only works related to the NNP1 Project but also electric pole installation works by EDL, logging works by timber companies, and slush and burn activities by local residents were carried out along the access road. These caused some damages to the road surface inducing soil erosion.



Figure-13 Timber truck on site on 22 May 2013 which is not related with road rehabilitation works of NNP1 PC

NNP1PC has not yet started the road construction works by the main civil contractor on time. The road construction works for the access road with environmental mitigation measures will be done after the consent by authorities concerned and lenders. The road construction works are expected to start before the next rainy season when soil erosion may occur seriously.

### 5 Environmental mitigation measures to be taken

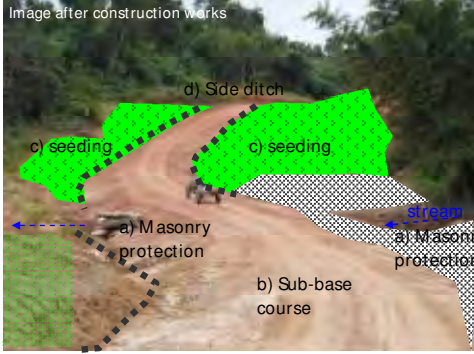
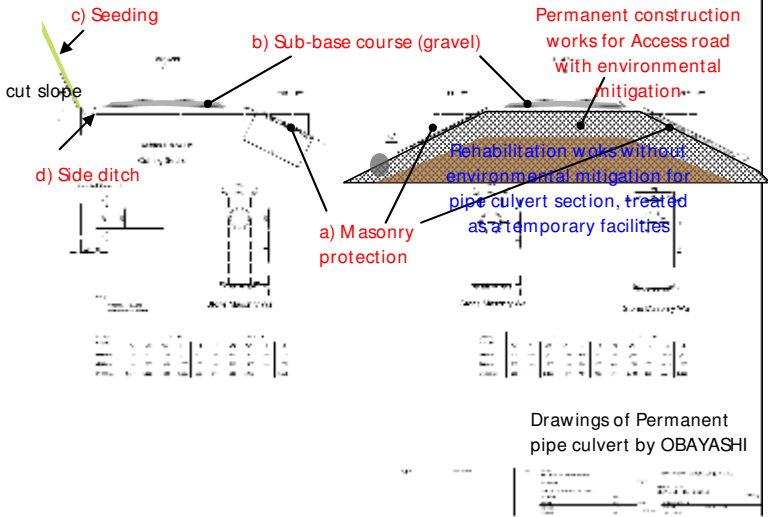
For all the locations taken photographs by ADB Mission, original and improved site conditions after the Works, and remaining environmental impacts and its mitigation measure were assessed. Proposed environmental mitigation measures to be done before the rainy season in 2014 against soil erosion by NNP1PC are as follows,

- a) Stone masonry: Installed on the embankment slope up to the elevation the river water rises during the rainy season
- b) Seeding for cutting slope: Applying to the excavated slope
- c) Sub-base course by gravel: Applying to the road surface
- d) Side ditch: In the case the gradient is steep, stone masonry is applied.
- e) Pipe culvert: To be installed in a small stream
- f) If mitigation measures is not completed by the rainy season, temporary protection by gravel, or sheet cover for embankment slope, pit digging for sedimentation and side ditches are to be taken as a temporary mitigation measure.


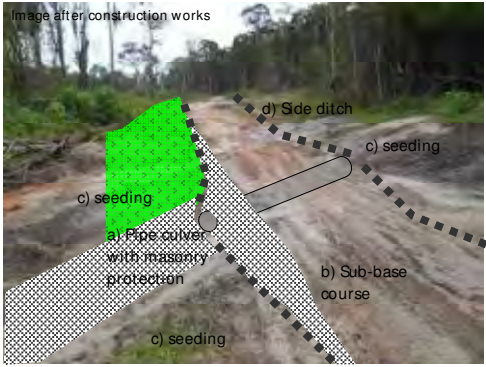
For other than the area pointed out by ADB, NNP1PC will take necessary measures in the same manner.

#### 5-1 Photograph-1 Pipe culvert “km 5.7 outside PPA”


	Photograph	Explanation(works done/ impacts/ mitigation)
Original condition		<ul style="list-style-type: none"> <li>a) Timber installed</li> <li>b) Road surface soil is eroded and discharge into the small stream.</li> <li>c) In case of flood, embanked soil, timber will be discharged and becoming inaccessible</li> <li>d) No environmental mitigation measure taken</li> </ul>
Current improved Condition/ Remaining impacts	<p>Photograph-1 taken on 24 Sep 2013</p> 	<ul style="list-style-type: none"> <li>a) Pipe culvert, side ditch installed, becoming accessible during the rainy season</li> <li>b) No turbid water due to vehicle passage in the river</li> <li>c) Soil erosion from a part of a embankment and cut slope</li> <li>d) Soil erosion from road surface</li> </ul>

<p>Mitigation measures</p>	 <p>Image after construction works</p>	<p>a) Stone masonry: Installed on the embankment slope up the elevation the river water rises during the rainy season</p> <p>b) Seeding for cutting slope: Applying to the excavated slope</p> <p>c) Sub-base course by gravel for road: Applying to the road surface</p> <p>d) Side ditch: In the case the gradient is steep, stone masonry is applied.</p> <p>e) If mitigation measures the above are not completed by the next rainy season, gravel placement or sheet cover for embankment slope, pit digging for sedimentation, sub-base course placement are to be taken as a temporary mitigation measure.</p>
		 <p>Drawings of Permanent pipe culvert by OBAYASHI</p>

**5-2 Photograph-2 km15.9 inside PPA**

	Photograph	Explanation
Original condition	No photo available	a) No photograph available because no works was planed and implemented in this section
Current improved Condition/ Remaining impacts		a) No repairing works was implemented b)The current road and surrounding environment were damaged because many vehicles, not only NNP1PC, and contractors of the Road Rehabilitation Works, but also many logging companies, passed this section during the dry and rainy seasons.
Mitigation measures		a) Pipe culvert installation including stone masonry b) Seeding for cutting slope: Applying to the excavated slope c) Sub-base course by gravel for road: Applying to the road surface d) Side ditch: In the case the gradient is steep, stone masonry is applied.

**5-3 Photograph-3 Nam Xao bridge at Ban Thafuea "inside PPA"**


	Photograph	Explanation
Original condition		a) Villagers can't cross the river be vehicle during rainy season even in case of emergency. b) Turbid water occur due to vehicle passage in the river


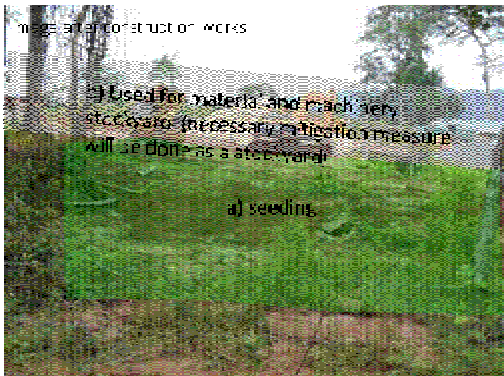


<p>Current improved Condition / Remaining impacts</p>		<p>a) The bridge crossing the Nam Xao River was built as a permanent facility. For erosion protection, gabion boxes were installed.</p> <p>b) Soil ground covers the right bank, thus no works were taken.</p> <p>c) Gravel was scatted on the left bank for villagers to approach the river for washing and bathing by the request of villagers.</p>
<p>Mitigation measures</p>		<p>a) Basically all mitigation measures were taken, however some embankment slope section for approaching the bridge shall be treated by gravel placement and gravel sub-base course to protect soil erosion from road surface.</p> <p>b) If mitigation measures the above are not completed by the next rainy season, gravel placement or sheet cover for embankment slope will be taken as a temporary mitigation measure.</p>



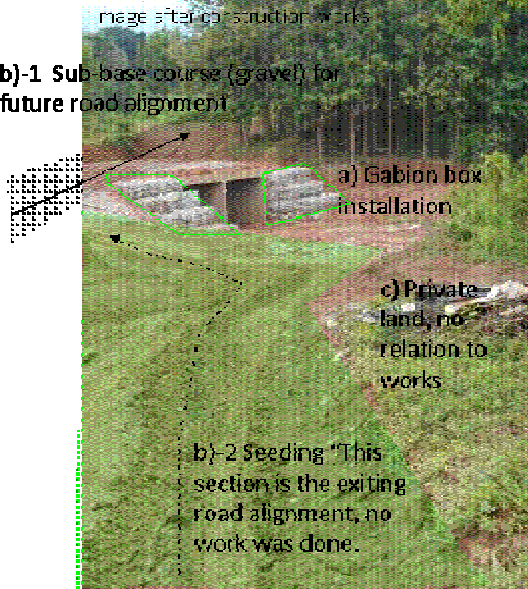
Notes: Timeline and back ground of Houay Ngua Provincial Preservation Area (Houay Ngua PPA) is referred to the Attachment-5.

**5-4 Photograph-4 Camp yard during the Road Rehabilitation Works “km 18.6 outside PPA”**

	Photograph	Explanation
<p>Original condition</p>		<p>a) Vegetation cleared</p> <p>b) No protection for soil erosion taken</p>

<p>Current improved Condition/ Remaining impacts</p>		<ul style="list-style-type: none"> <li>a) Vegetation cleared</li> <li>b) No protection for soil erosion taken</li> <li>c) Construction material and machinery are scattered.</li> </ul>
<p>Mitigation measures</p>		<ul style="list-style-type: none"> <li>a) Seeding: Applying to the cleared place</li> <li>b) Clearing stocked material and equipment</li> <li>c) Placing sub-base course</li> <li>d) Installation of temporary drainage facility</li> </ul> <p><i>Notes; The land is owned by GoL (Ban Thafue). The area will be used as material and machinery stockyard. Part of the camp during the Works will be cleared and used as a land for primary school.</i></p>

**5-5 Photograph-5 Nam Thak box culvert at Ban Thafuea "outside PPA"**

	Photograph	Explanation
Original condition		<ul style="list-style-type: none"> <li>a) No river crossing facilities</li> <li>b) Turbid water due to crossing river</li> <li>c) Villagers can't cross the river by vehicle during rainy season even in case of emergency.</li> </ul>
Current improved Condition/ Remaining impacts	<p>Photograph taken on 24 Sep 2013</p> 	<ul style="list-style-type: none"> <li>a) The box culvert crossing the Nam Thak River was built as a permanent facility. For the erosion protection, gabion boxes were installed.</li> </ul>
Mitigation measures	<p>Image after construction works</p>  <p><b>b)-1 Sub-base course (gravel) for future road alignment</b></p> <p><b>a) Gabion box installation</b></p> <p><b>c) Private land, no relation to works</b></p> <p><b>b)-2 Seeding</b> "This section is the existing road alignment, no work was done."</p>	<ul style="list-style-type: none"> <li>a) The environmental mitigation measures to be done are as follows,</li> <li>b)-1 Sub base course (gravel) will be placed for the permanent road construction works.</li> <li>b)-2 Seeding will be carried out</li> <li>c) If mitigation measures the above are not completed by the next rainy season, sheet cover for embankment slope and sub-base course placement for existing road alignment will be taken as a temporary mitigation measure.</li> </ul>

## 6 Conclusions

NNP1PC conducted the Works from February to September 2013. It is found through the site visit of ADB mission that some of environmental impacts have been remained and not sufficiently mitigated yet even considering that the road is under construction and necessary mitigation measures will be undertaken. Mitigating this situation of the NNP1PC, additional mitigation measures will be taken by the NNP1PC as the schedule below.

### [A. Schedule for environmental mitigation measures as remedial works of the Works]

Items	2013	2014								
	Dec	Jan	Feb	Mar	April	May	June	July	Aug	Sep
1. Remedial works Photograph-1 Pipe culvert "km 5.7 outside PPA"					Seeding, Sub base course/ Masonry					
2. Remedial works Photograph-2 km 15.9 inside PPA		Temporary Seeding			Pipe culvert installation/ side ditch/ sub-base course					
3. Remedial works Photograph-3 Nam Xao bridge at Ban Thafuea "inside PPA"					Seeding/ sub-base course					
4. Remedial works Photograph-4 Camp yard during the Road Rehabilitation Works "km 18.6 outside PPA"		Seeding								
5. Remedial works Photograph-5 Nam Thak box culvert at Ban Thafuea "outside PPA"					Seeding/ Sub base course/ Masonry protection					

Environmental mitigation measures for other areas of the Works will be checked and necessary measurements will be taken in the same manner before next rainy season.

EON



## **Attachment-1**

### **Certification of EIA including EMP and IEE for access road certified by MoNRE on 16th July 2012**

Revised Explanation for Concerns related rehabilitation works raised  
during the site visit by ADB mission on 24 September 2013

Nam Ngiep 1 Hydropower Project – 14 December 2013



Lao People's Democratic Republic

Peace Independence Democracy Unity Prosperity

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Ministry of the Natural Resources and Environment (MoNRE)

Ref. No: 4625/MoNRE

Vientiane Capital, 16 July 2012

**Certificate**

- According to the Law on Environmental Protection, Ref.No:02/99/NA,date:03 April 1999.
- According to the Decree on Institutional Organization and Implementing of the MoNRE, Ref.No: 435/PM, date: 28 November 2011.
- According to the Decree on Environmental and Social Impact Assessment, Ref.No.112/PM, date: 16 February 2010.
- According to the recommendation of the Bolikhamxay Province, Ref. No: 339/Cabinet Office, BKX, date: 05/July/2012.
- According to the recommendation of the Vientiane Province, Ref. No: 010/Cabinet Office, VT, date: 04/July/2012.
- According to the recommendation of the Xiengkhouang Province, Ref. No: 234/GO.XK, date: 06/July/2012.
- According to the official letter of the ESIA Department, Ref. No: 804/MoNRE, DESIA, date: 09 July 2012.

Prime Minister of MoNRE has agreed with the comments below:

1. Agree to approve the reports of Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) in May 2012 of the Nam Ngiep 1 Hydropower Project, THE KANSAI Electric Power Co., INC.
2. Developer has to implement the project with the conditions below:
  - a. Directly responsible to the Project's study and the data collection in EIA, to follow all the protections and the mitigation measures which are mentioned in the reports;
  - b. In any encountered problem related to the environmental matters uncovered in the EIA report, Developer needs to additionally respond in the Environmental Management Monitoring Plan (EMMP) including the sufficient budget;
  - c. To strongly implement EMMP and environmental obligations in Annex C of the Concession Agreement;
  - d. In the construction and the operation phase, Developer has to pay attention to the issues of erosion, water quality, chemical use in the project area, and has to conform the technical measures and the related law/regulations to prevent the environmental impact as much as possible;
  - e. To prepare monthly reports, semiannual reports and annual reports on EMMP of the project and to submit them to MoNRE, Natural Resources and Environment Department of

Bolikhamxay Province, Natural Resources and Environment Department of Vientiane Province, and Natural Resources and Environment Department of Xiengkhouang Province.

3. To assign Natural Resources and Environment Department of Bolikhamxay Province, Natural Resources and Environment Department of Vientiane Province, and Natural Resources and Environment Department of Xiengkhouang Province to cooperate with the related local authorities in the district level for the close monitoring on the actual EMMP of Nam Ngiep 1 Hydropower Project, THE KANSAI Electric Power Co. , INC. and then to report to MoNRE.

This certificate becomes effective on the date of signing.

Prime Minister of MoNRE

Noulin SINBUNDITH



Lao People's Democratic Republic  
Peace Independence Democracy Unity Prosperity

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Ministry of the Natural Resources and Environment (MoNRE)

Ref. No: 4626/MoNRE

Vientiane Capital, 16 July 2012

### **Certificate**

- According to the Law on Environmental Protection, Ref.No:02/99/NA,date:03 April 1999.
- According to the Decree on Institutional Organization and Implementing of the MoNRE, Ref.No: 435/PM, date: 28 November 2011.
- According to the Decree on Environmental and Social Impact Assessment, Ref.No.112/PM, date: 16 February 2010.
- According to the Decree on Compensation and Resettlement of Affected People by Development Projects, Ref.No:192/PM, date: 7 July 2005.
- According to the recommendation of the Bolikhamxay Province, Ref.No:339/Cabinet Office.BKX, date: 05/July/2012.
- According to the recommendation of the Vientiane Province, Ref. No: 010/Cabinet Office, VT, date: 04/July/2012.
- According to the recommendation of the Xiengkhouang Province, Ref. No: 234/GO.XK, date: 06/July/2012.
- According to the official letter of the ESIA Department, Ref. No: 804/MoNRE, DESIA, date:09 July 2012.

Prime Minister of MoNRE has agreed with the comments below:

1. Agree to approve the reports of Social Impact Assessment (SIA), Resettlement and Ethnic Minority Development Plan (REMP) and Social Development Plan (SDP) in May 2012 of the Nam Ngiep 1 Hydropower Project, THE KANSAI Electric Power Co., INC.
2. Developer has to implement the project with the conditions below:
  - a. Directly responsible on the Project's study and the data collection in SIA, to follow all the protections and the mitigation measures which are mentioned in the reports;
  - b. In any encountered problem related to the environmental matter uncovered in the SIA report, Developer needs to additionally respond in the Social Management Monitoring Plan including the sufficient budget;



- c. To strongly implement the compensation under the Decree on Compensation and Resettlement of Affected People by Development Projects, Ref.No:192/PM, date: 7 July 2005, and In case the budget in the reports for the Compensation and the Livelihood Restoration Programs are not enough, Developer needs to additionally provide the sufficient budget for those matters;
  - d. To implement the Resettlement Action Plan and the Livelihood Restoration Programs for the affected people due to the project and to strongly implement them under Annex C of the Concession Agreement;
  - e. To make plans to implement the Resettlement Action Plan and the Livelihood Restoration Programs due to the project, and to submit the plans to the Provincial Resettlement Committee for its considerations to approve the plans before start of the implementation;
  - f. To prepare monthly reports, semiannual reports and annual reports on the Resettlement implementation and the Livelihood Restoration Programs and to submit them to the Provincial Resettlement Committee for its monitoring.
3. To assign the Provincial Resettlement Committee to cooperate with the related local authorities for the close monitoring on the implementation of the Resettlement Action Plan and the Livelihood Restoration Programs of Nam Ngiep 1 Hydropower Project, THE KANSAI Electric Power Co., INC.

This certificate becomes effective on the date of signing.

Prime Minister of MoNRE

Noulin SINBUNDITH



Lao People's Democratic Republic  
Peace Independence Democracy Unity Prosperity

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Ministry of the Natural Resources and Environment

Ref. No: 4627/MoNRE

Vientiane Capital, 16 July 2012

### **Certificate**

- According to the Law on Environmental Protection, Ref.No:02/99/NA,date:03 April 1999.
- According to the Decree on Institutional Organization and Implementing of the MoNRE, Ref.No: 435/PM, date: 28 November 2011.
- According to the Decree on Environmental and Social Impact Assessment, Ref.No.112/PM, date: 16 February 2010.
- According to the Decree on Compensation and Resettlement of Affected People by Development Projects, Ref.No:192/PM, date: 7 July 2005.
- According to the recommendation of the Bolikhamxay Province, Ref. No: 339/Cabinet Office.BKX, date: 05/July/2012.
- According to the recommendation of the Vientiane Province, Ref. No: 010/Cabinet Office, VT, date: 04/July/2012.
- According to the recommendation of the Xiengkhouang Province, Ref. No: 234/GO.XK, date: 06/July/2012.
- According to the official letter of the ESIA Department, Ref. No: 804/MoNRE, DESIA, date:09 July 2012.

Prime Minister of MoNRE has agreed as the comments below:

1. Agree to approve the report of Initial Environmental Examination (IEE) for the 230 kV Transmission Line construction project from the powerhouse to Nabong substation in May 2012 of the Nam Ngiep 1 Hydropower Project, THE KANSAI Electric Power Co., INC.
2. Developer has to implement the project with the conditions below:
  - a. Directly responsible to the Project's study and the data collection in the IEE. In any encountered problem related to the environmental and the social matters uncovered in the report, Developer needs to respond in the Environmental and Social Management Monitoring Plan and to have the mitigation measures with the sufficient budget;
  - b. To compensate the loss of land or the other assets of the affected people due to the project, and to strongly follow the law and the regulations by having consultations and agreements between the affected people and the Project's owner;

- c. In the construction phase, Developer has to pay attention to implementing the Environmental Management Plan, especially on the waste management, fuel discharge, dust and air pollutant, reminding sign and others. The clearing the right-of-way for the transmission line construction has to follow the electric technical standard, and to limit the affected area with less impact as much as possible;
  - d. After finishing the construction, Developer needs to develop and improve the existing land to be usable as well as its original condition;
  - e. To prepare monthly reports for the monitoring on the environmental and the social implementation and to submit them to MoNRE, Natural Resources and Environment Department of Bolikhamxay Province, Natural Resources, Environment Department of Vientiane Province, and Natural Resources and Environment Department of Xiengkhouang Province
3. To assign Natural Resources and Environment Department of Bolikhamxay Province, Natural Resources and Environment Department of Vientiane Province, and Natural Resources and Environment Department of Xiengkhouang Province to cooperate with the related local authorities in the district level for the close monitoring of the implementation on the environmental and the social management plan of 230 kV Transmission Line Construction Project from the powerhouse to Nabong substation of Nam Ngiep 1 Hydropower Project, THE KANSAI Electric Power Co., INC.

This certificate becomes effective on the date of signing.

Prime Minister of MoNRE

Noonlin SINBUNDITH



Lao People's Democratic Republic  
Peace Independence Democracy Unity Prosperity

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Ministry of the Natural Resources and Environment

Ref. No: 4628/MoNRE

Vientiane Capital, 16 July 2012

### **Certificate**

- According to the Law on Environmental Protection, Ref.No:02/99/NA,date:03 April 1999.
- According to the Decree on Institutional Organization and Implementing of the MoNRE, Ref. No: 435/PM, date: 28 November 2011.
- According to the Decree on Environmental and Social Impact Assessment, Ref.No.112/PM, date: 16 February 2010.
- According to the Decree on Compensation and Resettlement of Affected People by Development Projects, Ref.No:192/PM, date: 7 July 2005.
- According to the recommendation of the Bolikhamxay Province, Ref. No: 339/Cabinet Office BKX, date: 05/July/2012.
- According to the recommendation of the Vientiane Province, Ref. No: 010/Cabinet Office VT, date: 04/July/2012.
- According to the recommendation of the Xiengkhouang Province, Ref. No: 234/GO.XK, date: 06/July/2012.
- According to the official letter of the ESIA Department, Ref. No: 804/MoNRE, DESIA, date:09 July 2012.

Prime Minister of MoNRE has agreed as the comments below:

1. Agree to approve the report of Initial Environmental Examination (IEE) for the 115 kV Transmission Line construction project from the powerhouse to the substation in Bolikhamxay Province, in May 2012 of the Nam Ngiep 1 Hydropower Project, THE KANSAI Electric Power Co., INC.
2. Developer has to implement the project with the below conditions:
  - a. Directly responsible to the study and the data collection in the IEE. In any encountered problem related to the environmental and the social matters uncovered in the report, Developer needs to respond in the Environmental and Social Management Monitoring Plan and to have the mitigation measures with the sufficient budget;
  - b. To compensate the loss of land or the other assets of the affected people due to the project and to strongly follow the law and the regulations by having consultations and agreements between the affected people and the project's owner;



- c. In the construction phase, Developer has to pay attention to implementing the Environmental Management Plan, especially on the waste management, fuel discharge, dust and air pollutant, reminding sign and others. The clearing the right-of-way for the transmission line construction has to follow the electric technical standard and to limit the affected area with less impacts as much as possible;
  - d. After finishing the construction, Developer needs to develop and improve the existing land to be usable as well as its original condition;
  - e. To prepare monthly reports on the environmental and the social monitoring and the implementation, and to submit them to MoNRE, Natural Resources and Environment Department of Bolikhamxay Province, Natural Resources and Environment Department of Vientiane Province, and Natural Resources and Environment Department of Xiengkhouang Province.
3. To assign the Natural Resources and Environment Department of Bolikhamxay Province, Natural Resources and Environment Department of Vientiane Province, and Natural Resources and Environment Department of Xiengkhouang Province to cooperate with the related local authorities in the district level for the close monitoring of the implementation on the environmental and the social management plan of 115 kV Transmission Line Construction Project from the powerhouse to the substation in Bolikhamxay Province of Nam Ngiep 1, THE KANSAI Electric Power Co., INC.

This certificate becomes effective on the date of signing.

Prime Minister of MoNRE

Noulin SINBUNDITH



ສາທາລະນະລັດ ປະຊາທິປະໄຕ ປະຊາຊົນລາວ

ສັນຕິພາບ ເອກະລາດ ປະຊາທິປະໄຕ ເອກະພາບ ວັດທະນາຖາວອນ

===== 000 =====

ກະຊວງຊັບພະຍາກອນທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມ

ເລກທີ 4625 /ກຊສ

ນະຄອນຫລວງວຽງຈັນ, ວັນທີ 16 ກໍລະກົດ 2012

ໃບຢັ້ງຢືນ

- ອີງຕາມ ກົດໝາຍ ວ່າດ້ວຍການປົກປັກຮັກສາສິ່ງແວດລ້ອມ ສະບັບເລກທີ 02/99/ສພຊ, ລົງວັນທີ 03 ເມສາ 1999.
- ອີງຕາມ ດຳລັດ ວ່າດ້ວຍ ການຈັດຕັ້ງ ແລະ ການເຄື່ອນໄຫວ ຂອງກະຊວງຊັບພະຍາກອນທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມ, ສະບັບເລກທີ 435/ນຍ, ລົງວັນທີ 28 ພະຈິກ 2011.
- ອີງຕາມ ດຳລັດ ວ່າດ້ວຍ ການປະເມີນຜົນກະທົບຕໍ່ສິ່ງແວດລ້ອມ, ສະບັບເລກທີ 112/ ນຍ, ລົງວັນທີ 16 ກຸມພາ 2010.
- ອີງຕາມໜັງສືຮັບຮອງ ຈາກແຂວງບໍລິຄຳໄຊ, ສະບັບເລກທີ 339/ທປຂ-ບຊ, ລົງວັນທີ 5/7/2012.
- ອີງຕາມໜັງສືຮັບຮອງ ຈາກແຂວງວຽງຈັນ, ສະບັບເລກທີ 10/ທປຂ-ວຈ, ລົງວັນທີ 4/7/2012.
- ອີງຕາມໜັງສືຮັບຮອງ ຈາກແຂວງຊຽງຂວາງ, ສະບັບເລກທີ 234/ຈຂ.ຊຂ, ລົງວັນທີ 6/7/2012.
- ອີງຕາມ ການສະເໜີ ຂອງກອງປະເມີນຜົນກະທົບຕໍ່ສິ່ງແວດລ້ອມ ແລະ ສັງຄົມ, ສະບັບເລກທີ 804 /ກຊສ.ກປສສ, ລົງວັນທີ 9 ກໍລະກົດ 2012.

ລັດຖະມົນຕີວ່າການ ກະຊວງຊັບພະຍາກອນທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມ ຕົກລົງ:

1. ເຫັນດີຮັບຮອງເອົາບົດລາຍງານການປະເມີນຜົນກະທົບຕໍ່ສິ່ງແວດລ້ອມ, ແຜນການຄຸ້ມຄອງ ແລະ ຕິດຕາມກວດກາສິ່ງແວດລ້ອມ ສະບັບເດືອນພຶດສະພາ 2012 ໂຄງການໄຟຟ້ານໍ້າຕົກນໍ້າງຽບ 1 ຂອງບໍລິສັດ ຄັນໄຊ ເອເລັກທິກ ພາວເວີ ຈຳກັດ.
2. ໃຫ້ເຈົ້າຂອງໂຄງການປະຕິບັດຕາມເງື່ອນໄຂດັ່ງນີ້:
  - ກ). ຮັບຜິດຊອບໂດຍກົງຕໍ່ກັບການສຶກສາ ແລະ ຂໍ້ມູນທີ່ກຳນົດໄວ້ໃນບົດລາຍງານການປະເມີນຜົນກະທົບຕໍ່ສິ່ງແວດລ້ອມ ພ້ອມທັງຈັດຕັ້ງປະຕິບັດທຸກມາດຕະການປ້ອງກັນ ແລະ ຫຼຸດຜ່ອນຜົນກະທົບ ທີ່ໄດ້ກຳນົດໄວ້ໃນບົດລາຍງານດັ່ງກ່າວ.
  - ຂ). ໃນກໍລະນີມີບັນຫາທາງດ້ານສິ່ງແວດລ້ອມ ເກີດຂຶ້ນທີ່ບໍ່ໄດ້ສຶກສາໄວ້ໃນບົດລາຍງານດັ່ງກ່າວ ເຈົ້າຂອງໂຄງການຕ້ອງຮັບຜິດຊອບເພີ່ມເຕີມ ໃນການສ້າງແຜນການຄຸ້ມຄອງຕິດຕາມກວດກາສິ່ງແວດລ້ອມ ແລະ ມີມາດຕະການແກ້ໄຂບັນຫາເຫຼົ່ານັ້ນ ພ້ອມທັງຮັບປະກັນໃຫ້ມີງົບປະມານພຽງພໍ.
  - ຄ). ປະຕິບັດຕາມແຜນການຄຸ້ມຄອງ ແລະ ຕິດຕາມກວດກາສິ່ງແວດລ້ອມ ແລະ ພັນທະທາງດ້ານສິ່ງແວດລ້ອມ ຂອງສັນຍາສຳປະທານ ຢ່າງເຄັ່ງຄັດ ແລະ ເຂັ້ມງວດ. ✍



ງ). ໃນໄລຍະການກໍ່ສ້າງ ແລະ ດຳເນີນງານ ຂອງໂຄງການ ຕ້ອງເອົາໃຈໃສ່ເປັນພິເສດ ຕໍ່ບັນຫາການ ເຊາະເຈື່ອນ, ຄຸນນະພາບນໍ້າ, ການນຳໃຊ້ສານເຄມີ ໃນເຂດໂຄງການ ໂດຍໃຫ້ສອດຄ່ອງກັບ ມາດຕະຖານເຕັກນິກ ແລະ ລະບຽບກົດໝາຍທີ່ກ່ຽວຂ້ອງ ເພື່ອຮັບປະກັນໃຫ້ມີຜົນກະທົບຕໍ່ສິ່ງແວດ ລ້ອມ ໜ້ອຍທີ່ສຸດ.

ຈ). ເຮັດບົດລາຍງານປະຈຳເດືອນ, ປະຈຳໄຕມາດ ແລະ ປະຈຳປີ ກ່ຽວກັບ ການຕິດຕາມກວດກາການ ຈັດຕັ້ງປະຕິບັດ ແຜນການຄຸ້ມຄອງ ແລະ ຕິດຕາມກວດກາສິ່ງແວດລ້ອມ ຂອງໂຄງການ ສິ່ງໃຫ້ ກະຊວງຊັບພະຍາກອນທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມ ແລະ ພະແນກຊັບພະຍາກອນທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມ ແຂວງບໍລິຄຳໄຊ, ແຂວງວຽງຈັນ ແລະ ແຂວງຊຽງຂວາງ ເພື່ອຊາບ ແລະ ຕິດຕາມ.

3. ມອບໃຫ້ ພະແນກຊັບພະຍາກອນທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມ ແຂວງບໍລິຄຳໄຊ, ແຂວງວຽງຈັນ ແລະ ແຂວງຊຽງຂວາງ ສົມທົບກັບຂະແໜງການ ແລະ ອຳນາດການປົກຄອງເມືອງ ທີ່ກ່ຽວຂ້ອງ ເຮັດໜ້າທີ່ຕິດຕາມກວດກາການຈັດຕັ້ງ ປະຕິບັດແຜນການຄຸ້ມຄອງ ແລະ ຕິດຕາມກວດກາສິ່ງແວດລ້ອມ ໂຄງການໄຟຟ້ານໍ້າຕົກນໍ້າງຽບ 1 ຂອງບໍລິສັດ ຄັນໄຊ ເອເລັກທຶກ ພາວເວີ ຈຳກັດ ແລ້ວລາຍງານໃຫ້ ກະຊວງຊັບພະຍາກອນທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມ ຮັບຊາບ.

ໃບຢັ້ງຢືນສະບັບນີ້ ມີຜົນນຳໃຊ້ໄດ້ ນັບແຕ່ວັນລົງລາຍເຊັນເປັນຕົ້ນໄປ. ✖

ສັດຖະມົນຕີວ່າການ

ກະຊວງຊັບພະຍາກອນທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມ



*(Handwritten signature in blue ink)*

ບູລິນ ສິນບັນດິດ

**Attachment-2**

**Consultation meeting for B Hat  
Gniun and Ban Thafuea on 8  
February 2013**

Revised Explanation for Concerns related rehabilitation works raised  
during the site visit by ADB mission on 24 September 2013

Nam Ngiep 1 Hydropower Project – 14 December 2013



## Explanation of access road rehabilitation works

### 1. Meeting with Ban Hat Gniun and Ban Thahua

1-1. Time; 8<sup>th</sup> February 9:45-10:50

1-2. Attendees;

- ① Bolikhan district; Mr. Bounphanh (President of Lao Front for National Construction, Bolikhan District), Mr. Vongsavanh (Official staff, secretary of Bolikhan District Governor)
- ② PAPs; 60 peoples (Ban Hat Gniun, Ban Thahua and Ban Hatsaykham) including village head, lao women union, lao front national construction and representative of youth
- ③ NNP1; Tanaka, Keo, Vilanhpan, Vylar, Tomioka
- ④ Contractor of road rehabilitation works; Mr. Kheungkham (Road No.8)
- ⑤ Consultant of compensation; Mr. Bounma (SSAFE)

1-3. Minutes of meeting;

NNP1 explained as follows;

- This explanation is not for the whole construction works but for just road rehabilitation works. The purpose of this meeting is to explain the plan of access road rehabilitation works, environmental mitigation plan, compensation and grievance redress mechanism to PAPs.
- The purpose of this works is to secure accessibility to go to site for geological survey even in the coming rainy season. We will install 3 bridges at Nam Xao, Nam Tak and Nam Miang River. Villagers along the existing road can get benefits from this works due to the improvement of accessibility.

a) Village head (Hat Gniun);

We agree the plan of access road rehabilitation works and compensation scheme. The village head requests villagers to cooperate with the works. Also, the village head agrees that the existing fence, which demarcates the public land from the private land, along the access road can be removed to be convenient for the works. Regarding the location of borrow pits of the works, the village head also requests villagers to cooperate with contractor and consultant on the decision of location.

b) Villagers (Hat Gniun);

We have been explained such plan of construction works from developer many times. My concern is whether this works are to be certainly realized.

NNP1; We're already contracted with contractor to start rehabilitation works.

c) Villagers (Ban Thahua);

We have been waiting for start of this project. We worry that the whole construction works of NNP1 are not to be implemented.

NNP1; We will start the whole construction works in the near future.

d) Bolikhan District;

The villagers have waited for this project for a long time. Bolikhan District would like to ask the both villages to cooperate with NNP1. Regarding the compensation rate, Resettlement Committee will discuss to decide the rate later. If villagers have any uncertain points, please don't hesitate to construct with NNP1.

## 2. Meeting with Ban Hat Nonsomboun and Ban Sisavath

2-1. Time; 8<sup>th</sup> February 14:00-15:00

2-2. Attendees;

- ① Bolikhan district; Mr. Bounphanh (President of Lao Front for National Construction, Bolikhan District), Mr. Vongsavanh (Official staff, secretary of Bolikhan District Governor)
- ② PAPs; 60 peoples (Ban Hat Nonsomboun and Ban Sisavath) including village head, lao women union, lao front national construction and representative of youth
- ③ NNP1; Tanaka, Keo, Vilanhpan, Vylar, Tomioka
- ④ Contractor of road rehabilitation works; Mr. Kheungkham (Road No.8)
- ⑤ Consultant of compensation; Mr. Bounma (SSAFE)

2-3. Minutes of meeting;

As same as the meeting in the morning, NNP1 explained the purpose of the explanation.

a) Villagers (Ban Nonsomboun);

My paddy field is located in lower area along the small valley. In the last rainy season, my paddy field was flooded because the backfill, which locates at access road near my paddy field, blocked water flow. That's why, please install pipe culverts at my paddy field to pass through water flow.

NNP1; According to our layout plan of pipe culverts, your paddy field is located at the No. 2 and No. 3 of pipe culvert. We will install pipe culverts near your paddy field.

b) Villagers (Ban Nonsomboun);

If your work schedule is delayed, there is a possibility not to be completed due to rainy season.

NNP1; Thank you for your advice. We consider the impact from rainy season carefully.

c) Village head (Ban Nonsomboun);

We hope that almost of work items are to be completed before the rainy season.

We should recognize that this works contribute to improvement of living standards of each village. The village head requests villagers to cooperate for the works and owners of each affected asset to wait RC decision on the compensation rate for negotiation of compensation. However, each record on loss of assets is required in advance.

d) Bolikhan District;

The villagers have waited for this project for a long time. Bolikhan District would like to ask the both villages to cooperate with NNP1. Regarding the compensation rate, Resettlement Committee will discuss to decide the rate later. If villagers have any uncertain points, please don't hesitate to construct with NNP1.

(Attachment)

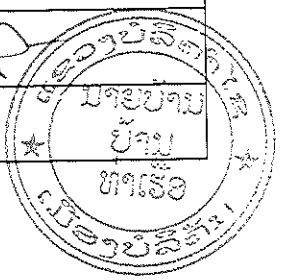
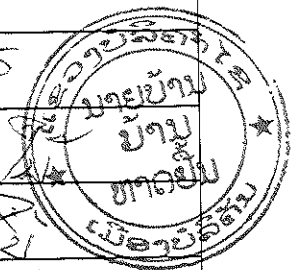
Attachment-1; Presentation document

Attachment-2; Participants list

Attachment-3; Photos

ລາຍຊື່ຜູ້ເຂົ້າຮ່ວມ

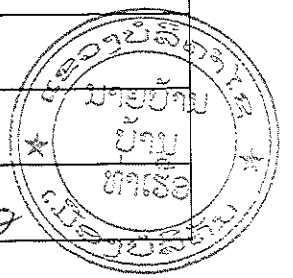
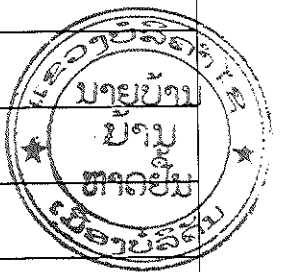
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4	ໂທດ ເສນ	ທາດ ຢືມ	18	ບຸງ ດາ
5	ທາດ ພອນ	ທາດ ຢືມ	19	ບ. ດາ
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7	ສິມ ວິດ	ທາດ ຢືມ	21	ບຸງ ຈຸນ
8	ຈຸນ ສີ	ທາດ ຢືມ	22	ບຸງ ຈຸນ ພະ ອົງ ສີ
9	ຄຳ ພັມ	ທາດ ຢືມ	23	ທ. ໂທດ ອອນ ທາດ ອົງ ສີ
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12	ສິ ສິ ພັມ	ທາດ ຢືມ	26	ບຸງ ອົງ
13	ສິ ສິ ພັມ	ທາດ ຢືມ	27	ບຸງ ອົງ





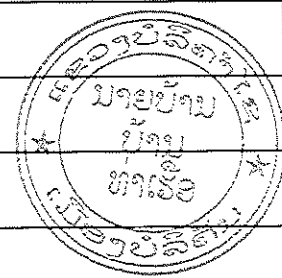
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8	ທິ ສິດ	ບ້ານ ສາມ	22	ທິ ສິດ	ບ້ານ ສາມ
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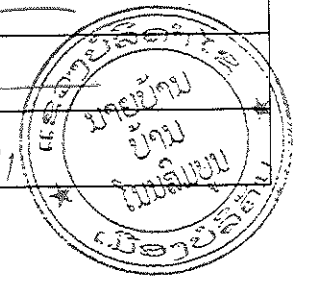
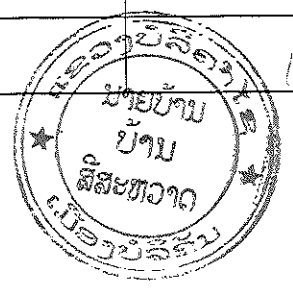
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2	ສິນທິພິຍ	ທ່າໂຮງ	16	
3	ຄຳພັດ	ທ່າໂຮງ	17	
4	ຄຳບຸນ	ທ່າໂຮງ	18	
5	ສິນທິພິຍ	ທ່າໂຮງ	19	
6	ສິນທິພິຍ	ທ່າໂຮງ	20	
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8	ສິນທິພິຍ	ທ່າໂຮງ	22	
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12	ສິນທິພິຍ	ທ່າໂຮງ	26	
13	ສິນທິພິຍ	ທ່າໂຮງ	27	



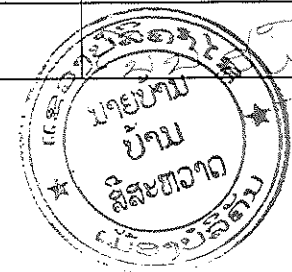
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8	ທ່ານ ຈິນ ພິມ	—    —	22	ທ່ານ ຈິນ ພິມ	ບ້ານ ສີສະຫວາດ
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13	ທ່ານ ຫິມ ພິມ	—    —	27	ທ່ານ ຫິມ ພິມ	



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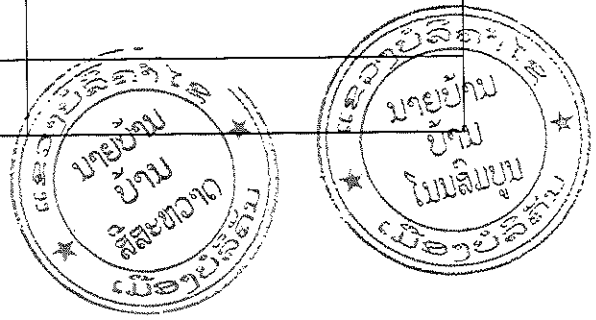
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6	ທ. ສິມສິດ	—	20	ທ. ສິມສິດ	—
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8	ທ. ສິມສິດ	ສິມສິດ	22	ທ. ສິມສິດ	ສິມສິດ
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2	ນ. ພຣ.	ເຂັ້ມສິມບຸນ	16	
3	ທ້າວ ສິມບຸນ	— ນ — ນ	17	
4	ທ. ບຸນ	— ນ —	18	
5		— ນ —	19	
6	ທ. ຊິງ		20	
7	ທ. ຊິງອິງ	ບຸນສິມບຸນ	21	
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9	ທ. ພຣ. ພິມມະສິມບຸນ	ທ້າວ ສສາຟີ (22336525)	23	
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11	ທ. ຊິງ ພຣ.	NNP1.	25	
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## Explanation to Hat Gniun and Ban Thahua





## Explanation to Ban Nonsomboun and Ban Sisavath





**Access road rehabilitation works**

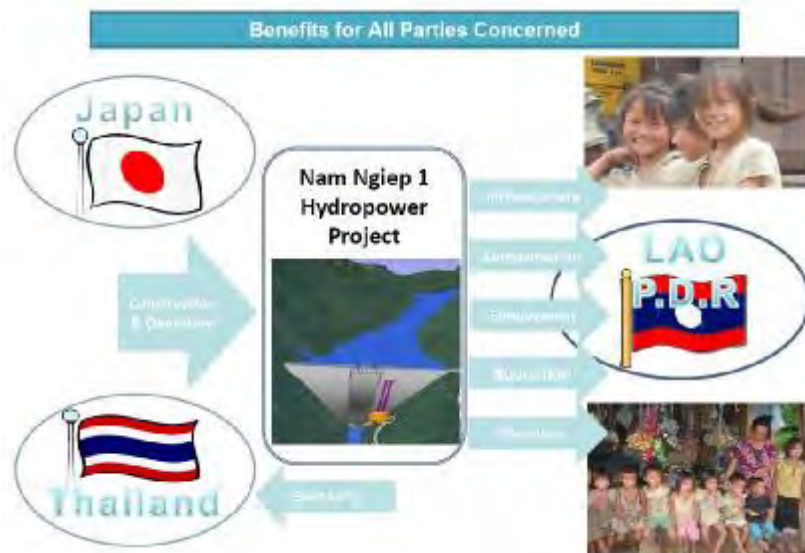
**Feb 2013**

**Nam Ngiep 1 Hydropower Project**

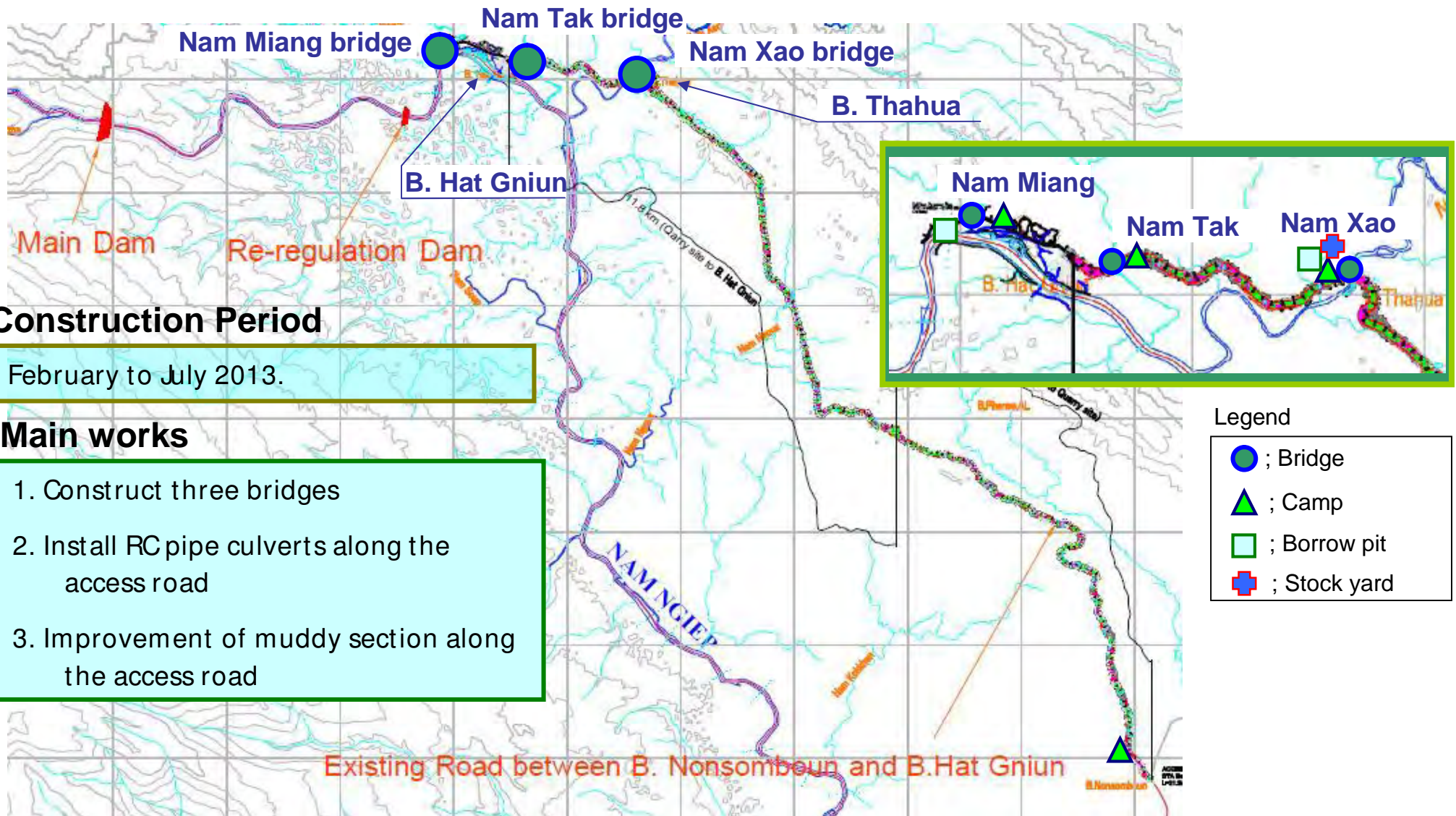


# Project outline

1. The Nam Ngiep 1 Hydropower Project (NNP1) is located on the Nam Ngiep River in Bolikhamxay Province, a tributary of the Mekong River.
2. The main dam is a concrete gravity dam with 148.0 m high with a power station of 272 MW which will be exported to Thailand. At 6 km downstream from the main dam, a re-regulation dam will be constructed for flattening the peak operation of the main dam with 18MW for domestic power supply to improve the rural electrification within Lao PDR.
3. NNP1 has three (3) main share holders: Kansai Electric Power Co., Inc. (KANSAI) of Japan, Electric Generating Authorities of Thailand International (EGATi) of Thailand and, Lao Holding State Enterprise of Lao PDR (LHSE). Through the project three (3) countries will get each benefit and NNP1 aims to contribute Lao local population "Poverty Reduction".



# Layout



## Construction Period

February to July 2013.

## Main works

1. Construct three bridges
2. Install RC pipe culverts along the access road
3. Improvement of muddy section along the access road

People along the existing road can get benefits from this work due to improvement of accessibility.



## Salient feature

1. Three Bridges	Nam Xao	L=40.00 m, W=5.5m
	Nam Miang	L=11.35 m, W=11.0m
	Nam Tak	L=11.35 m, W=12.0m
2. RC Pipe Culverts	Diameter; 800mm	Total length=75m (4 nos)
	Diameter; 1,000mm	Total length=245m (16 nos)
3. Improvement of Muddy Section	5 Locations	
4. Total Concrete Works	Around 890 m <sup>3</sup>	
5. Total Earth Works	Around 5,000 m <sup>3</sup> (Excavation and back fill)	
6. Contractor	Road Construction No.8 Enterprise	



# Schedule

	2013						
	Jan	Feb	Mar	Apr	May	Jun	Jul
Mobilization		Mobilization					Demobilization
Nam Xao bridge		Earth work					
		Concrete work					
				Structure work			
Nam Miang bridge		Box culvert work					
Nam Tak bridge		Box culvert work					
RC pipe culvert		RC pipe culvert work					
Improvement of muddy section		Improvement					



# Mobilization schedule

## Equipment mobilization schedule





Item		Maximum Qty/day
Earth work	 Back hoe (0.9m <sup>3</sup> )	6 nos.
	 Bulldozer (D6)	
Haulage work	 Dump truck (12m <sup>3</sup> )	7 nos.
	 Concrete mixer (5m <sup>3</sup> )	
	 Crane	
Pick up vehicle	 	3 nos.

## Labor camp location



Maximum;  
Approximately 100 workers / day

# Environmental mitigation plan

Impacts	Concerned Activities	Mitigation Measures and Monitoring	
Dust	- Moving of vehicle and heavy machinery	- Spraying water by water tank truck	
River water quality	- Turbid water due to excavation works in the river bed	-Water quality monitoring (Monitoring spots; Nam Xao, Nam Tak, Nam Miang)	
Noise, Vibration	- Excavation works - Moving of equipment	- From 10 pm to 6 am, earthwork is reduced.	
Traffic disturbance	- Construction of bridges and culverts	- Detour during construction period	
Local community	- Conflict with villagers	-To educate labors to avoid troubles with villagers	

## Compensation for access road rehabilitation works

### 0. Back ground on compensation

We have carried out the land use survey in 2012 to identify the existing assets to be affected potentially and got the **agreements with the signatures of land owner, head village, Bolikhamxay representative and Bolikhan District** through this survey as follows;

**1. To agree to conduct the access road works**

**2. To agree to start the negotiation of compensation after the establishment of Resettlement Committee (“RC”)**

### 1. Timing of payment of compensation

To start access road rehabilitation works in advance to compensation according to the agreements in 2012.

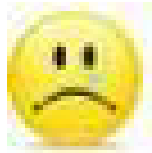
To make payment for compensation to PAPs at rates decided by RC after RC decision of compensation rate.

### 2. Evidence of loss of assets

Assets to be impacted will be identified by means of written agreements which are to be shared copies of lists of loss of assets among the PAPs, district and developer before the construction.

# Grievance Redress Mechanism

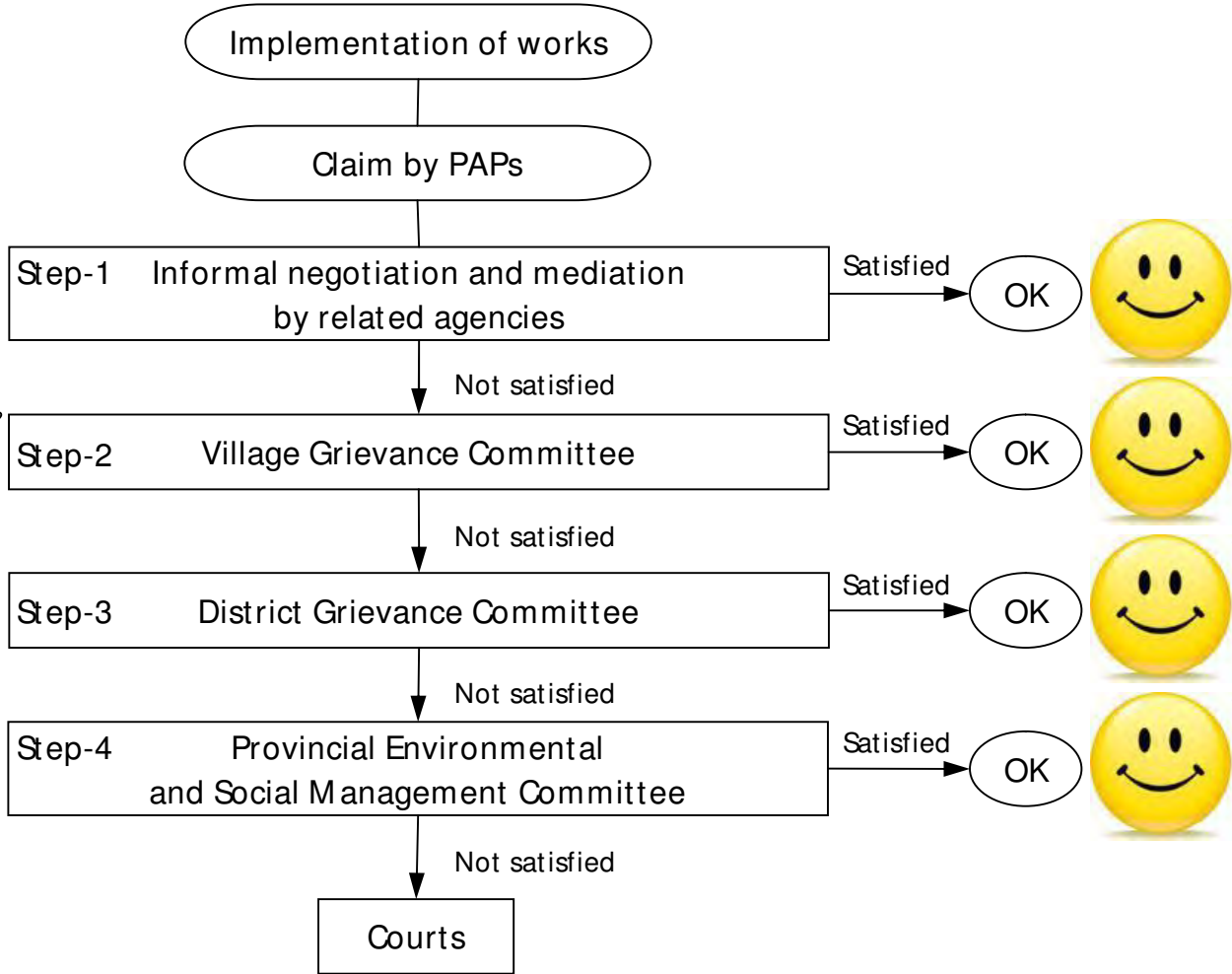
**PAPs have the right to make a claim if not adequately protected, compensated, and received entitlements.**



**Committee member (Draft)**

- Head of village
- at least 2 representatives of village
- at least 4 respected villagers among 4, one is member of Women's Union
- 1 staff from ESMMU for register
- .....
- .....

ໂຄງການເຂື່ອນໄຟຟ້ານ້ຳຈຽງບູ 1  
 ທ່ອງການພາກສະໜາມປາກຊັນ  
 ພະແນກສິ່ງແວດລ້ອມ ແລະ ສັງຄົມ (ESD)  
 ຖະໜົນ 13 ໃຕ້, ເຮືອນເລກທີ 279, ໜ່ວຍ 30  
 ບ້ານ ອານສອນໄຊ, ເມືອງປາກຊັນ,  
 ແຂວງ ບໍລິຄຳໄຊ, ຫານ ວິລະພັນ (020) 22239839







# ວຽກປັບປຸງແລະຟື້ນຟູເສັ້ນທາງເກົ່າ

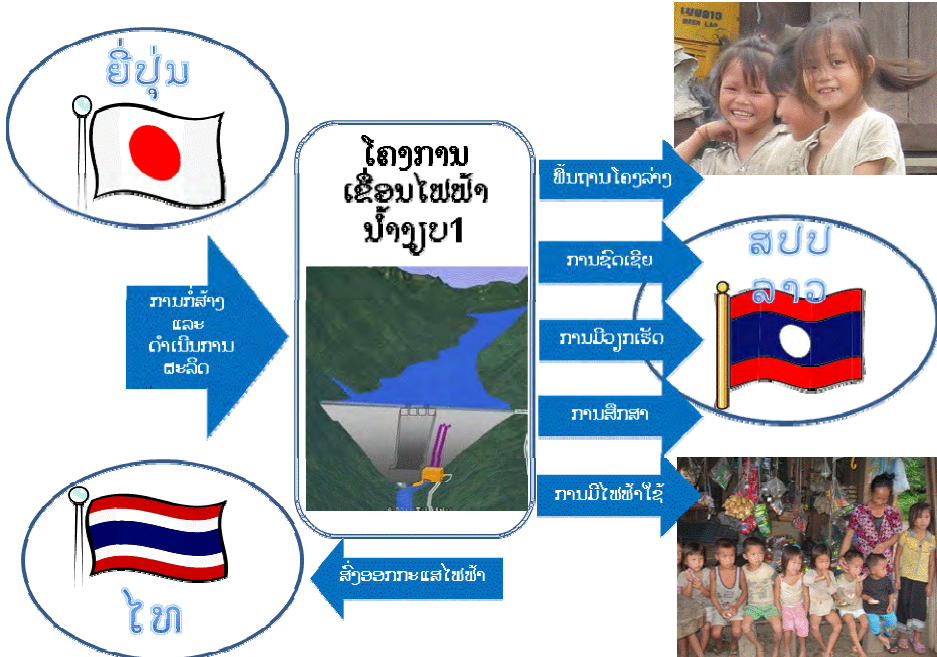
ເດືອນ ກຸມພາ 2013

ໂຄງການເຂື່ອນໄຟຟ້ານໍ້າງຽບ1

# ໂຄງຮ່າງຂອງໂຄງການເຂື່ອນໄຟຟ້ານ້ຳງຽບ1

1. ໂຄງການພະລັງງານເຂື່ອນໄຟຟ້ານ້ຳງຽບ1 ແມ່ນຕັ້ງຢູ່ສາຍນ້ຳງຽບ ເຊິ່ງເປັນສາຂາຂອງແມ່ນ້ຳຂອງ, ນ້ຳງຽບມີຕົ້ນກຳເນີດມາຈາກແຂວງຊຽງຂວາງ ແລະ ໄດ້ໄຫຼຜ່ານແຂວງວຽງຈັນ ແລະ ແຂວງບໍລິຄຳໄຊ ມີຄວາມຍາວປະມານ 160 ກິໂລແມັດ, ແລ້ວໄຫຼລົງໃສ່ແມ່ນ້ຳຂອງທີ່ເມືອງປາກຊັນ ເຊິ່ງເປັນຕົວເມືອງນ້ອຍ, ເມືອງໜຶ່ງທີ່ຕັ້ງຢູ່ຫ່າງຈາກນະຄອນຫຼວງວຽງຈັນປະມານ 145 ກິໂລແມັດ ລົງໄປທາງທິດໃຕ້ ໂດຍຜ່ານເສັ້ນທາງຫຼວງແຫ່ງຊາດ ເລກທີ13 ໃຕ້.
2. ເຂື່ອນໃຫຍ່ເປັນເຂື່ອນທີ່ຈະສ້າງຂຶ້ນດ້ວຍຄອນກຼີດບົດອັດແຫ້ນ, ມີຄວາມສູງ148 ແມັດ ໂດຍມີກຳລັງຕິດຕັ້ງການຜະລິດໄຟຟ້າ 272MW ແລະ ໃນນັ້ນມີກຳລັງການຜະລິດປະຈຳປີແມ່ນ1,515 GWh ຊຶ່ງກຳລັງການຜະລິດດັ່ງກ່າວແມ່ນມີສະຖານທີ່ຕັ້ງຢູ່ແຂວງບໍລິຄຳໄຊ, ສປປ ລາວ. ພະລັງງານໄຟຟ້າທີ່ຜະລິດນີ້ແມ່ນຈະໄດ້ສົ່ງອອກໄປສູ່ປະເທດໄທໂດຍຜ່ານສາຍສົ່ງຂະໜາດ 230kV ຈາກເຂື່ອນໄປຫາສະຖານີແຈກຈາຍໄຟຟ້າທີ່ນາບົງ ແລະ ຫ່າງຈາກເຂື່ອນໃຫຍ່(ເຂື່ອນຫຼັກ)ລົງມາຕາມລຳນ້ຳ 6 ກິໂລແມັດ ແມ່ນເຂື່ອນດັດສົມ(ເຂື່ອນນ້ອຍ)ຊຶ່ງຈະຖືກສ້າງຂຶ້ນໃນສະຖານທີ່ຮາບພຽງ ຈາກຈຸດສູງສຸດຂອງເຂື່ອນໃຫຍ່ ແລະ ມີຄວາມສາມາດໃນການຜະລິດກະແສໄຟຟ້າໄດ້ 105 GWh ເພື່ອເປັນການຕອບສະໜອງ ແລະ ປັບປຸງທາງດ້ານພະລັງງານໄຟຟ້າຮັບໃຊ້ໃນຂອບເຂດຊຸມນະບົດຂອງ ສປປ ລາວ.
3. ໂຄງການເຂື່ອນໄຟຟ້ານ້ຳງຽບ1 ປະກອບມີຜູ້ຖືຮຸ້ນຫຼັກຢູ່ 3 ພາກສ່ວນຄື: ບໍລິສັດພະລັງງານໄຟຟ້າຄັນໄຊ, ປະເທດຍີ່ປຸ່ນ (KANSAI); ບໍລິສັດການໄຟຟ້າຝ່າຍຜະລິດແຫ່ງປະເທດໄທ (EGATi) ແລະ ລັດຜູ້ສາທະກິດຖືຮຸ້ນລາວ (LHSE). ພາຍໃຕ້ໂຄງການດັ່ງກ່າວທັງ 3 ປະເທດລ້ວນແຕ່ໄດ້ຮັບຜົນປະໂຫຍດຕ່າງໆຮ່ວມກັນ ແລະ ພ້ອມດຽວກັນນີ້ໂຄງການເຂື່ອນໄຟຟ້ານ້ຳງຽບ 1 ມີເປົ້າໝາຍແນໃສ່ເພື່ອຫຼຸດຜ່ອນຄວາມທຸກຍາກຂອງປະຊາຊົນລາວບັນດາເຜົ່າ.

## ສົມປະໂຫຍດທັງໝົດທີ່ພາກສ່ວນກ່ຽວຂ້ອງຈະໄດ້ຮັບ

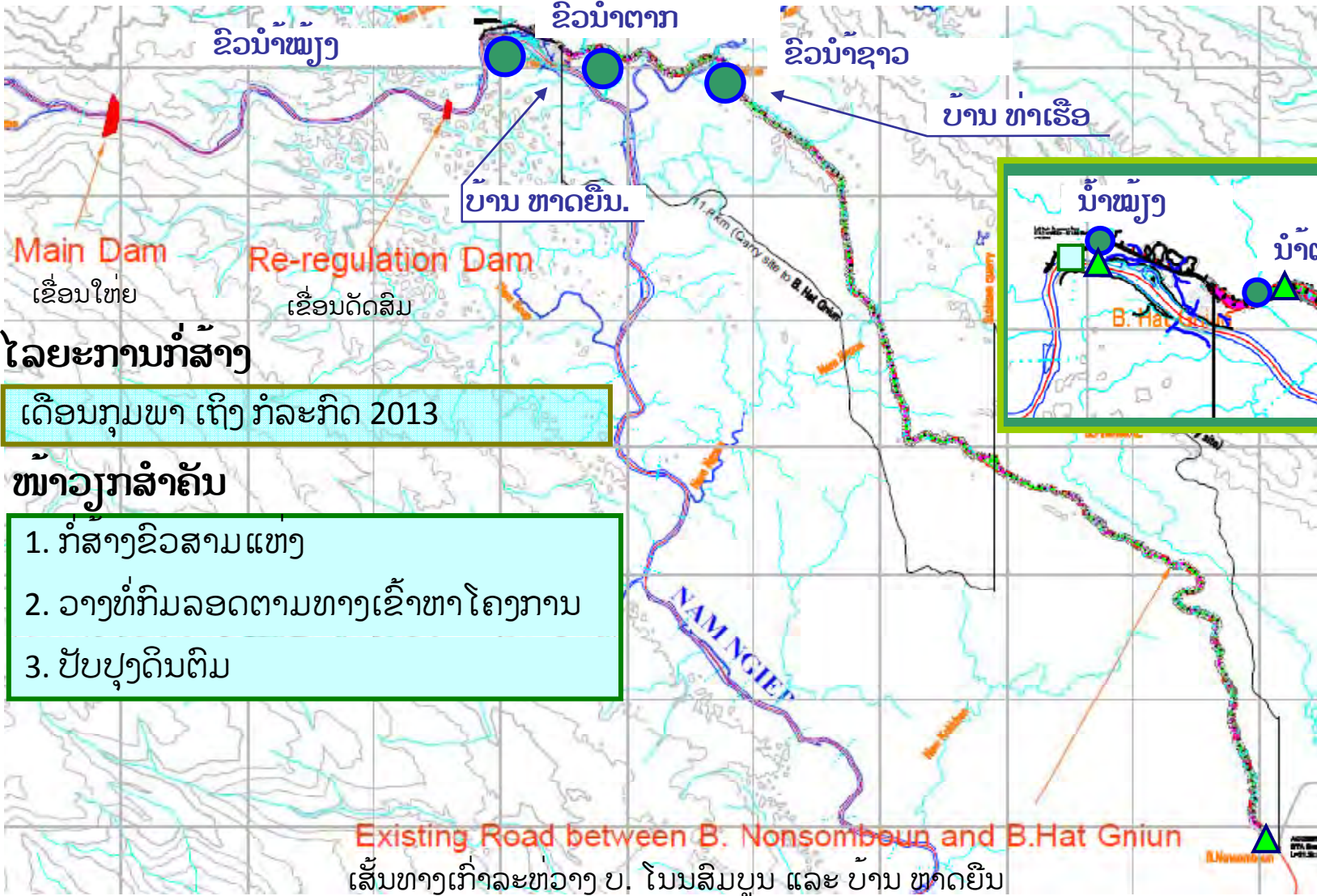


## ທີ່ຕັ້ງໂຄງການ





# ແຜນຜັງລວມ



## ໄລຍະການກໍ່ສ້າງ

ເດືອນກຸມພາ ເຖິງ ກໍລະກົດ 2013

## ໜ້າວຽກສໍາຄັນ

1. ກໍ່ສ້າງຂົວສາມແຫ່ງ
2. ວາງທໍ່ກົມລອດຕາມທາງເຂົ້າຫາໂຄງການ
3. ປັບປຸງດິນຕົມ



ເລື່ອງໝາຍ

- ; ຂົວ
- ▲ ; ແຄ້ມ
- ; ບໍ່ດິນ
- + ; ບ່ອນເກັບວັດສະດຸ

Existing Road between B. Nonsomboun and B. Hat Gniun  
ເສັ້ນທາງເກົ່າລະຫວ່າງ ບ. ໂນນສົມບູນ ແລະ ບ້ານ ຫາດຍືນ

ປະຊາຊົນອາໄສຢູ່ຕາມເສັ້ນທາງເກົ່າສາມາດໄດ້ຮັບຜົນປະໂຫຍດຈາກໂຄງການປັບປຸງເສັ້ນທາງເກົ່ານີ້

# ລັກສະນະເດັ່ນ

1. ຂົວ 3 ແຫ່ງ	ນ້ຳຊາວ	ຄວາມຍາວ=40.00 ແມັດ, ຄວາມກ້ວາງ =5.5 ແມັດ
	ນ້ຳໝັງ	ຄວາມຍາວ =11.35 ແມັດ, ຄວາມກ້ວາງ =11.0 ແມັດ
	ນ້ຳຕາກ	ຄວາມຍາວ =11.35 ແມັດ, ຄວາມກ້ວາງ=12.0 ແມັດ
2. ທໍ່ເບຕົງເສີມເຫຼັກ	ທໍ່ເສັ້ນຜ່າກາງ ; 800 ມິນລີແມັດ	ລວງຍາວທັງໝົດ=75 ແມັດຍາວ(4 ຈຸດ)
	ທໍ່ເສັ້ນຜ່າກາງ ; 1,000 ມິນລີ ແມັດ	ລວງຍາວທັງໝົດ=245 ແມັດ (16 ຈຸດ)
3. ປັບປຸງເຂດດິນຕົມ	5 ຈຸດ	
4. ລວມວຽກເບຕົງ	ປະມານ 890 ມ3	
5. ລວມວຽກດິນ	ປະມານ 5,000 ມ3( ຕິດຕັ້ງເຂດດິນຕົມ)	
6. ຜູ້ຮັບເໝົາ	ລັດວິສະຫະກິດກໍ່ສ້າງທາງເລກ 8	





# ແຜນວຽກ

	2013						
	ມັງກອນ	ກຸມພາ	ມີນາ	ເມສາ	ພຶດສະພາ	ມິຖຸນາ	ກໍລະກົດ
ການຈັດຕັ້ງກຳລັງແຮງງານ		ການຈັດຕັ້ງກຳລັງແຮງງານ					ການຖອນກຳລັງງານ
ຂົວນໍ້າຊາວ		ວຽກດິນ	ວຽກເບຕິງ	ວຽກໂຄງສ້າງ			
ຂົວນໍ້າໝັ້ງ		ວຽກກໍ່ສ້າງທີ່ສີ່ຫຼ່ຽມລອດທາງ					
ຂົວນໍ້າຕາກ		ວຽກກໍ່ສ້າງທີ່ສີ່ຫຼ່ຽມລອດທາງ					
ທໍ່ເບຕິງເສີມເຫຼັກ		ວຽກງານທີ່ກົມລອດທາງ					
ປັບປຸງເຂດດິນຕຶມ		ປັບປຸງ					

# ແຜນການຈັດຕັ້ງກຳລັງແຮງງານ

## ແຜນການຈັດຕັ້ງກົນຈັກ

ລຳດັບ		ຈຳນວນ/ມື້
ວຽກດິນ	  <p>ລົດຈັກ(0.9 ແມັດ3)      ລົດປະສົມປູນ (5 ແມັດ3)</p>	6 ຈຸດ
ວຽກຂັ້ນສິ່ງວັດສະດຸ	   <p>ລົດແກ່ດິນ (12 ແມັດ3)      ລົດປະສົມປູນ (ແມັດ3)</p> <p>ລົດຍົກ</p>	7 ຈຸດ
ລົດກະບະ	  <p>ລົດຮຸນໄດ      ໂຕໂຍຕ້າ</p>	3 ຈຸດ

## ທີ່ຕັ້ງຂອງແຄ້ມແຮງງານ



ຈຳນວນແຮງງານສູງສຸດ : ປະມານ 100 ຄົນຕໍ່ ມື້

# ແຜນການແກ້ໄຂເລື່ອງສິ່ງແວດລ້ອມ

ຜົນກະທົບ	ກິດຈະກຳທີ່ກ່ຽວຂ້ອງ	ການຕິດຕາມແລະແກ້ໄຂ	
ຜຸນ	- ການເຄື່ອນພາຫະນະ ແລະ ກິນຈັກ	- ຫົດນໍ້າດ້ວຍລົດນໍ້າ	
ຄຸນນະພາບນໍ້າໃນແມ່ນໍ້າ	- ການຂຸດດິນໃນນໍ້າຈະເຮັດໃຫ້ນໍ້າຂຸນ	- ການຕິດຕາມກ່ຽວກັບຄຸນນະພາບນໍ້າ (ຈຸດຕິດຕາມ; ນໍ້າຊາວ, ນໍ້າຕາກ, ນໍ້າໝຽງ)	
ສຽງລັບກວນ ແລະ ການສັ່ນສະເທືອນ	- ວຽກຂຸດດິນ - ເຄື່ອນຍາຍອຸປະກອນ	- ຈາກ 10 ໂມງແລງ - 6 ໂມງເຊົ້າ, ຫຼຸດຜອນວຽກດິນ	
ການລົບກວນເລື່ອງການສັ່ນຈອນ	- ວຽກງານກໍ່ສ້າງຂົວ ແລະ ວາງທໍ່ລອດທາງ	- ເຮັດທາງເວັ້ນໃນເຂດທີ່ມີການກໍ່ສ້າງ	
ຊາວບ້ານເຂດພື້ນທີ່	- ວຽກຂັດກັບຊາວບ້ານ	- ອົບຮົມຄົນງານຫຼີກລ້ຽງການສ້າງບັນຫາໃຫ້ຊາວບ້ານ	

## ການຊົດເຊີຍຜົນເສຍຫາຍຈາກວຽກງານປັບປຸງພື້ນຟູເສັ້ນທາງ

### 0. ຄວາມເປັນມາຂອງການຊົດເຊີຍຜົນເສຍຫາຍ

- ✓ ພວກຂ້າພະເຈົ້າໄດ້ມີການສຳຫຼວດດິນໃນປີ 2012 ເພື່ອຍັງຢືນຢັນເປັນພື້ນຖານໃຫ້ແກ່ຊັບສິນທີ່ໄດ້ຮັບຜົນເສຍຫາຍຈາກໂຄງການ ແລະ ໄດ້ຮັບການເຫັນດີ, ຍັງຢືນລົງລາຍເຊັນຈາກເຈົ້າຂອງດິນ, ນາຍບ້ານ, ຕົວແທນຈາກເມືອງ ແລະ ແຂວງ ດັ່ງລຸ່ມນີ້;

  1. ເຫັນດີໃຫ້ມີການດຳເນີນວຽກງານປັບປຸງພື້ນຟູເສັ້ນທາງເຂົ້າຫາພື້ນທີ່ໂຄງການ
  2. ເຫັນດີໃຫ້ມີການເລີ່ມຕົ້ນການເຈລະຈາຄ່າຊົດເຊີຍ ພາຍຫຼັງທີ່ ຄະນະກຳມະການຍົກຍ້າຍຈັດສັນ (ຂັ້ນສູນກາງ) ຖືກແຕ່ງຕັ້ງຂຶ້ນເປັນທາງການ ("RC")

### 1. ໄລຍະເວລາຂອງການຈ່າຍຄ່າຊົດເຊີຍ

- ✓ ເລີ່ມດຳເນີນວຽກງານປັບປຸງພື້ນຟູເສັ້ນທາງກ່ອນ, ແລ້ວຈຶ່ງຈ່າຍຄ່າຊົດເຊີຍຜົນເສຍຫາຍຕາມທີ່ຫຼັງ, ໂດຍອີງຕາມການຕົກລົງເຫັນດີນຳກັນໃນປີ 2012.
- ✓ ຕົກລົງຈ່າຍຄ່າຊົດເຊີຍຜົນເສຍຫາຍໃຫ້ກັບຜູ້ທີ່ໄດ້ຮັບຜົນເສຍຫາຍ ຕາມອັດຕາລາຄາຕົວເລກທີ່ໄດ້ກຳນົດ ແລະ ຮັບຮອງໂດຍ ຄະນະກຳມະການຍົກຍ້າຍຈັດສັນ.

### 2. ຫຼັກຖານຍັງຢືນຂອງຊັບສິນທີ່ໄດ້ຮັບຜົນເສຍຫາຍ

- ✓ ບັນດາຊັບສິນທີ່ໄດ້ຮັບຜົນເສຍຫາຍຈາກໂຄງການ ຕ້ອງໄດ້ຮັບການເຫັນດີຍັງຢືນຢັນເປັນລາຍລັກອັກສອນ, ຊຶ່ງມີເອກະສານລາຍລະອຽດຂອງຊັບສິນຄັດຕິດມາພ້ອມ, ພ້ອມທັງສຳເນົາໃຫ້ແກ່ຜູ້ທີ່ໄດ້ຮັບຜົນເສຍຫາຍ, ຫ້ອງການເມືອງ ແລະ ຜູ້ພັດທະນາໂຄງການ ກ່ອນມີການກໍ່ສ້າງ .



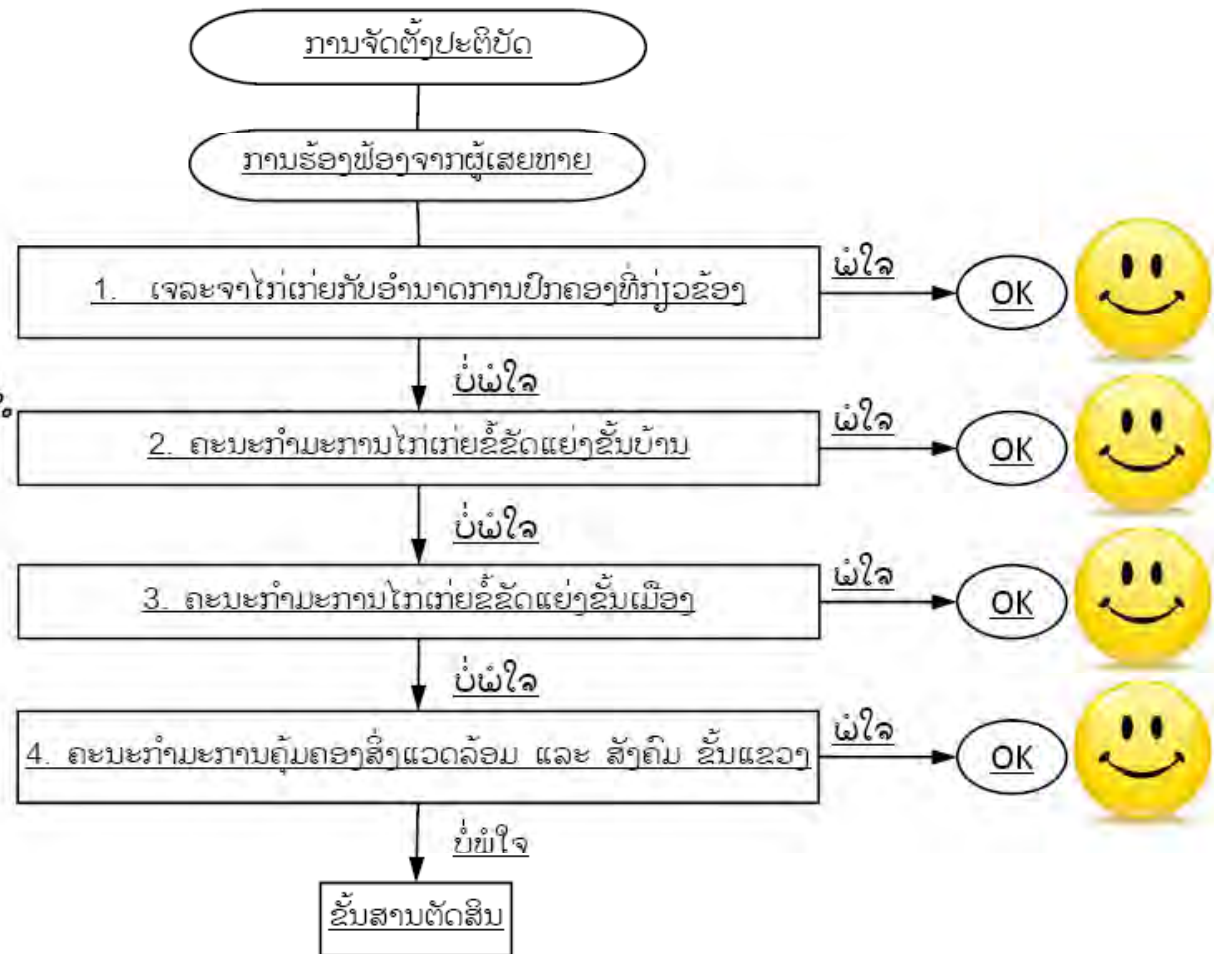
# ກິນໂກການແກ້ໄຂຂໍ້ຂັດແຍ່ງ

ຜູ້ໄດ້ຮັບຜົນກະທົບຈາກໂຄງການມີສິດຮ້ອງຟ້ອງ ຫາກເຫັນວ່າຕົນເອງບໍ່ໄດ້ຮັບການປົກປ້ອງຄວາມເປັນທຳ ຕໍ່ການຊົດເຊີຍ ແລະ ສິດໃນການໄດ້ຮັບຄ່າຊົດເຊີຍຕາມຜົນເສຍຫາຍ.



ສ.ຊ ຄະນະກຳມະການ (ສະບັບຮ່າງ)

- ທ່ານນາຍບ້ານ
- ຕົວແທນຈາກບ້ານຢ່າງໜ້ອຍ 2ທ່ານ
- ຜູ້ຊົງຄຸນວຸດທິຈາກບ້ານ 4ທ່ານ, ລວມທັງຕ່າງໜ້າສະຫະພັນແມ່ຍິງ 1ທ່ານ
- ໜ່ວຍງານຕິດຕາມ ຄຸ້ມຄອງສິ່ງແວດເພື່ອ ລ້ອມ ແລະ ສັງຄົມ ຂອງໂຄງການ 1ທ່ານ ບັນທຶກ



ໂຄງການເຂື່ອນໄຟຟ້ານໍ້າງຽບ 1  
 ຫ່ອງການພາກສະໜາມປາກຊັນ  
 ພະແນກສິ່ງແວດລ້ອມ ແລະ ສັງຄົມ ( ESD)  
 ຖະໜົນ 13 ໃຕ, ເຮືອນເລກທີ 279, ໜ່ວຍ 30  
 ບານ ອານຸສອນໄຊ, ເມືອງປາກຊັນ,  
 ແຂວງ ບໍລິຄຳໄຊ, ທ່ານ ວິລະພັນ (020) 22239839

## **Attachment-3**

# **Approval for the construction of the road rehabilitation works on Bolikhamxay province on 18 Feb 2013**

Revised Explanation for Concerns related rehabilitation works raised during the site visit by ADB mission on 24 September 2013

Nam Ngiep 1 Hydropower Project – 14 December 2013

Lao People's Democratic Republic.  
Peace Independence Democracy Unity Prosperity.

-----

Bolikhamxay Province

No: 094/

Bolikhamxay, 18 Feb 2013.

**The agreement**

**Provincial Governor – Bolikhamxay Province**

**Approval to implement the road rehabilitation work by NNP1 from Ban Nonsomboun to Ban hat Yeuan, total length 21.2 kilometers.**

- Refer to the request letter form Department of Public work and Transport, Bolikhmaxay Province, issued No.585/ , , dated on 4 Feb 2013.
- Refer to the agreement from the meeting, dated on 1 Feb 2013 at the the Department of Public work and Transport, Bolikhmaxay Province.

**Provincial Governor – Bolikhamxay Province agreed:**

Article1: Approval to implement the road rehabilitation work by NNP1 from Ban

Nonsomboun to Ban hat Yeuan, total length 21.2 kilometers.

Article2: The budget for road rehabilitation work is funded by NNP1.

Article3: NNP1 can apply this agreement to the concerned authorities to recognize and make cooperation with NNP1 in order to complete this work on time.

Article4: This agreement shall enter into force after the signature date.

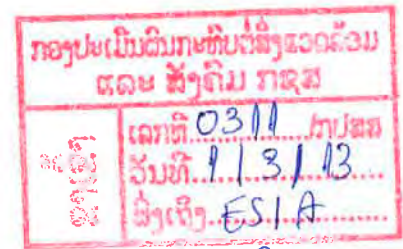
Dispatch:

**Provincial Governor-Bolikhamxay Provice**

- |                                       |       |
|---------------------------------------|-------|
| 1. Concerning authorities             | 1 set |
| 2. Head of village (affected village) | 1 set |
| 3. NNP1                               | 1set  |
| 4. Copy                               | 1 set |

26<sup>th</sup> February 2013  
Reference: NNP1/018/MoNRE

Department of Environment and Social Impact Assessment  
Ministry of Natural Resource and Environment  
The Lao Peoples's Democratic Republic



264921

**ATTENTION: Director General**

**SUBJECT : Submission of the Environmental Mitigation Plans for the Road Rehabilitation Works from Ban Nonsomboun to Ban Hat Gniun on the Nam Ngiep1 Hydropower Project**

Dear Sir,

We would like to express our sincere appreciation for your continuous support and effort to the Nam Ngiep 1 Hydropower Project ("Project").

Prior to access road construction works of the Project, we have been implementing the rehabilitation works on the existing road from Ban Nonsomboun to Ban Hat Gniun including the construction of three bridges at Nam Xao, Nam Tak and Nam Miang as one of annual repair to secure an accessibility to the site of the Project in rainy season ("Work").

With reference to the letter of No.00973/MoPWT dated on 24<sup>th</sup> Jan 2013 from Ministry of Public Works and Transportation as Attachment 1, we were informed from MoPWT to coordinate with local authorities in order to implement the Work. We got the approval from Bolikhamxay Province to implement the Work as shown in Attachment 2 (No.094 latter dated on 18<sup>th</sup> Feb 2013 from Bolikhamxay Province) after explanation meeting of our work plans including environmental mitigation plans to the relevant authorities and villagers to be affected.

Under the circumstance, we are pleased to submit our environmental mitigation plans and relevant data as attached. Regarding access road construction and the whole construction works of the Project, we will submit the ESMMP-CP to MoNRE separately for approval in accordance with Annex-C.

If you have any inquiries, at any time please don't hesitate to contact us.

Sincerely yours,

多田隆司

Takashi Tada  
General Site Manager of Nam Ngiep 1 Hydropower Project  
The Kansai Electric Power Company  
Mobile: +856-20-5554-4678 or +81-90-7753-1631, TEL/FAX: +856-21-215354  
E-mail: tada.takashi@b2.kepco.co.jp

Nam Ngiep 1 Office		
71 FEB 2013		
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Distribution	Action	Copy
MD	(noted)	
Technical M.		○
Finance M.		
Adm. M.		
Env. M.		○
KS head off		
Coordinator		





ສາທາລະນະລັດ ປະຊາທິປະໄຕ ປະຊາຊົນລາວ  
ສັນຕິພາບ ເອກະລາດ ປະຊາທິປະໄຕ ເອກະພາບ ວັດທະນະຖາວອນ  
☆☆☆☆

094 - - - -

ແຂວງບໍລິຄໍາໄຊ

ເລກທີ: \_\_\_\_\_/ຂບຊ  
ບໍລິຄໍາໄຊ, ວັນທີ: 18 FEB 2013

**ຂໍ້ຕົກລົງ**

**ຂອງເຈົ້າແຂວງ - ແຂວງບໍລິຄໍາໄຊ**

ວ່າດ້ວຍການອະນຸມັດໃຫ້ໂຄງການເຂື່ອນໄຟຟ້ານໍ້າຕົກ ນ້ຳງຽບ 1 ເຂົ້າຈັດຕັ້ງປະຕິບັດໂຄງການ  
ປັບປຸງພື້ນຟູເສັ້ນທາງແຕ່ບ້ານໂນນສີມບູນ - ບ້ານຫາດຍື່ນ, ລວງຍາວ 21.2 ກມ.

- ອີງໃສ່ ໃບສະເໜີຂອງພະແນກ ໂຍທາທິການ ແລະ ຂົນສົ່ງແຂວງບໍລິຄໍາໄຊ ສະບັບເລກທີ: 585/ ຍທຂ, ຂບຊ, ລົງວັນ  
ທີ 4/2/2013.
- ອີງຕາມ ການຕົກລົງເຫັນດີເປັນເອກະພາບຂອງກອງປະຊຸມຄັ້ງວັນທີ 1 ກຸມພາ 2013 ທີ່ພະແນກ ໂຍທາທິການ ແລະ ຂົນ  
ສົ່ງແຂວງບໍລິຄໍາໄຊ.

**ເຈົ້າແຂວງ - ແຂວງບໍລິຄໍາໄຊຕົກລົງ:**

- ມາດຕາ 1: ເຫັນດີອະນຸມັດໃຫ້ໂຄງການກໍ່ສ້າງເຂື່ອນໄຟຟ້ານໍ້າຕົກ ນ້ຳງຽບ 1 ລົງມີຈັດຕັ້ງປະຕິບັດໂຄງການ ປັບປຸງພື້ນຟູ  
ເສັ້ນທາງແຕ່ບ້ານ ໂນນສີມບູນ ຫາ ບ້ານ ຫາດຍື່ນ, ລວງຍາວ 21.2 ກມ.
- ມາດຕາ 2: ດ້ານງົບປະມານທີ່ນໍາມາປັບປຸງພື້ນຟູເສັ້ນທາງແມ່ນນໍາໃຊ້ຮ່ວງເງິນງົບປະມານຂອງໂຄງການ ກໍ່ສ້າງເຂື່ອນໄຟຟ້ານໍ້າ  
ງຽບ 1.
- ມາດຕາ 3: ມອບໃຫ້ພະແນກການທີ່ກ່ຽວຂ້ອງຕະຫຼອດຮອດອໍານາດການປົກຄອງທ້ອງຖິ່ນ ຈົ່ງຮັບຮູ້ ແລະ ອໍານວຍຄວາມ  
ສະດວກ ແລະ ພ້ອມກັນຈັດຕັ້ງປະຕິບັດໃຫ້ສໍາເລັດເປັນຢ່າງດີ.
- ມາດຕາ 4: ຂໍ້ຕົກລົງສະບັບນີ້ມີຜົນສັກສິດນັບແຕ່ມີລົງລາຍເຊັນເປັນຕົ້ນໄປ.

**ບ່ອນສົ່ງ:**

- |   |         |
|---|---------|
| 1. ພະແນກ ການທີ່ກ່ຽວຂ້ອງພະແນກ            | 1 ສະບັບ |
| 2. ການຈັດຕັ້ງບ້ານທີ່ເສັ້ນທາງຕັດຜ່ານບ້ານ | 1 ສະບັບ |
| 3. ໂຄງການກໍ່ສ້າງເຂື່ອນໄຟຟ້ານໍ້າງຽບ 1    | 1 ສະບັບ |
| 4. ສໍາເນົາ                              | 1 ສະບັບ |

ເຈົ້າແຂວງ - ແຂວງບໍລິຄໍາໄຊ

ບ້ານ ນ້ອຍມະນີ  
Pan NOYMANE

# **Attachment-4**

## **Hydrological design documents**

Revised Explanation for Concerns related rehabilitation works raised during the site visit by ADB mission on 24 September 2013

Nam Ngiep 1 Hydropower Project – 14 December 2013

**Hydrological design consideration for the road rehabilitation works**

1 General

The access road between B Nonsomboun and B Hat Gniun (the Road) passes small river named Nam Xiao, Nam Thak, and Nam Miang, and several streams named Houay Peun and Houay Ngua, and its tributary drainage. NNP1PC constructed one bridge, and two box culverts, and several pipe culverts in these sections for survey purpose. The catchment area for these rivers, streams, drainage and installed facilities including plate girder bridge, box culvert, and pipe culvert are summarized in the figure and table below.

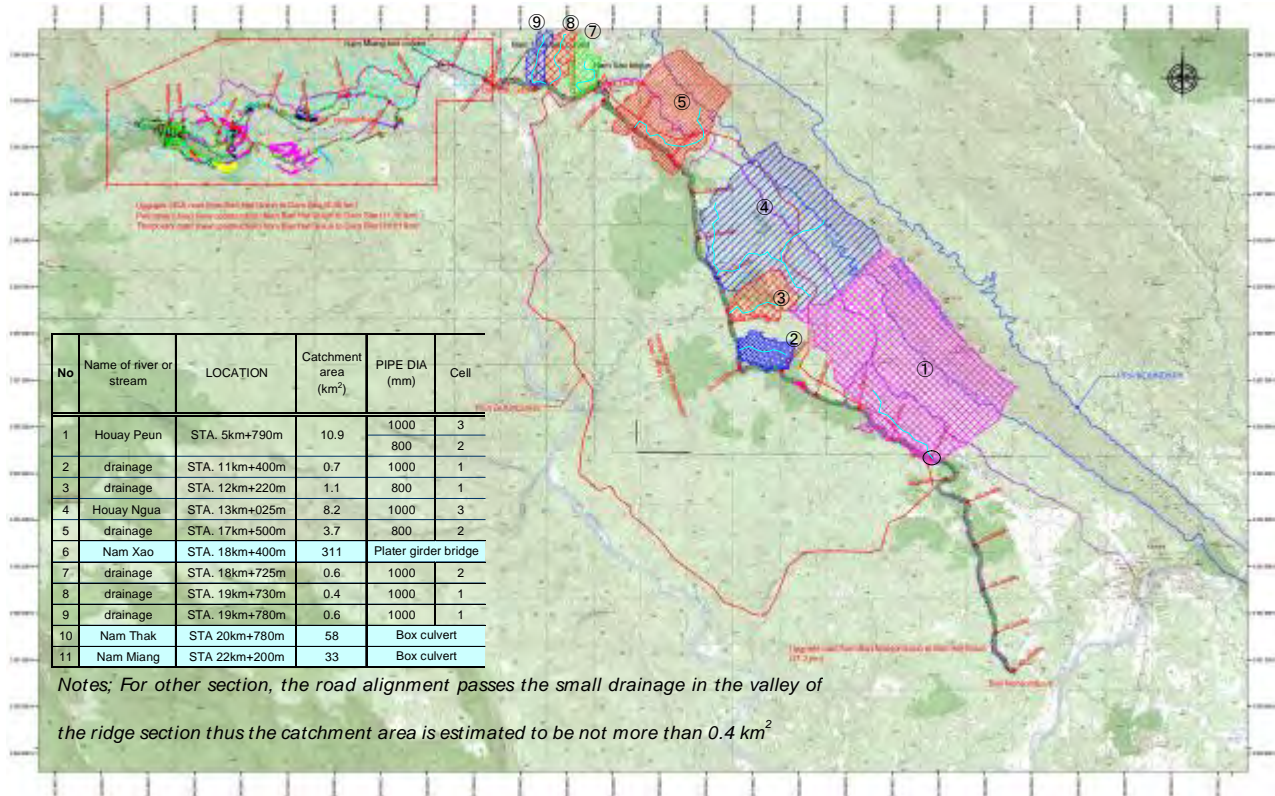


Figure-1 Location map

2 Design flood

Nam Xiao bridge and Nam Thak and Nam Miang box culverts were designed by applying 100-year flood in consideration of its difficulty in repairing and replacement in case. Probable flood discharge for various return periods at the location of Nam Xiao, Nam Thak and Nam Miang bridges was calculated based on the observed discharge data at the Muong Mai G/S for the period from 1978 to 2000 in the JICA FS. Annual daily maximum discharge at the Muong Mai G/S multiplied by 1.2 are plotted in Figure 2.3.4-1. Peak flood discharge is estimated by using a frequency distribution curve of “Log Peason III” which is the most adaptable curve among all the frequency distribution curves as the Appendix-1.

*\* 1 JAPAN INTERNATIONAL COOPERATION AGENCY MINISTRY OF INDUSTRY AND HANDICRAFTS OF THE GOVERNMENT OF LAO PDR, FEASIBILITY STUDY ON THE NAM NGIEP-1 HYDROPOWER PROJECT (Phase2), NOVEMBER 2002, NIPPON KOEI CO., LTD*

	Nam Xiao	Nam Thak	Nam Miang
Design flood	280	52	29

(100-year flood)			
------------------	--	--	--

For the pipe culvert section, 10-year flood was applied as a design flood for considering its easiness of repairing and maintenance. The flood discharge is calculated by proportional ratio by catchment area based on the flood analysis for small stream along the JICA road as the Appendix-2. The summary of design flood discharge for each location is shown in table below. For sections of small drainage other than listed below, NNP1PC set the minimum diameter of pipe culvert as 800 mm for securing enough discharged capacity. For the calculation of discharged capacity, manning equation was applied and calculated as shown in the Appendix-3 and Appendix-4.

No	Name of river or stream	LOCATION	Catchment area (km <sup>2</sup> )	PIPE DIA (mm)	Cell	Design Flood discharge	Discharged capacity
1	Houay Peun	STA. 5km+790m	10.9	1000	3	13.4	15.0
				800	2		
2	drainage	STA. 11km+400m	0.7	1000	1	0.9	3.4
3	drainage	STA. 12km+220m	1.1	800	1	1.3	2.4
4	Houay Ngua	STA. 13km+025m	8.2	1000	3	10.0	10.3
5	drainage	STA. 17km+500m	3.7	800	2	4.6	4.7
6	Nam Xao	STA. 18km+400m	311	Plater girder bridge		280	280
7	drainage	STA. 18km+725m	0.6	1000	2	0.7	6.8
8	drainage	STA. 19km+730m	0.4	1000	1	0.5	3.4
9	drainage	STA. 19km+780m	0.6	1000	1	0.7	3.4
10	Nam Thak	STA 20km+780m	58	Box culvert		52	52
11	Nam Miang	STA 22km+200m	33	Box culvert		29	29

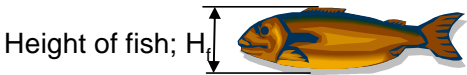
Nam Xao river is the largest tributary of Nam Ngiep in the downstream of main dam, For bridge construction, NNP1PC secure water flow area in the bridge section equivalent to that of upstream and downstream of the bridge section. Thus there is no adverse impact in Hydrology such as water level increase upstream of the bridge by the construction of Nam Xao bridge.

**4 Environmental considerations in hydrology**

Environmental and social impacts in hydrology by the construction of bridge, box and pipe culvert were assessed and summarize in table below.

As a result of hydrological analysis, water level of upstream the bridge, box and pipe culverts after the construction is equivalent to that of before construction.

For fish migration, it is usually said that required water depth for fish is double of height of fish (2 H<sub>f</sub>) and 300 mm is the practicable value in Japan. For the pipe culvert section with small stream, diameter of pipe culvert is designed as not less than a diameter of 800 mm. Thus no adverse impacts in hydrology by the bridge, box and pipe culverts construction was found.

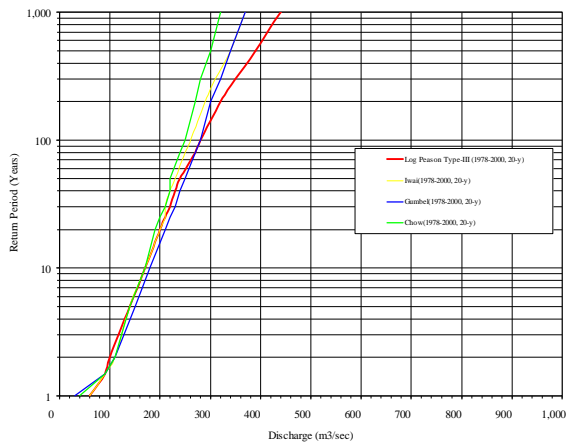




	<b>Nam Xao</b>	<b>Nam Thak</b>	<b>Nam M iang</b>	<b>Pipe culvert</b>
<b>Water level upstream</b>	- No impacts because these facilities have enough discharged capacity.			
<b>Fish migration</b>	- No impacts because of large cross section			- Pipe culvert with its diameter of not less than 800 mm is installed.
<b>Navigation by boat</b>	- No impacts because of large cross section			- No impacts because no villagers uses a boat in a small drainage.

**Appendix 1**

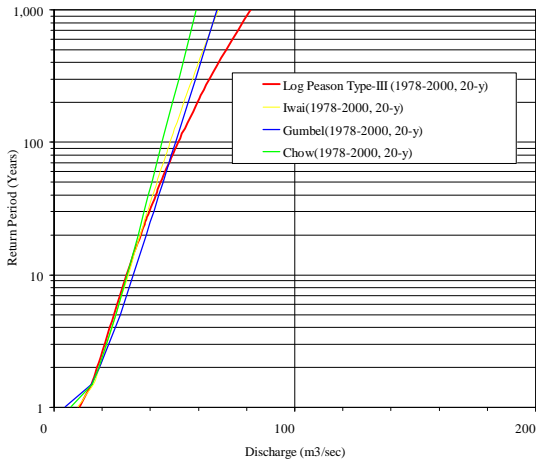
**Nam Xao Flood discharge (CA=311 km<sup>2</sup>)**



Return Period (Year)	Excess Probability	Computation Method			
		Iwai	Log Pearson Type-III	Gumbel	Chow
1.01	0.9901	60	60	30	40
1.50	0.6667	90	90	90	90
2	0.5000	110	100	110	110
5	0.2000	140	140	150	140
10	0.1000	170	170	180	170
20	0.0500	200	200	210	190
25	0.0400	210	210	220	200
30	0.0333	210	220	230	210
40	0.0250	220	230	240	220
50	0.0200	230	240	250	220
80	0.0125	250	270	270	240
100	0.0100	260	280	280	250
200	0.0050	290	320	300	270
300	0.0033	310	350	320	280
500	0.0020	340	390	340	300
1,000	0.0010	370	440	370	320
2,000	0.0005	410	500	400	350
5,000	0.0002	460	590	430	380
10,000	0.0001	500	670	460	400

Note: ( Flood discharge ) = ( Muang Mai Flow ) x 3,11 / 4,320 (Rounded-up to 10)

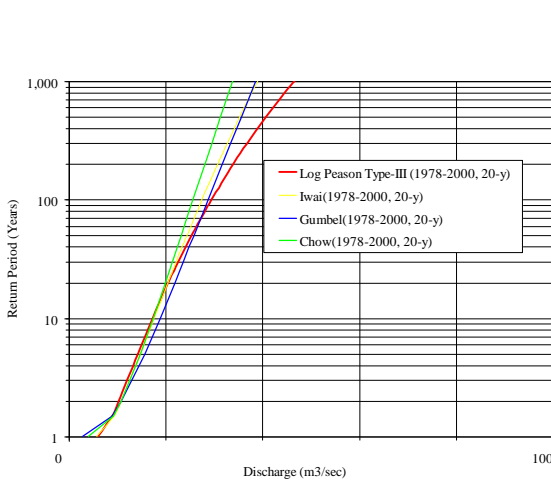
**Nam Tak flood discharge (CA=58 km<sup>2</sup>)**



Return Period (Year)	Excess Probability	Computation Method			
		Iwai	Log Pearson Type-III	Gumbel	Chow
1.01	0.9901	10	11	5	7
1.50	0.6667	16	16	15	16
2	0.5000	19	18	19	19
5	0.2000	26	25	27	26
10	0.1000	31	30	33	30
20	0.0500	36	36	38	35
25	0.0400	37	38	40	36
30	0.0333	39	40	41	37
40	0.0250	41	42	44	39
50	0.0200	43	44	45	41
80	0.0125	46	49	49	44
100	0.0100	48	52	50	45
200	0.0050	54	60	56	49
300	0.0033	57	65	59	52
500	0.0020	62	71	62	55
1,000	0.0010	68	82	68	59
2,000	0.0005	75	93	73	63
5,000	0.0002	85	110	80	69
10,000	0.0001	92	124	85	73

Note: ( Flood discharge ) = ( Muang Mai Flow ) x 58 / 4,320

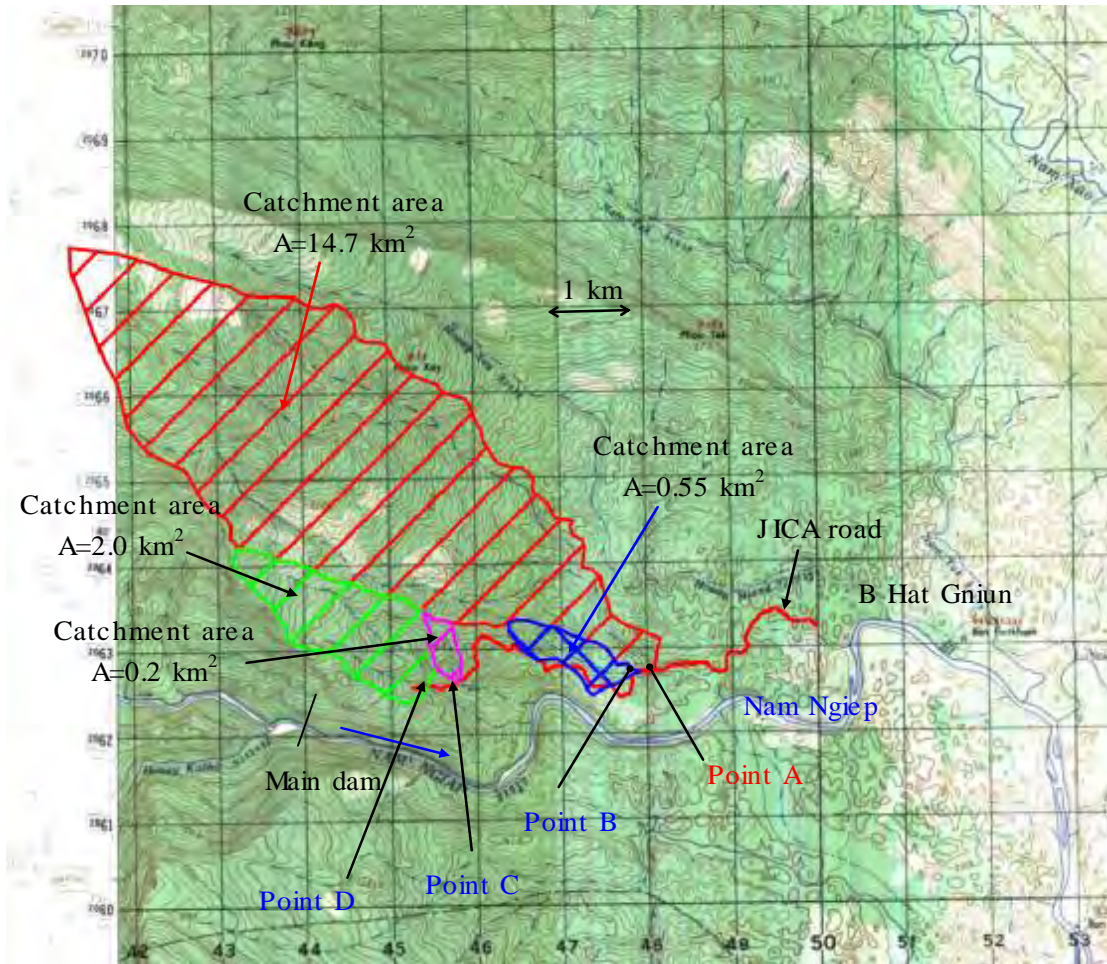
**Nam Miang flood discharge (CA=33 km<sup>2</sup>)**



Return Period (Year)	Excess Probability	Computation Method			
		Iwai	Log Pearson Type-III	Gumbel	Chow
1.01	0.9901	6	6	3	4
1.50	0.6667	9	9	9	9
2	0.5000	11	10	11	11
5	0.2000	15	14	16	15
10	0.1000	17	17	19	17
20	0.0500	20	20	22	20
25	0.0400	21	22	23	21
30	0.0333	22	22	24	21
40	0.0250	23	24	25	22
50	0.0200	24	25	26	23
80	0.0125	26	28	28	25
100	0.0100	27	29	29	26
200	0.0050	31	34	32	28
300	0.0033	33	37	33	29
500	0.0020	35	41	36	31
1,000	0.0010	39	46	39	34
2,000	0.0005	43	53	41	36
5,000	0.0002	48	62	45	39
10,000	0.0001	52	71	48	42

**Appendix 2**

The NNP1 PC calculated the flood discharge of the location of point A along the JICA road and apply the flood discharge as other small drainage with its catchment area not more than 20 km<sup>2</sup> by proportional ratio by catchment area.



The catchment area in the point A is calculated based on the topographic map scaled 1/50,000 as follows.

Location	Catchment area (km <sup>2</sup> )	River Gradient
Point A	14.7	0.130

1.5-year flood is applied for temporary facilities similar as diversion tunnel. Flood analysis was conducted based on unit hydrograph method. For lag time, Kirpich's formula is applied. The flood discharge at Point A is calculated as approximately 3.5 m<sup>3</sup>/s.

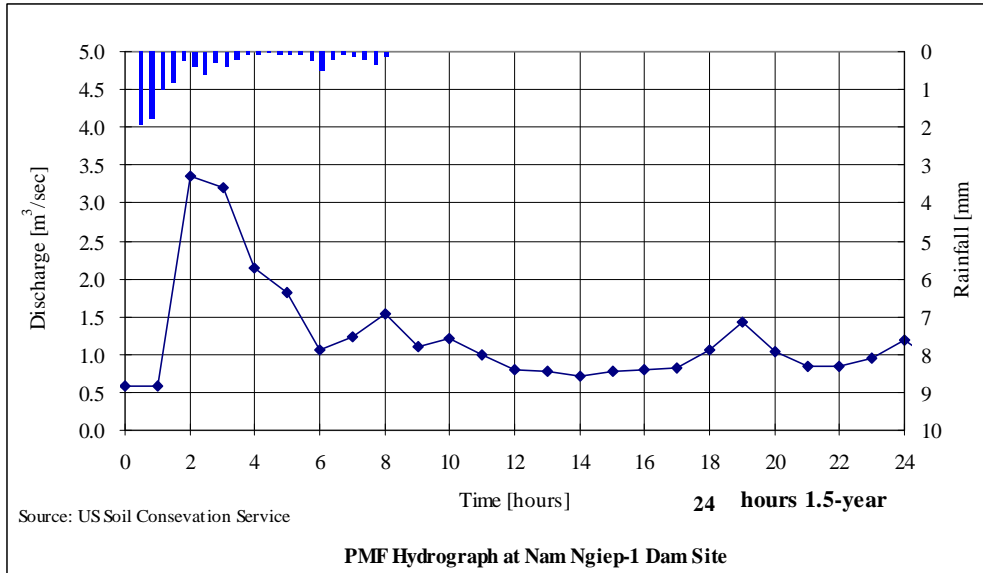
Location	Catchment area (km <sup>2</sup> )	1.5 –year flood (m <sup>3</sup> /s)
Point A	14.7	3.5

Details condition for the flood analysis is shown in below

a) Probable rainfall at pakxan is shown in table below.

Rainfall	72	48	24	18	12	6	5	4	3	2	1
1.5	111.4	92.1	56.3	53.8	48.5	40.6	38.8	36.6	34.0	30.7	25.7
2	132.5	109.4	72.1	69.0	62.2	52.1	49.7	46.9	43.6	39.3	32.9
5	184.5	151.9	111.1	106.3	95.8	80.2	76.6	72.3	67.2	60.5	50.7
10	218.9	180.1	137.0	131.0	118.0	98.8	94.3	89.1	82.8	74.6	62.5
20	251.9	207.1	161.7	154.6	139.4	116.7	111.4	105.2	97.7	88.1	73.8
25	262.3	215.7	169.6	162.1	146.2	122.4	116.8	110.3	102.5	92.4	77.4

b) Hydrograph



c) Details of the calculation of lag time

### SCS Unit Hydrograph for Nam Ngiep-1 HEPP

#### SCS Unit Hydrograph

$$Q_p = 0.208 * A * Q / t_p \quad (\text{US Soil Conservation Service Unit Hydrograph})$$

$Q_p$  : Peak Discharge [ $m^3/sec$ ]

A : Catchment Area [ $km^2$ ]

Q : Total volume of the unit graph (= 1 mm)

$t_p$  : Time to peak [hours]

at Nam Ngiep-1

Location A

6.6 [ $m^3/sec/mm$ ]

14.7 [ $km^2$ ]

1 [mm]

0.47 [hours]

#### Time to Peak

$$t_p = 2 * t_c / 3$$

0.5 [hours]

0.47

#### Rainfall Duration

$$D = 0.133 * t_c$$

0.1 [hours]

0.09 [hours]

#### Flood Concentration Time

(Kirpich's formula)

$$t_c = 3.97 * L^{0.77} * S^{-0.385} \quad (\text{Kirpich's formula})$$

$t_c$  : Flood concentration time [min]

L : Maximum length of travel of water [km]

S : Average slope (= H/L)

H : Difference in elevation between the remote point in the basin and the outlet

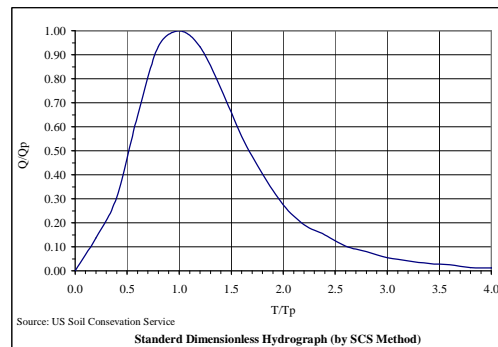
0.7 [hours]

42.63 [min]

7.9 [km]

0.1298

1.020 [m]



T/Tp	Q/Qp
0.00	0.0000
0.00	0.0000
0.20	0.1374
0.40	0.3069
0.60	0.6449
0.80	0.9346
1.00	1.0000
1.20	0.9336
1.40	0.7602
1.60	0.5607
1.80	0.4045
2.00	0.2748
2.20	0.1924
2.40	0.1498
2.60	0.1031
2.80	0.0797
3.00	0.0550
3.20	0.0412
3.40	0.0302
3.60	0.0247
3.80	0.0137
4.00	0.0124
4.20	0.0110
4.40	0.0069
4.60	0.0027
4.80	0.0014



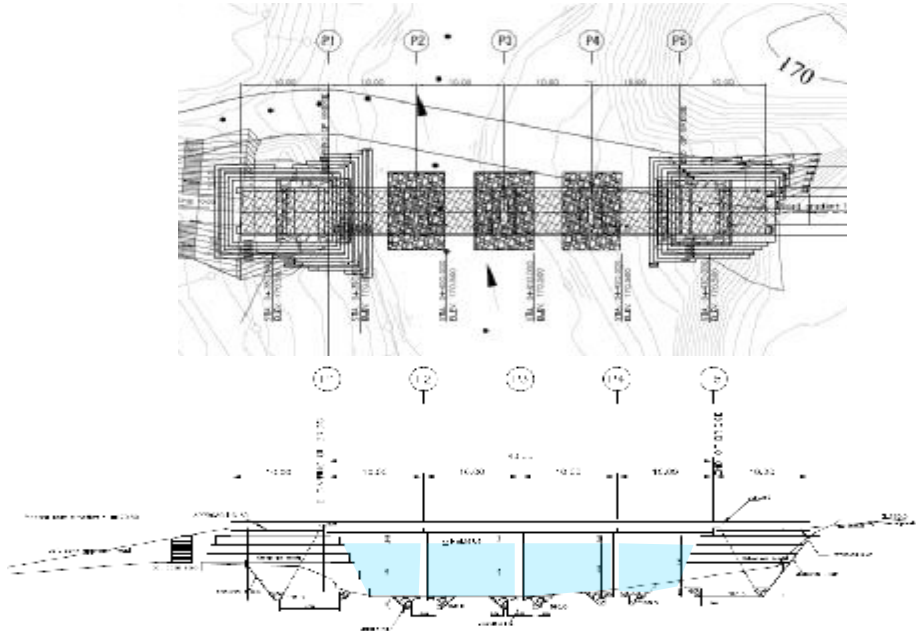
**Appendix 3**

Items	Unit	Pipe culvert		
Diameter	m	800	800	800
Cross sectional area	m <sup>2</sup>	0.50	0.50	0.50
Material		Concrete	Concrete	Concrete
Coefficient of roughness	sec/ m <sup>1/3</sup>	0.012	0.012	0.012
Gradient		0.015	0.015	0.015
Water depth	m	0.95%	0.95%	0.95%
Water area	m <sup>2</sup>	0.62	0.62	0.62
Perimeter depth	m	2.69	2.69	2.69
Hydraulic radius	m	0.23	0.23	0.23
Average water velocity	m/ sec	3.82	3.82	3.82
Maximum discharged capacity	m <sup>3</sup> / sec	2.36	2.36	2.36
Number of row	row	1	2	3
Total discharge capacity	m <sup>3</sup> / sec	2.4	4.7	7.1
Items	Unit	Pipe culvert		
Diameter	m	1000	1000	1000
Cross sectional area	m <sup>2</sup>	0.79	0.79	0.79
Material		Concrete	Concrete	Concrete
Coefficient of roughness	sec/ m <sup>1/3</sup>	0.012	0.012	0.012
Gradient		0.015	0.015	0.015
Water depth	m	0.95%	0.95%	0.95%
Water area	m <sup>2</sup>	0.77	0.77	0.77
Perimeter depth	m	2.69	2.69	2.69
Hydraulic radius	m	0.29	0.29	0.29
Average water velocity	m/ sec	4.44	4.44	4.44
Maximum discharged capacity	m <sup>3</sup> / sec	3.42	3.42	3.42
Number of row	row	1	2	3
Total discharge capacity	m <sup>3</sup> / sec	3.4	6.8	10.3

Appendix-4

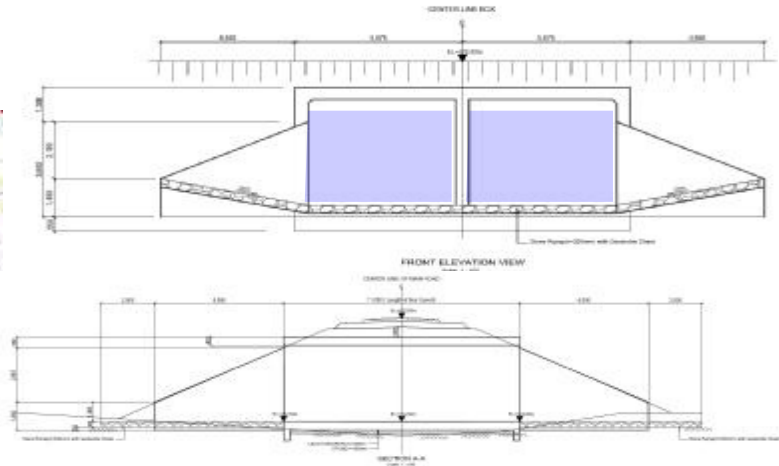
The elevation of bridge is considering with flood water level at Nam Xao, Nam Miang and Nam Thak calculated as follows. As a result of calculation, every bridge has enough discharged capacity and make it possible to discharge over 100-year flood.

Nam Xao River flood water level



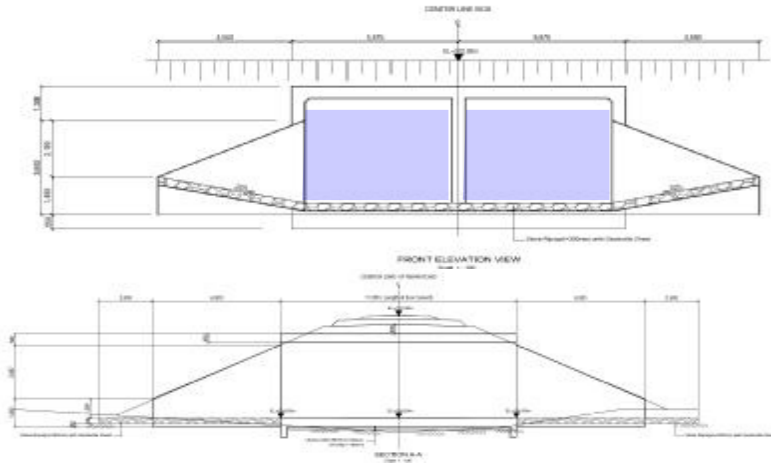
Items	Unit	amount	Remarks
River crosssection		Rectangle	
Width	m	9.65	=10 (span) - (0.7/ 2)
Maximum height	m	5.60	EL167.6 - EL.162m (River bed)
Maximum cross section	m <sup>2</sup>	54.04	
Coefficient of roughness	sec/ m <sup>1/3</sup>	0.040	
River gradient		0.001	
Cross section area	m <sup>2</sup>	54.00	
Wetted perimeter	m	20.85	
Hydraulic mean depth	m	2.59	
Water velocity	m/ sec	1.49	
Maximum discharge for 1 section	m <sup>3</sup> / sec	80.46	
Number of section	nos	3.5	
Maximum discharge	m <sup>3</sup> / sec	281.61	>> over 100- year flood of 280 m <sup>3</sup> / s

Nam Tak River flood water level



Items	Unit	amount	Remarks
River crosssection		Rectangle	
Width	m	5.0	width of box culvert
Maximum height	m	3.8	EL.168.6m - EL.164.6m (River bed) Culvert height
Maximum cross section	m <sup>2</sup>	19.00	
Coefficient of roughness	sec/ m <sup>1/3</sup>	0.025	Based on general coefficient of roughness
River gradient		0.0010	
Cross section area	m <sup>2</sup>	19.00	
Wetted perimeter	m	12.60	
Hydraulic mean depth	m	1.51	
Water velocity	m/ sec	1.66	
Maximum discharge for 1 section	m <sup>3</sup> / sec	31.54	
Number of section	nos	2	
Maximum discharge	m <sup>3</sup> / sec	63.08	>> over 100- year flood of 52 m <sup>3</sup> / s

Nam Miang River flood water level



Items	Unit	amount	Remarks
River crosssection		Rectangle	
Width	m	5.0	width of box culvert
Maximum height	m	3.8	EL168.6m - EL.164.6m (River bed) Culvert height
Maximum cross section	m <sup>2</sup>	19.00	
Coefficient of roughness	sec/m <sup>1/3</sup>	0.025	Based on general coefficient of roughness
River gradient		0.0010	
Cross section area	m <sup>2</sup>	19.00	
Wetted perimeter	m	12.60	
Hydraulic mean depth	m	1.51	
Water velocity	m/ sec	1.66	
Maximum discharge for 1 section	m <sup>3</sup> / sec	31.54	
Number of section	nos	2	
Maximum discharge	m <sup>3</sup> / sec	63.08	>> over 100- year flood of 52 m <sup>3</sup> /s



## **Attachment-5**

### **Timeline and back ground of Houay Ngua Provincial Preservation Area (Houay Ngua PPA)**

Revised Explanation for Concerns related rehabilitation works raised  
during the site visit by ADB mission on 24 September 2013

Nam Ngiep 1 Hydropower Project – 14 December 2013

## History of Houay Ngua Provincial Preservation Forest

Jun 2010	Determined the boundary of Houay Ngua Provincial Preservation Forest (“PPA”) by Bolikhamxay Governor under “Decision of Bolikhamxay Governor No.0294/BLKX, date 24 June 2010 on Determination of Boundary of Houay Ngua Reservation Forest”
Dec 2012	<p>Established Houay Ngua Provincial Preservation Area Management Plan (2011-2015)</p> <ul style="list-style-type: none"> <li>- Description of the management plan           <p>PPA had been established in 1995 as the district level, and upgraded to the provincial level in 1998 with the total area of 13,500 ha where the coordinates of its boundary had not been set.</p> <p>PPA consists of three zones of the total preservation zone, the corridor zone and the buffer zone</p> <p>The total area of PPA is 4,595 ha</p> </li> <li>- Others           <p>The drawing of Attachment-1 shows the cartoon of PPA described in the management plan and the latest PPA boundary in red bold line which was being submitted to NNP1PC with the Bolikhamxay province’s official letter in October, 2013. The both PPAs are same area of 4,595 ha according to each document, however each boundary is not same. The PPA boundary described in the management plan seems to be wrong.</p> <p>At the site, some bulletin boards are already set as Attachment-2.</p> </li> </ul>
29 May 2013	The official announcement which the land use of buffer zone is canceled was received from the Bolikhamxay Province via the ESteam of NNP1PC.
31 May 2013	<p>Celebration on world environmental day</p> <p style="text-align: center;">Jun 2010      Installation of bulletin board of PPA at approx. km 6+800 (Referred to Attachment-3)</p> <p>Official announce “ cancel the right using the land in the buffer area of Houay Ngua PPA”</p>
Jun 2012	Received Auto CAD data of PPA boundary
10 Oct 2013	<p>Received confirmation letter of PPA (Referred to Attachment-5)</p> <p>Area of PPA is 4,595 ha.</p> <p>Area of buffer zone is 1,023 ha of which width is 50 - 100 m is newly set at the boundary of PPA.</p> <p>ROW of 30m is set along the existing road within PPA.</p>

Attachment-1; Comparison of PPA boundary between the management plan and the confirmation letter in October, 2013

Attachment-2 Original bulletin board of PPA

Attachment-3 New bulletin board of PPA in May 2013

Attachment-4 Confirmation letter in October 2013

Attachment-1; Comparison of PPA boundary between the management plan and the confirmation letter in October, 2013





Attachment-2 Original bulletin board of PPA

Map of protection area of Houay Ngua

(Ending point at approximate STA 17km measured by car measure meter)



Each area of PAP is managed by each village as shown above map.

Starting point at approximate STA 6 km measured by car measure meter





Attachment-3 New bulletin board of PPA in May 2013

New bulletin board of PPA at approx. Km 6+800



Attachment-4 Confirmation letter in October 2013



ສາທາລະນະລັດ ປະຊາທິປະໄຕ ປະຊາຊົນລາວ  
ຕີພາບ ເອກະລາດ ປະຊາທິປະໄຕ ເອກະພາບ ວັດທະນະຖາວອນ

ພະແນກຊັບພະຍາກອນທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມ  
ຂະແໜງຄຸ້ມຄອງຊັບພະຍາກອນປ່າໄມ້.

ເລກທີ.....177/ຂຄຸປ.ພສສ -  
ບໍລິຄຳໄຊ, ວັນທີ .....10 OCT. 2013

ເຖິງ: ໂຄງການກໍ່ສ້າງເຂື່ອນໄຟຟ້ານ້ຳງຽບ 1.  
ເລື່ອງ: ຍິ່ງຢືນຂໍ້ມູນແຜນທີ່ຕາມເຂດກັນຊີນຂອງປ່າສະຫງວນຫ້ວຍງົວ  
(ປ່າສະຫງວນແຂວງ).

- ອີງຕາມກົດໝາຍປ່າໄມ້ ເລກທີ 06 / ສພຊ, ມາດຕາ 11.ຂອງປ່າສະຫງວນ ແລະ ປ່າປ້ອງກັນໃນ  
ທ້ວແຂວງບໍລິຄຳໄຊ, ເພື່ອຈຸດປະສົງນຳໃຊ້ໃນການອະນຸລັກທຳມະຊາດ, ປົກປັກຮັກສາພັນພືດ, ພັນ  
ສັດລະບົບນິເວດຕ່າງໆ, ຍິ່ງຢືນຂໍ້ມູນ ໃນແຜນທີ່.
- ເນື້ອທີ່ປ່າສະຫງວນຫ້ວຍງົວມີທັງໝົດ. 4,595 ha.
- ເນື້ອທີ່ເຂດກັນຊີນປ່າສະຫງວນຫ້ວຍງົວມີທັງໝົດ. 1,023 ha.
- ໄລຍະຫ່າງເຂດກັນຊີນ. 50 - 100 m.

ດັ່ງນັ້ນ: ຈຶ່ງລາຍງານຂໍ້ມູນຂ້າງເທິງນັ້ນມາຍັງບໍລິສັດເພື່ອຊາບ.

ຂະແໜງຄຸ້ມຄອງຊັບພະຍາກອນປ່າໄມ້.





ແກ້ວວິງເດືອນ ຜົນທະນຸລີ

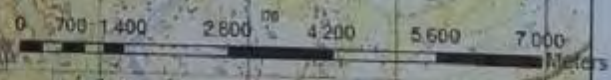
# ແຜນທີ່ປ່າສະຫງວນຫ້ວຍງົວ

ເນື້ອທີ່ເຂດກັ້ນຊົນ 1,023 ha

ເນື້ອທີ່ປ່າສະຫງວນ 4,505 ha

## ເຄື່ອງໝາຍ

-  ຂອບເຂດກັ້ນຊົນປ່າສະຫງວນຫ້ວຍງົວ
-  ຂອບເຂດປ່າສະຫງວນຫ້ວຍງົວ



352000

356000

360000

2054000

2056000

2058000

2060000





352000

356000

360000

# ແຜນທີ່ປ່າສະຫງວນຫ້ວຍງົວ

2064000

2060000

2056000

2052000

2064000

2060000



2056000

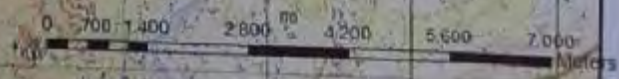
2052000

ເນື້ອທີ່ເຂດກັນຊີນ 1,023 ha

ເນື້ອທີ່ປ່າສະຫງວນ 4,505 ha

## ເຄື່ອງໝາຍ

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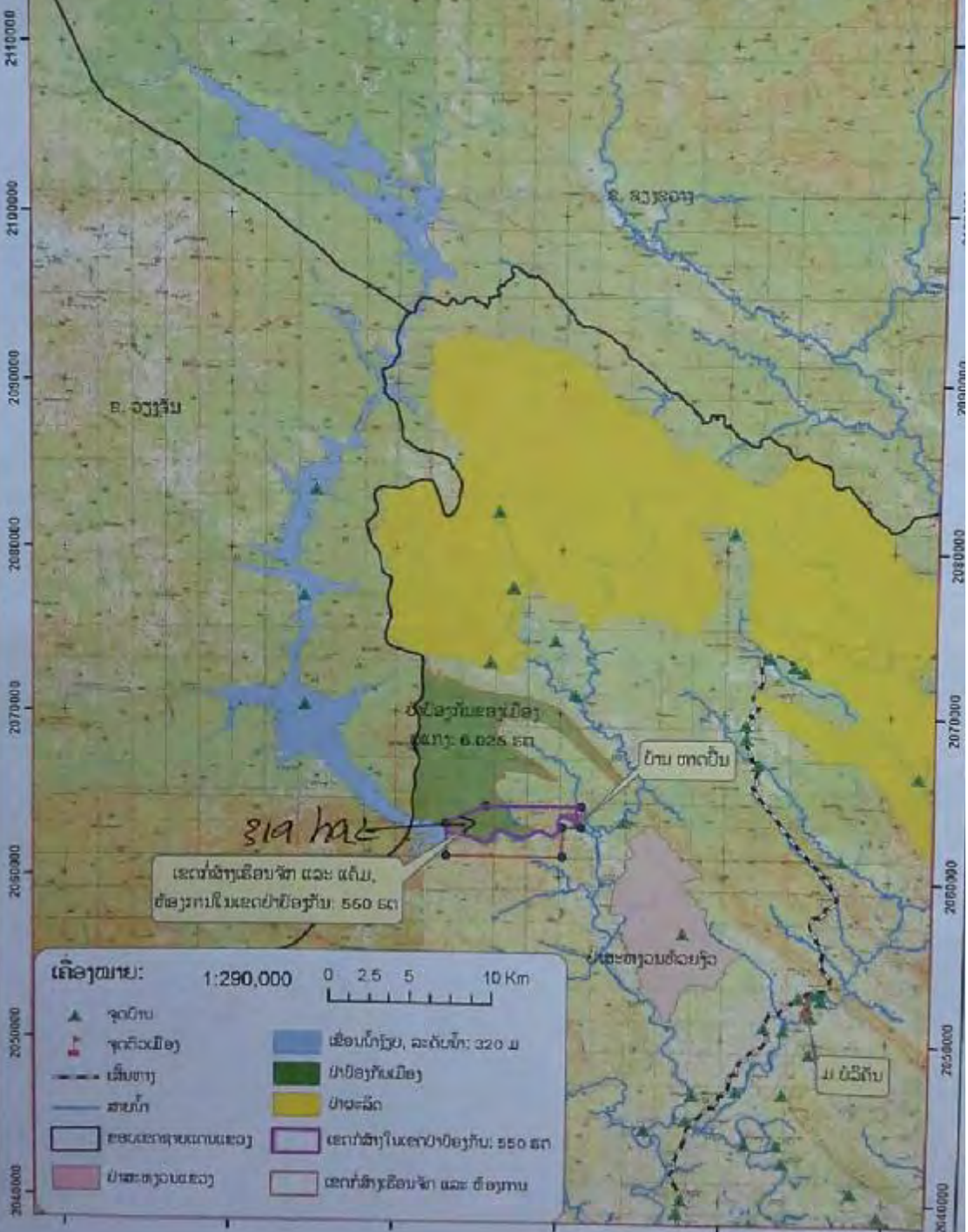
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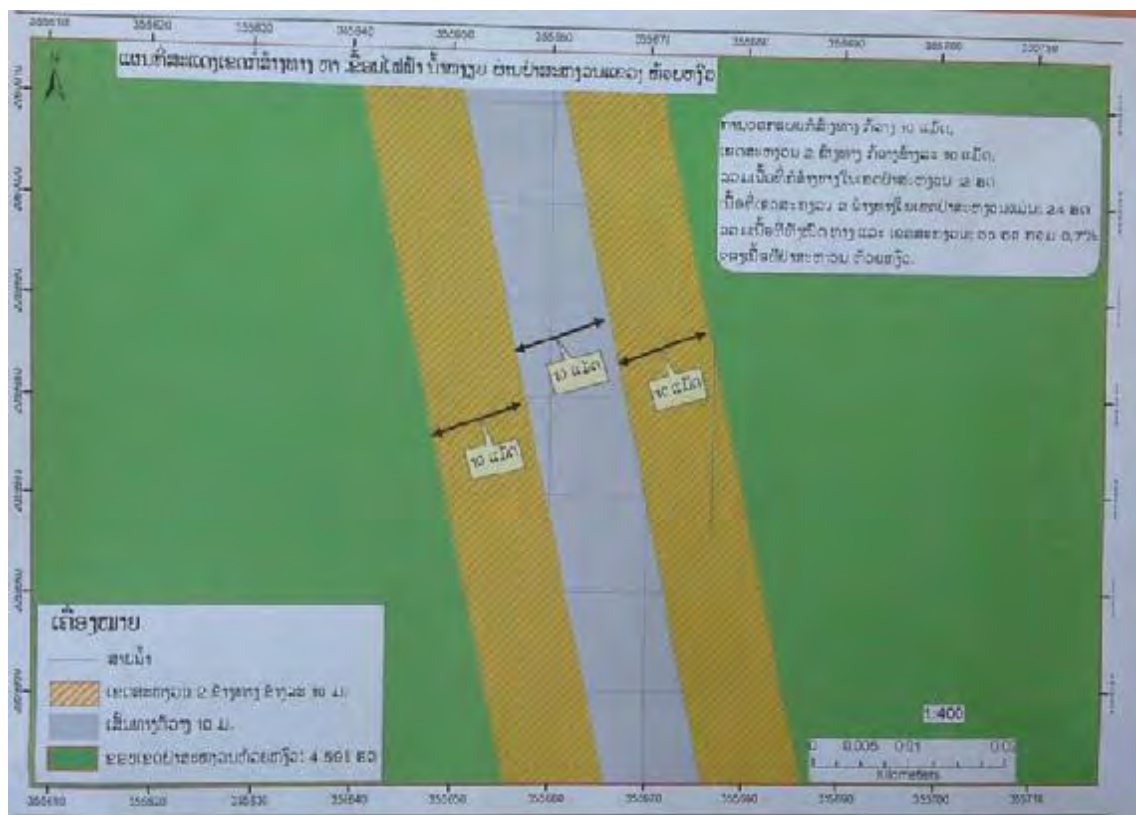




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Annex E

NNP1 Access Road  
Biodiversity Assessment  
Report



Nam Ngiep One Power Company Limited

NNP1 Access Road  
Biodiversity Assessment  
*Report*

May 2014

Reference: 0200749

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## EXECUTIVE SUMMARY

*The Nam Ngiep Hydropower Project (NNP1) in northern Lao is currently undertaking investigations to support an approval to construct and operate a hydropower facility on the Nam Ngiep River. As a component of the Project an access road is required to facilitate the transport of construction materials and other equipment as well as provide all-weather access to the facility for operation.*

*This report provides a biodiversity assessment specific to the proposed access road network (Proposed Road) such that preliminary construction can be initiated during completion of other NNP1 Project studies. The Proposed Road extends from Ban Nomsomboun, through the Huay Ngua Provincial Preserved Area to Ban Hat Gniun and to the proposed dam site. The Proposed Road involves upgrade of existing road infrastructure as well as construction of new permanent roads, temporary roads and ancillary infrastructure such as a worker's camp, batching plant and quarries. The Proposed Road is approximately 58 km in length and of varying width. For the purposes of assessment a road width of 9.5 metres has been considered to allow for interpretation of biodiversity values that may be associated with the disturbance area.*

*The Asian Development Bank has requested information specific to the biodiversity values of the Proposed Road that consider the ADB Safeguard Policy Statement and International Finance Corporation performance Standard 6 guidance. This report uses available data sources from desktop review, field survey, village interview, spatial analysis and species specialist consultation to describe the biodiversity values in accordance with the standard. Primarily this involves the identification and assessment of habitats (natural and modified) that may be impacted by the Proposed Road.*

*Biodiversity values of the Proposed Road were identified relating to the land cover of the region, condition of the vegetated areas, and flora and fauna species. The outcomes of the assessment identified seven flora species, four mammals, seven birds, two reptiles and 18 fish species as candidates for assessment against the IFC critical habitat criteria. Candidates included IUCN listed species, nationally listed species and migratory species. Through investigation and consultation with species specialists information was compiled and assessed against the critical habitat criteria. The assessment identified that the Proposed Road Project area is unlikely to be associated with habitat considered to be critical habitat for these priority biodiversity values.*

*An impact assessment was undertaken for the biodiversity values identified for the Project area. The key threats to biodiversity as a result of the Proposed Road relate to permanent loss of habitat, disturbance and displacement of species, creation of barriers to fauna movement, degradation of habitat due to edge effects and fragmentation, and fauna mortality. In general the significance of these impacts to biodiversity and priority biodiversity values was considered to be minor or negligible. The exception related to the potential loss of natural habitat that is suitable for IUCN listed and nationally listed species. Although the Project area is not considered critical habitat for these species potential habitat will be permanently removed to facilitate the construction of the Proposed Road.*

*The mitigation hierarchy recognises a preference for avoiding environmental impacts and as such an alternative road route was considered to investigate the potential to reduce the permanent net loss in habitat and requirement for clearing within the Huay Ngua PPA. Biodiversity values of the Alternative Road were determined to be similar to those identified for the Proposed Road route and as result of constructability factors the Proposed Route was determined preferred.*

*Disturbance to habitat in modified and natural habitat areas has potential to have impacts on the local biodiversity and downstream biodiversity as well as impacts to priority biodiversity values. The biodiversity impact assessment (Section 5) identified potential impacts to both modified and natural habitats however the modified habitat types were not identified to play a significant role in habitat suitability for priority biodiversity values.*

*Primarily, a Biodiversity Action Plan (BAP) will be developed that will document a strategy for refining the mitigation and management approach to conservation of biodiversity values, including key objectives, specific measures for the IUCN listed threatened species with potential to occur in the Project area, performance indicators and responsible parties. Management measures specific to managing the natural environment will be also incorporated into the Project EMMP.*

*Direct disturbance to habitats will be minimised where possible however this impact assessment has identified an unavoidable loss of approximately 28 ha of natural habitat and 19 ha of modified habitat. A Biodiversity Offset Design Report has been drafted for the entire NNP1 Project that provides the methodology and approach to the design and implementation of biodiversity offsets as the compensatory measure for residual impact to habitats. The report incorporates the Proposed Road as part of the NNP1 Project and will include the resulting impact to natural habitats and priority biodiversity values identified within this biodiversity assessment*

# 1 INTRODUCTION

## 1.1 PURPOSE OF THIS REPORT

The Asian Development Bank (ADB) has requested information on the biodiversity values of the Proposed Road for the Nam Ngiep Hydropower Project (NNP1). The purpose of this report is to provide an assessment of biodiversity values for the Proposed Road considering the ADB's Safeguard Policy Statement (SPS) and International Finance Corporation Performance Standard 6 guidance.

ERM understand that the ADB will consider this biodiversity assessment of the Proposed Road to determine if there will be impacts on critical habitat, and determine appropriate safeguard provisions to protect natural habitats and endangered species during construction of the road.

ERM have prepared the following assessment based on information collected from field survey subcontracted by ERM and field survey results made available by government agency, existing biodiversity reports relevant to the area, spatial data on the biodiversity values of the road corridor, assessment of an alternative route and advice from the ADB.

This report has been prepared to enable NNP1PC to progress construction of the Proposed Road during the 2013 dry season in Lao PDR. Overall, the report aims to:

- Develop an understanding of the biodiversity values of the site, focussing on the potential for priority biodiversity values;
- Further investigate the priority biodiversity values in terms of the critical habitat criteria defined by the International Finance Corporation;
- Assess the level of impact of the Proposed Road on the identified biodiversity values, priority and otherwise;
- Develop mitigation and management strategy to manage any potential significant impacts identified.

## 1.2 EXISTING REPORTS

This report has been prepared using information from the following key information sources:

- Environmental Research Institute (ERI) 2012 Environmental Impact Assessment – Nam Ngiep 1 Hydropower Project;
- ERM 2014 Biodiversity Baseline Assessment Nam Ngiep Hydropower Project; and
- Chapter 5 excerpt from Kansai IEE of the Whole Access Road: Updated Version – Nam Ngiep 1 Hydropower Project.



### 1.3

#### REFERENCE MATERIALS

ERM has used the following key reference materials when undertaking the revised EIA:

- Asian Development Bank Safeguard Policy Statement (January 2010);
- Asian Development Bank Environmental Safeguards A Good Practice Sourcebook – Draft Working Document (November 2012); and
- International Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources (January 2012), and guidance note;
- Summary notes of Environmental Safeguards of NNP meetings 22 August 2013, 21 October, 2013, 30 October 2013, 5 November 2013, 6 November 2013 and 16 November 2013.

### 1.4

#### PROJECT AREA

The Proposed Road is required to facilitate the transport of construction materials from outside the Project site such as cement, steel bars, gates, penstocks for metal work, turbines and generators for the power station and other equipment.

The route extends from Ban Nomsomboun to the proposed dam site, with a total length of approximately 58 km. The 'Proposed Road' collectively refers to the following components shown on *Figure 1.1*:

- Upgrade of an existing road from Ban Nomsomboun to Ban Hat Gniun through the Huay Ngua Provincial Preserved Area (PPA) (21.2 km);
- Upgrade of the existing JICA Road from Ban Hat Gniun to dam site (9.25 km);
- Construction of permanent roads, P1 and P2, from Ban Hat Gniun to the dam site (11.16 km);
- Construction of a network of temporary roads (numbered T1 to T13) from Ban Hat Gniun to the dam site (16.81 km);
- Bridges and culverts, at four locations; and
- Associated infrastructure including a worker's camp, batching plants and quarries.

In order to characterise the biodiversity values and assess the potential impacts to biodiversity values associated with the Proposed Road, information has been collated from a number of field surveys, available

literature, spatial data, species profiles and input from species specialists. For the purposes of this assessment the Project area is defined as the area potentially directly impacted by the construction and operation of the Proposed Road. This includes the temporary and permanent footprint of disturbance. A detailed description of the Proposed Road components is provided in *Annex A*. Varying road widths are described, usually dependant on the condition of the existing thoroughfare and amount of upgrade required. In order to facilitate this assessment, a standard road width of 9.5 metres (m) has been used. This approach allows for an approximate footprint to be described and biodiversity values that may be directly impacted identified, while considering the resolution of the spatial datasets. All area calculations for land cover and vegetation conditions should be considered upper estimates and have been derived for the purposes of identifying biodiversity values associated with the Project rather than detailed disturbance footprint areas. As described in the following sections, ground truthing has been undertaken for substantial sections of the Proposed Road which provides more accurate information in those sections and a broad indication of the accuracy of the spatial layers at the Project scale.

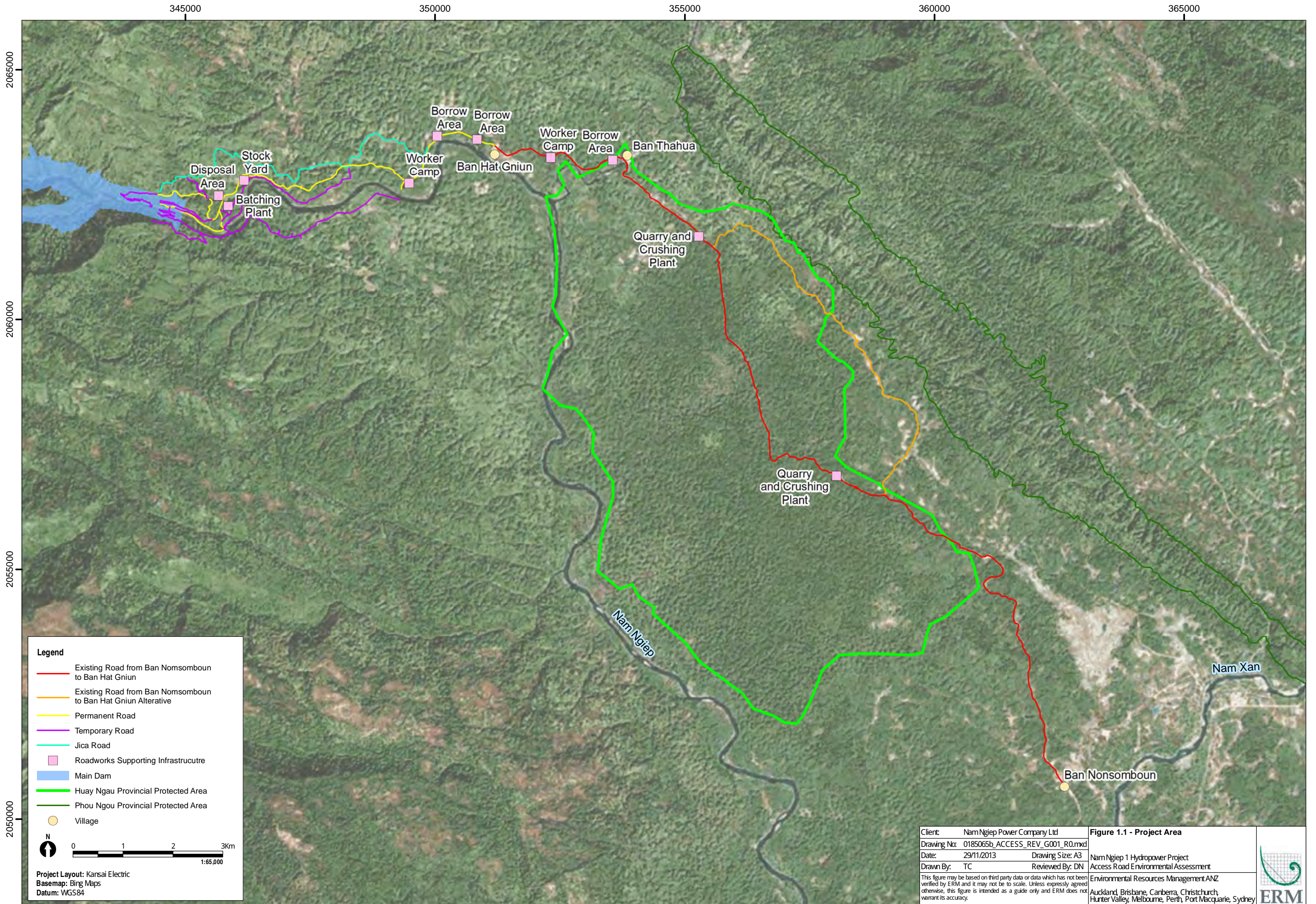
## 1.5 ASSESSMENT APPROACH

In accordance with the ADB sourcebook (Section V) the objectives of the biodiversity impact assessment are to identify and quantify the potential project impacts; design measures to avoid, minimise or mitigate potential adverse impacts; and identify likely residual impacts. To achieve this; a five step process was undertaken. This included:

- **Screening** to determine the biodiversity features that require studying (*Section 2*);
- **Scoping** to determine which direct and indirect biological impacts are likely to be significant in order to determine the focus issues of the impact assessment (*Section 3*);
- **Baseline Studies** to define the values of the habitats that will be affected on the Project area and in the area of influence (*Section 4*);
- **Impact Analysis** to assess impacts identified during scoping and baseline studies to determine the significance of the impacts (*Section 5*);
- **Mitigation Measures** are developed to avoid or reduce adverse impacts to biodiversity with a priority given to impacts on features with significant biodiversity values (*Section 6*); and
- **Biodiversity Offsets** are determined to compensate for unavoidable residual harm caused to biodiversity (*Section 6.4*).

The vegetation within the Project area and surrounds is described in terms of modified and natural habitats in accordance with the ADB sourcebook. Baseline surveys undertaken, desktop sources and consultation with species specialists provided information specific to IUCN Red List critically endangered and endangered species that are known or may occur within the Project area such that a determination of critical habitat status can be made.





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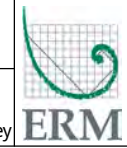
**Legend**

- Existing Road from Ban Nomsomboun to Ban Hat Gniun
- Existing Road from Ban Nomsomboun to Ban Hat Gniun Alternative
- Permanent Road
- Temporary Road
- Jica Road
- Roadworks Supporting Infrastructure
- Main Dam
- Huay Ngau Provincial Protected Area
- Phou Ngou Provincial Protected Area
- Village

1:65,000

Project Layout: Karsai Electric  
 Basemap: Bing Maps  
 Datum: WGS84

Client: Nam Ngiep Power Company Ltd	<b>Figure 1.1 - Project Area</b>
Drawing No: 0185065b_ACCESS_REV_G001_R0.mxd	Nam Ngiep 1 Hydropower Project Access Road Environmental Assessment
Date: 29/11/2013	
Drawn By: TC	Reviewed By: DN
<small>This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.</small>	
<small>Environmental Resources Management ANZ Auckland, Brisbane, Canberra, Christchurch, Hunter Valley, Melbourne, Perth, Port Macquarie, Sydney</small>	





## 2.1

*REGIONAL BIODIVERSITY VALUES*

Terrestrial ecoregions are natural ecological communities with shared species, dynamics and environmental conditions and offer a useful way of understanding the biodiversity within each area (ADB & UNEP, 2004). Central Lao PDR straddles two ecoregions; namely the Luang Prabang Montane Rainforest (Eco-region IM0121) and the Northern Annamites Rain Forests (Eco-region IM0136). Ecoregions are natural ecological communities with shared species, dynamics and environmental conditions and offer a useful way of understanding the biodiversity within each area (ADB & UNEP, 2004).

The Luang Prabang Montane Rainforests ecoregion comprises areas largely above 800 m in north-central Lao PDR. It is globally recognised for its diversity in bird species (some 540 different species of birds have been recorded) despite more than 70% of the original forest cover being lost as a result of shifting cultivation. The remaining forests contain a rich mix of tree and non-timber species including hardwoods, conifers, rhododendron, ferns, orchids and lichens (WWF, 2003b). No endemic species have been recorded in this eco-region but this is thought to be due to the lack of biological surveys conducted here (WWF, 2003b). Large tracts of untouched and inaccessible forest within the eco-region are known to shelter several large mammals, including tigers, Asian elephants, wild dogs, Himalayan (or Asiatic) black bears, Francois' leaf monkeys, and guars. Their continued existence is however under threat through habitat loss and hunting/ poaching (WWF, 2003b).

The Northern Annamites Rain Forest ecoregion runs along the border between Lao PDR and Vietnam, southwards from the southern edge of the Project area. The area is characterised by large areas of limestone karst topography; higher elevations produce cooler temperatures and distinct conditions for plant growth. It is globally recognised for its species diversity and in particular the number of new large or mid-sized mammals that have been (and still expected to be) discovered there in recent years. Of the 134 mammals known from the ecoregion, three are near endemic and four are endemic to the region. Each new survey reveals more new species of mammals, birds, fishes, reptiles, butterflies and plants. Vascular plant levels of endemism are high (WWF, 2003b).

The Annamites Rain Forest eco-region has also been categorised by the WWF as one of the Global 200 most important biogeographic regions, on the basis of its species richness, endemism and global rarity of the major habitat type. The Global 200 eco-regions represent the areas of highest conservation importance.

The Proposed Road passes through the Huay Ngua PPA in the Bolikhamxay Province. The Huay Ngua PPA (the PPA) was established in 2010 and is located to the east of the Nam Ngiep River between Borikham and Hat Kham. The preserved area is approximately 5,430 ha. There are five villages with a total population of 4,302 made up of Laoloum, Laosoung and Keummou ethnic groups. The groups are located in scattered settlements living near highland rice fields and rivers. The villagers use local terrestrial and aquatic biodiversity however dependence varies (Provincial Conservation Division, 2010).

The PPA is an important part of a wildlife corridor between PKK and along the Nam Ngiep River. The area is considered significant for aquatic and wildlife habitat (Provincial Conservation Division, 2010) as well as providing a research site of Province Agriculture and Forestry School. The PPA currently does not have any formal management arrangements in place to facilitate its management. A management committee under Central, Provisional or District levels of government has not been established. A Management Plan for the PPA has been prepared but it has not been implemented as no funding currently exists to pay for the management actions it contains. The priority actions to manage the PPA included in the plan are related to:

- raising community awareness to increase participation in sustainable uses;
- improving community livelihoods in and around the PPA to assist in management of natural resources;
- law enforcement and patrolling;
- biodiversity research and monitoring; and
- development of ecotourism opportunities.

The forest and wildlife is considered a high value resource with increasing demand in Lao PDR and neighbouring countries. The PPA is abundant in these resources. Some fauna species have been impacted by hunting and trapping for local and regional market and there is harvesting for rosewood and agar wood (*Aguilaria cassna*) (Provincial Conservation Division, 2010).

Forest resources have played an important role in the economics of the surrounding province contributing to almost 30% of the total province economy in 2000. Although production of forest products is important for the province, environmental values remain important and the forest is considered a place for production and collection of food for the rural population as well as a source of traditional medicine (Provincial Conservation Division, 2010).

The Huay Ngua PPA is currently being considered as one of the candidate offset sites for the NNP1 project.

## 2.3 *BASELINE BIODIVERSITY SURVEY*

### 2.3.1 *Overview*

The baseline biodiversity values of the Proposed Road have been determined using a number of information sources including:

- Flora and fauna survey within the Huay Ngua PPA;
- Desktop sources;
- Species expert consultation; and
- Detailed flora surveys of the road corridor.

These sources provide description of vegetation communities and habitats, and species that may occur in the Project area. The data collated for the purposes of this report can be categorised into two types:

*Direct:* Species recorded during biodiversity field surveys undertaken during the 2013 are considered direct counts. In general the location and details of this data has been recorded and a higher level of certainty can be inferred.

*Indirect:* Species reported from village surveys or within reports using a more regional study area are considered indirect records. These data sources provide a valuable understanding of the biodiversity of the locality and region however should be afforded further analysis or applicability considered. Data obtained from village surveys can contain errors in some instances, especially when considering identification of species with more challenging diagnostic features.

The reliability of the records has been considered throughout the report and the category of any species records are denoted throughout.

### 2.3.2 *Direct Biodiversity Data Sources*

*Thailand Institute of Scientific and Technological Research Biodiversity Survey (2013)*

As part of the NNP1 Project biodiversity baseline assessment field investigations were undertaken in four key areas in the region, one of which included habitat areas associated with the Proposed Road.

Field investigations were undertaken in March and July 2013 by the Thailand Institute of Scientific and Technological Research (TISTR) to collect data representative of wet and dry season biodiversity conditions. The TISTR team as a subcontractor to ERM were engaged to undertake survey design, field survey and deliver a field survey biodiversity report. This report has been used in the development of this impact assessment report.

Surveys were undertaken by teams targeting separate taxa: vegetation (team of 7 people), terrestrial wildlife (team of 6 people) and aquatic biota (team of 5 people). The locations of the survey sites associated with the Huay Ngua PPA and the Proposed Road are shown in *Figure 2.1*.

The surveys incorporated detailed assessments that included forest and vegetation cover survey and assessment, wildlife survey and assessment, and aquatic ecology survey and assessment.

#### Forest and Vegetation Survey

The forest survey team surveyed for species diversity along trails and in sampling plots. Unknown plants were collected and three duplicates of leaves with flowers or fruits for further analysis in the laboratory. Botanists recorded necessary information i.e. morphology, habit, colour of flowers and ecology, georeferenced location, and compiled photographic records.

Across the survey the sampling plots consisted of 3 types of temporary plots;

- A circular sample plot with a radius of 17.85 meters (or 0.1 ha);
- Square plots of 5x5 meters (25 square meters or 0.0025 ha); and
- Square plots of 2x2 meters (4 square meters or 0.0004 ha).

Analyses of the data collected included specialised laboratory investigations to establish identification of voucher specimens.

#### Terrestrial Fauna Survey

The terrestrial fauna survey aimed to describe the baseline wildlife diversity of the NNP1 Project area impact zones for the purposes of assessing the potential Project impacts to terrestrial wildlife. Survey and sampling work involved developing an inventory of wildlife species (amphibians, reptiles, birds, and mammals).

One survey station was located in Huay Ngua PPA. The inventory for each fauna group was collected through direct and indirect counts.

Direct counts were carried out to determine numbers of amphibians, reptiles, birds, and mammals by sightings during the field surveys at each survey station. Observations and records of animal signs such as tracks, nests, burrows, droppings, hair and feathers, were also recorded. Details of the techniques used for each group include:

- Amphibians and reptiles: species searches were undertaken in habitats such as under logs, rocks, bark as well as digging in the buttress of trees. At night, spotlighting was used to detect nocturnal species along rivers, around poundages, and within tree canopies.



- Birds: were directly observed using binoculars during day time. Some species of birds were identified using call identification during the morning or evening, when they are the most active. Birds were also caught using mist-nets under tree canopies or cross the creeks these were identified, photographed, and released.
- Mammals: were observed from their signs such as tracks, scats, scratches on trees, burrows, etc. small mammals, were captured using live-traps or Sherman's traps. Bats were surveyed at night using mist-net and harp traps placed under tree canopies or cross creeks. Some species of mammals were identified from local hunters.

For all wildlife species the habitats were recorded. In the case of unidentified individuals these were collected and preserved and later analysed at the laboratory in the Natural History Museum-Nation Science Museum, Prathum Thani, Thailand.

Indirect counts were used to obtain supplementary information on fauna by interviewing local residents who lived in or near by the area. Some local villagers may hunt animals for food or for sale. Local households as well as local markets were also sampled.

Relative abundance of wildlife was calculated from numbers obtained in the direct and indirect counts, species were assigned as abundant, common, and less common using a calculation formulated by Pettingil (1969).

#### Aquatic Biota Survey

Aquatic biota sampling was conducted at different locations in Nam Ngiep, Nam Xan, Huay Ngua PPA and the Houay Soup resettlement area. Two survey stations were located in the Nam Ngiep River associated with the Project area. Techniques included:

- collection of phytoplankton and zooplankton species using multiple plankton net surveys at each location, followed by preservation, identification and laboratory analysis at TISTR;
- collection of benthos at multiple replicate sites using an Ekman dredge, followed by identification and abundance counts at the TISTR laboratories; and;
- capture and identification of fish species within the main rivers and their tributaries using the help of local fishermen using multi-mesh gillnets, electrofishing, cast nets, gun and hook, as well as discussions with fishermen and other information sources.

### *Department of Forest Resource Management Road Corridor Flora Survey*

Specific to the proposed disturbance area for the road corridor two surveys have been undertaken to ground-truth flora species and delineate natural/modified habitat.

The Lao PDR Department of Forest Resource Management (DFRM) undertook a flora survey to record tree species adjacent to the existing road between Ban Nomsomboun and Ban Hat Gnium in August 2013 and results were provided to ERM Siam. This assessment was completed independent of the NNP1 assessment however the results assisted in understanding the local biodiversity values and have been considered in this report.

### *National University of Laos Ground-truth of Natural Habitat Survey*

Nam Ngiep 1 Power Company engaged Pheng Phengsintham, a local botanist and lecturer of the National University of Laos (NUL) to undertake a similar vegetation assessment along most of the Proposed Road in November 2013. The assessment aimed to identify areas of natural and modified habitat within the Proposed Road. Some stretches of temporary and permanent roads in the vicinity of the re-regulation dam were not able to be assessed. The assessment involved survey at 53 temporary sampling plots where the vegetation type and tree species were recorded each side of the Proposed Road. The temporary sample plots were set within the Proposed Road area with the ten closest trees recorded and measured. The outcomes of NUL assessment are provided in *Annex D*.

## **2.3.3 Indirect Biodiversity Data Sources**

### *Desktop Review*

Desktop review was undertaken to collate and assess other data sources. The desktop review included an assessment of:

- Online reports relating to the Project area and biodiversity of Lao PDR;
- Threatened species profiles and online species distribution information; and
- Published literature relating to threatened species and Lao PDR biodiversity.

Information collated through desktop review was used to provide additional background information relating to the biodiversity values associated with the PPA and potentially the Project area. Specific to the PPA, species identified within the Houy Ngua Provincial Preserved Area Management Plan (MP) 2011-2015 by the Provincial Agriculture and Forestry Office of Bolikhamxay (PAFO) (December 2010) have been considered to have potential to occur in the Project area (indirect data). The management plan reports species based on some field survey and village interview results.

## Geospatial Analysis

Geospatial analysis was undertaken to assist in understanding the biodiversity values in the Project area. Primarily this was based on interpretation of a variety of spatial layers provided by DFRM and Rapideye Imagery.

In order to further understand the biodiversity values represented within the Project area, remote sensing analysis was undertaken to map the variation in vegetation condition. Rapideye Imagery was used to identify the normalised difference vegetation index (NDVI) across the Project area. NDVI is a remote sensing indicator that provides a measure of vegetation density and condition by indicating the photosynthetic capacity of the land surface cover.

The imagery outputs provide a NDVI in grid formation (5m x 5m) across the Project area. For the Project condition classes (for a range of NDVI) were defined and applied to each forest type. The condition classes are shown in *Table 2-1*. These condition classes we used to refine land cover calculations. Area within the Impacted NDVI range were removed from habitat area calculations.

**Table 2.1** *Condition Class NDVI Range*

Condition	NDVI Range
Benchmark	0.8 to 1.0
High	0.6 to 0.8
Moderate	0.4 to 0.6
Low	0 to 0.4
Impacted	-ve to 0

### Limitations and Benefits

For this Project NDVI has been used as a remote sensing tool to indicate vegetation condition. As with all remote sensing techniques there are limitations associated and all information has not been ground-truthed. The outcomes of this assessment should be interpreted on a regional scale and note that the data is based on image capture at one specific time. Similarly, as discussed NDVI is an indicator of photosynthetic capacity of the surface and does not distinguish between vegetation communities.

The inherent benefit of utilising NDVI relates to the remote sensing accessibility of information from areas that may be difficult to access on the ground or when considering larger areas for a local and regional context. The index allows for comparison of vegetation photosynthetic capacity along the length of the corridor in the context of the surrounding landscape.

The NDVI and land cover calculations are based on 5 metre square pixels. The RapidEye satellite imagery provided was at 5 metre square pixels and this

same level of accuracy was used in generating the NDVI and land cover calculations presented in this report.

#### *Species Specialist Consultation*

In addition to desktop sources, a number of species specialists were consulted to assist in developing an understanding of the importance of the Project area for the critical habitat candidate species. Each specialist contacted provided advice via email response to queries clearly identified as related to this Project. The specialists that provided advice are listed in *Annex D* and advice is referenced as appropriate.

Key input was provided by Dr J.W Duckworth and Dr M Kottelat. Comments was provided on some species texts however it is acknowledged that the final content remains the responsibility of the report compilers.

#### *Social and Cultural Surveys*

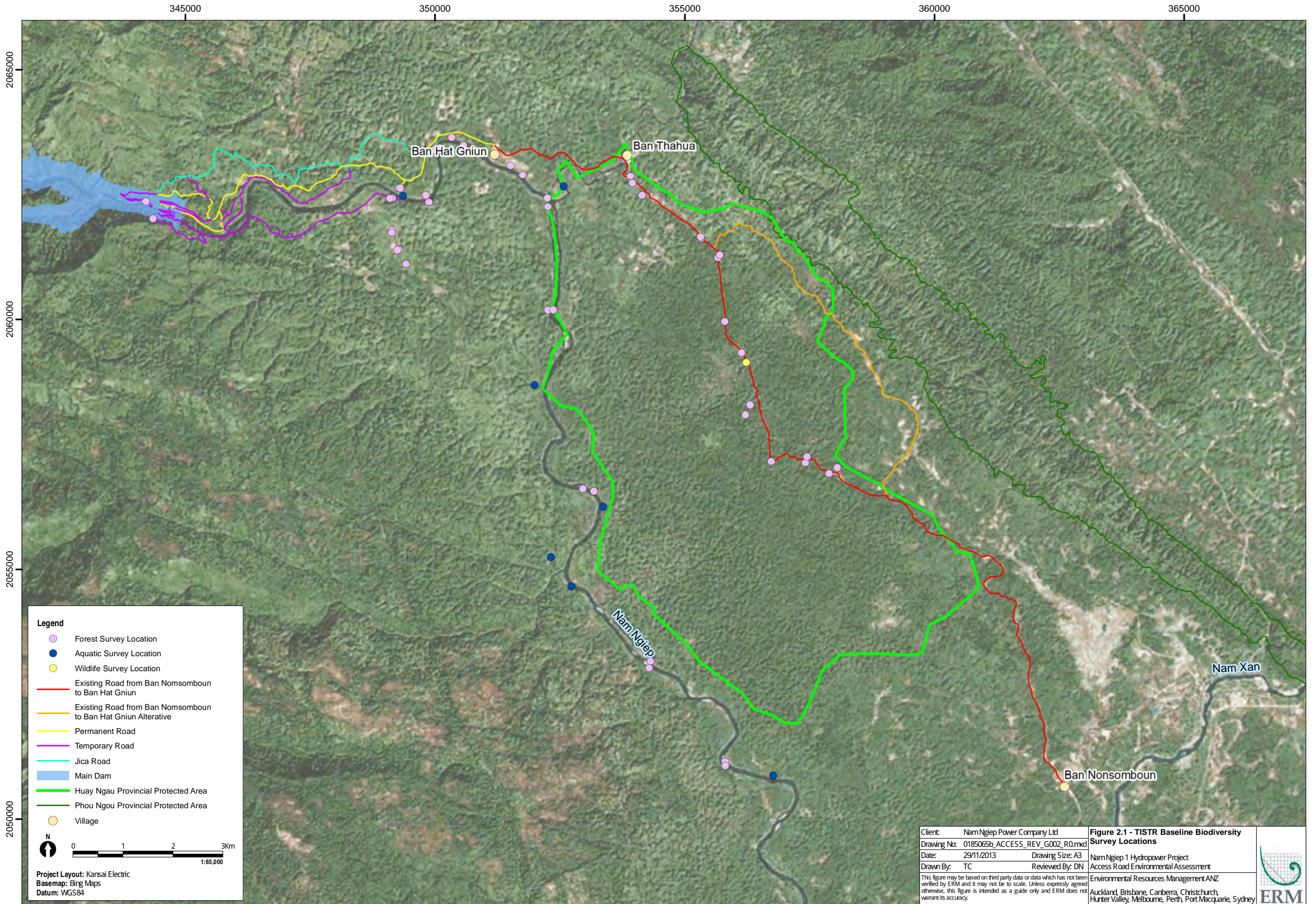
An assessment of the ecosystem services was undertaken to supplement the biodiversity surveys completed for the Project. Two visits to the region were undertaken.

The first visit was conducted in February and March 2013 involving engagement with key government and non-government officials to understand current land use and tenure as well as threats to biodiversity in the Nam Ngiep catchment. Village and market surveys were also undertaken to gather data on the utilisation of ecosystem services by project affected people, including the use of threatened flora and fauna. Village surveys included focus group discussions and in-depth interviews as well as visual market surveys and information discussions.

The second field visit was conducted in July 2013 and focussed on village and market surveys.

Further detail specific to the stakeholder engagement is provided in *Annex B*. The results have been used to assist in identifying threatened species that may occur associated with the Project area.





**Legend**

- Forest Survey Location
- Aquatic Survey Location
- Wildlife Survey Location
- Existing Road from Ban Nomsomboun to Ban Hat Gniun
- Existing Road from Ban Nomsomboun to Ban Hat Gniun Alternative
- Permanent Road
- Temporary Road
- Jica Road
- Main Dam
- Huay Ngau Provincial Protected Area
- Phou Ngou Provincial Protected Area
- Village

N  
 0 1 2 3km  
 1:65,000

Project Layout: Karsai Electric  
 Basemap: Bing Maps  
 Datum: WGS84

Client: Nam Ngiep Power Company Ltd	<b>Figure 2.1 - TISTR Baseline Biodiversity Survey Locations</b>
Drawing No: 0185065b_ACCESS_REV_G002_R0.mxd	Nam Ngiep 1 Hydropower Project
Date: 29/11/2013	Access Road Environmental Assessment
Drawn By: TC	Reviewed By: DN
<small>This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.</small>	
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### 3 SCOPING OF PROJECT IMPACTS ON BIODIVERSITY VALUES

#### 3.1 BACKGROUND

This Section documents the scoping of potential project impacts on biodiversity values in accordance with the requirements of IFC PS6. It considers:

- type of activities; including the nature of the Project impacts based on the Project lifecycle (pre-construction and construction of project facilities, and operation activities);
- impacts and threats to biodiversity values (in terms of *direct* or *indirect* impacts); and
- spatial extent of the impacts (area and condition of habitats); and
- permanence of the impacts (temporal nature of impacts or cumulative impacts).

#### 3.2 SCOPING

##### 3.2.1 *Project Activities*

The main activities associated with the upgrade of the existing road include:

- UXO clearance for any footprint;
- Land clearing for road construction;
- Excavation including land levelling required for the footprint;
- Transport of materials;
- Operation of large machinery;
- In-stream construction activities for waterway crossings;
- Interruption of river and tributary flows for infrastructure construction; and
- Storage of hazardous materials and refuelling.

The main activities associated with the operation of the Proposed Road are mainly associated with vehicle movements along the route.

##### 3.2.2 *Nature of Impacts*

*Table 3-1* summarises the nature of impacts to biodiversity values related to the activities. These terms are used in the scoping of project impacts on biodiversity values and relate to the identified threats from the activities.

**Table 3.1** *Nature of impacts on biodiversity values*

<b>Term</b>	<b>Description</b>
Direct Impacts	Direct physical displacement or impact from the Project on a species' habitat or lifecycle.
Indirect Impacts	A secondary impact resulting from a direct impact from the Project on a species' habitat or lifecycle.
Spatial Impacts	Impacts on species' habitats or lifecycle including: isolation of populations or individuals; impacts on species endemism; impacts on the heterogeneity of species; environmental gradients; edaphic interfaces (derived from soil toils); connectivity between habitats and climate change adaptation importance.
Temporal Impacts	<ul style="list-style-type: none"> <li>• Temporary Impact means a reversible impact on a species' habitat or lifecycle; and</li> <li>• Permanent Impact means an irreversible impact on a species' habitat or lifecycle.</li> </ul>
Cumulative Impacts	Impacts from the total of all impacts on a species' habitat or lifecycle.

### 3.2.3 *Threats to Biodiversity Values*

Table 3-2 defines the threats to biodiversity values related to the activities. These threats to biodiversity are derived from IFC 6 and relate to the activities that are likely to occur during Project construction and post construction phases.

**Table 3.2** *Threats to biodiversity values*

<b>Term</b>	<b>Description</b>
Permanent Loss	Permanent loss of habitat or species due to permanent or temporary site activities for the Project
Disturbance and displacement	Disturbance to, or displacement/exclusion of a species from foraging habitat due to construction and operational activities.
Barrier creation	Creation of barriers to the movements of animals with limited powers of dispersal.
Fragmentation	Fragmentation of habitat, or permanent /temporary severance of wildlife corridors between isolated habitats of importance for biodiversity.
Edge Effects	Disturbance or damage to adjacent habitat and species caused by movement of vehicles and personnel, potential mobilisation of sediment, artificial lighting, dust, spillage of fuels and chemicals, emissions and noise, and subsidence.
Alteration of Flow Regime	Effects on habitats caused by alterations to natural flow regime.
Light Impacts	Effects on species caused by alterations in night time light conditions.
Alien Species	Introduction or spreading of alien species during the construction works.
Pollution	Contamination of the environment that has a direct or indirect impact on a species either through exposure to harmful substances.
Mortality	Mortality of individual fauna species as a result of vehicle or machinery strike or falling debris during clearing activities.

## 4 BASELINE BIODIVERSITY VALUES OF THE PROJECT AREA

### 4.1 OVERVIEW

The following Section summarises the key biodiversity values identified from the desktop review, the TISTR (2013) study, and geospatial analysis. Where appropriate the values are quantified or discussed in terms of the Project area (disturbance footprint) however the biodiversity values of the surrounds are also considered.

### 4.2 TERRESTRIAL BIODIVERSITY VALUES

The terrestrial biodiversity values have been described using a combination of desktop based information sources (for example literature, databases, and species profiles), field collected data (2013 TISTR study) and geospatial analysis (including forest mapping and vegetation condition analysis).

#### 4.2.1 *Vegetation*

##### *Land Cover*

The Lao landscape has historically been dominated by dense forest and, despite more recent clearance, retains significantly more forest coverage than neighbouring countries Thailand, Vietnam and China (Yunnan Province) (Duckworth *et al.*, 1999). The original forests of the Northern-Central Highlands, where the Project area is located, were predominantly dry evergreen and mixed deciduous forests. However, shifting cultivation has removed much of the original forest and large areas of grassland, bamboo and other secondary vegetation are now present. Non-timber forest products (NTFPs) such as leaves, shoots, flowers, fruits and bark are used extensively by the Lao people and are of great importance both as a food source and also medicinally and culturally.

Land cover type mapping based on DFRM 2010 forest mapping identifies the dominant forest types within the Project area to be deciduous forest with smaller proportions of old fallow land. The land cover types mapped within the Project area are presented in *Table 4-1*, based on the 9.5 m wide road, and shown in *Figure 4.1*.



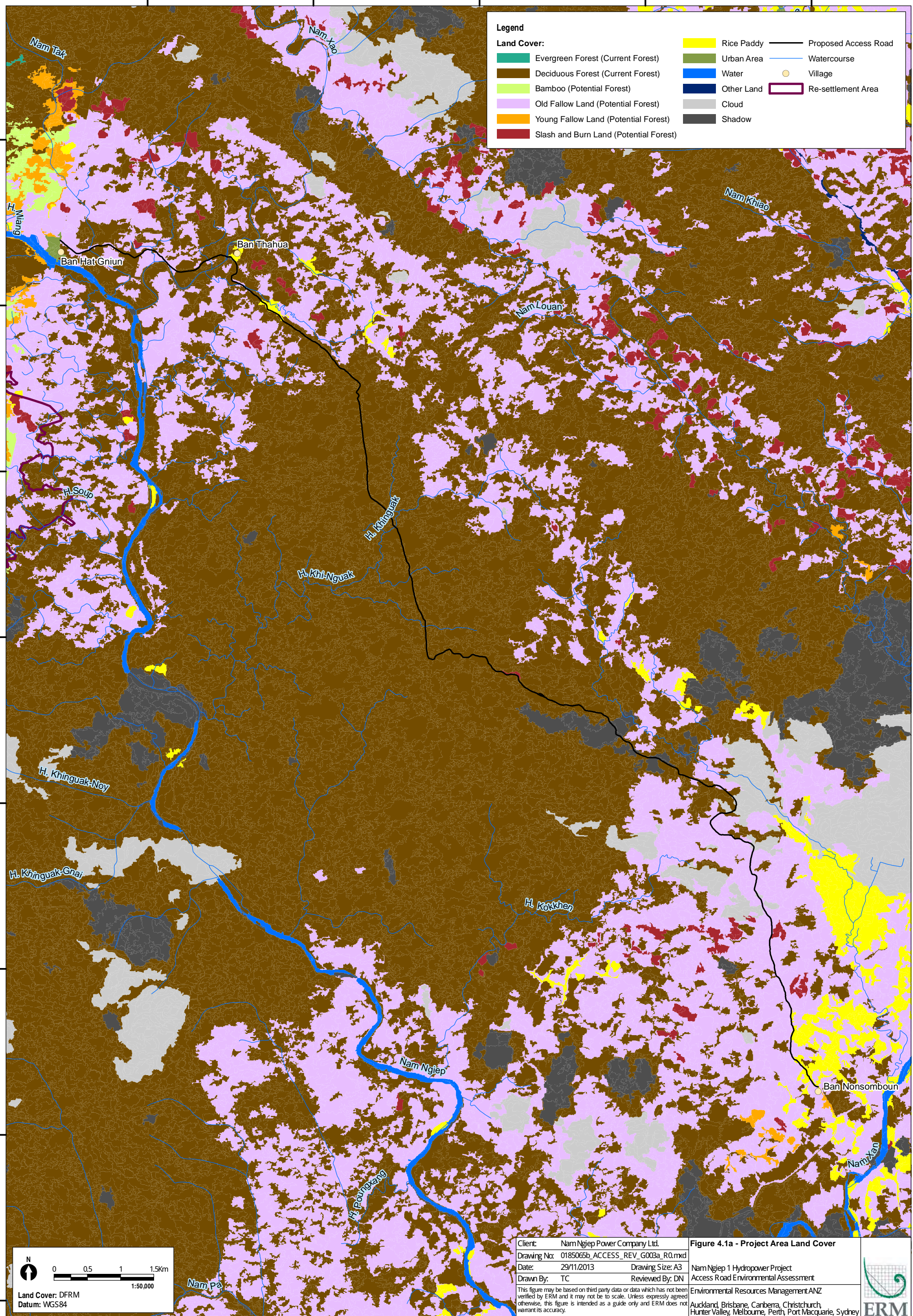
**Table 4.1 Land cover types within the Project Area**

Type (code)	Description	Total within Project area (ha)
<b>Natural Habitat</b>		
Deciduous forest (DF)	Deciduous forest occurs when deciduous tree species represent more than 50% of the stand. The forest storeys are not as dense as those of evergreen type. Most often bamboo occurs in this type of forest. Deciduous Forest includes both Upper and Lower deciduous forest types and this definition is based on relative altitude, forest occurring above 200 m is classified as Upper Mixed deciduous Forest and deciduous forest occurring at an altitude 200 m and below is classified as Lower Deciduous Forest.	19
Evergreen forest (EF)	Area dominated by trees where 75% or more of the tree species maintain their leaves all year. Canopy is never without green foliage.	2
Bamboo (B)	Bamboo area where the over storey has a crown cover less than 5%.	7
<b>Modified Habitat</b>		
Old fallow land (OFL)	Land that has been ploughed and tilled and left un-seeded during a growing season.	12
Young fallow land (YFL)	Land that has been recently ploughed and tilled and left un-seeded during a growing season.	5
Rice paddy (RP)	Areas permanently being used for rice cultivation.	1
Slash and burn (SB)	Slash-and-burn is a description of land that has been subjected to an agricultural technique which involves cutting and burning of forests or woodlands to create fields.	1
Urban (U)	Urban Areas include all areas being used for permanent settlements such as villages, towns, public gardens etc. It also includes roads having a width of more than 5 m and areas under electric high power lines. Any type of land under high power lines, except Rice Paddy, should be classified as Urban Areas.	<1
<b>Unclassified</b>		
Water (W)	The land cover class Water includes rivers, water reservoirs (i.e. ponds and dams for irrigation and hydro power) and lakes. Water reservoirs and lakes with an area of 0.5 ha and rivers should be at least 10m wide to be classified as Water.	<1
Shadow*	Shadow indicates limitations in the dataset from shadows and cloud contained in the aerial imagery.	1
Cloud*	Cloud indicates limitations in the dataset from shadows and cloud contained in the aerial imagery.	<1



352500 355000 357500 360000 362500

2065000  
2062500  
2060000  
2057500  
2055000  
2052500  
2050000  
2047500



**Legend**

**Land Cover:**

- Evergreen Forest (Current Forest)
- Deciduous Forest (Current Forest)
- Bamboo (Potential Forest)
- Old Fallow Land (Potential Forest)
- Young Fallow Land (Potential Forest)
- Slash and Burn Land (Potential Forest)
- Rice Paddy
- Urban Area
- Water
- Other Land
- Cloud
- Shadow
- Proposed Access Road
- Watercourse
- Village
- Re-settlement Area

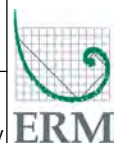
N

0 0.5 1 1.5km

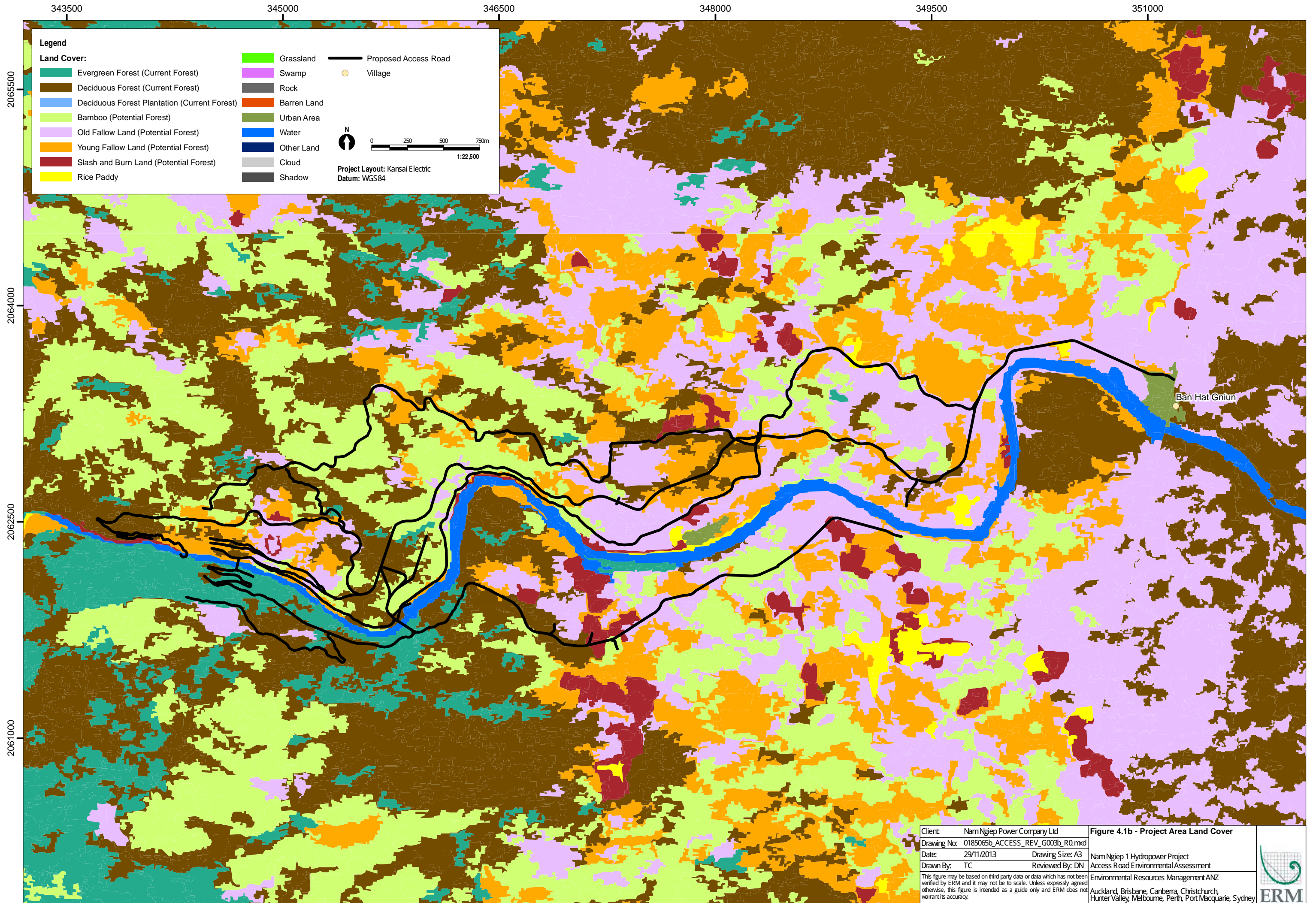
1:50,000


Land Cover: DFRM  
Datum: WGS84

Client: Nam Ngiep Power Company Ltd.	<b>Figure 4.1a - Project Area Land Cover</b>
Drawing No: 0185065b_ACCESS_REV_G003a_R0.mxd	Nam Ngiep 1 Hydropower Project
Date: 29/11/2013	Access Road Environmental Assessment
Drawn By: TC	Reviewed By: DN
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Client:	Nam Ngiep Power Company Ltd	<b>Figure 4.1b - Project Area Land Cover</b>	
Drawing No:	0185065b_ACCESS_REV_G003b_R0.mxd		
Date:	29/11/2013	Nam Ngiep 1 Hydropower Project Access Road Environmental Assessment Environmental Resources Management ANZ Auckland, Brisbane, Canberra, Christchurch, Hunter Valley, Melbourne, Perth, Port Macquarie, Sydney	
Drawn By:	TC		
	Reviewed By: DN		
<small>This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.</small>			

### Vegetation Condition

Vegetation condition based on the NDVI data within the Project area is divided into four categories. The representation of these categories within the Project area is summarised in *Table 4-2* and *Table 4-3* and shown *Figure 4.2*.

The area of high condition with potential to be impacted is approximately 8 ha, of which most of the area is located between Ban Hat Gniun and the dam site. The area of high condition vegetation in the route through the PPA (Ban Nomsomboun to Ban Hat Gniun) is less than 1 ha.

**Table 4.2** *Vegetation Condition in the Project Area*

Condition Category (NDVI range)	Area within Project area (ha)	% within Project area
Impacted (- to 0)	1	2%
Low (0 to 0.4)	16	33%
Moderate (0.4 to 0.6)	24	49%
High (0.6 to 0.8)	8	16%

**Table 4.3** *Vegetation Condition – Proposed Road Component Breakdown*

	Ban Nomsomboun – Ban Hat Gniun (ha)	JICA Road (ha)	Permanent Roads Ban Hat Gniun – Dam Site (ha)	Temp Roads Ban Hat Gniun – Dam Site (ha)
Impacted (- to 0)	<1	<1	<1	<1
Low (0 - 0.4)	11	2	1	2
Moderate (0.4 - 0.6)	6	4	6	8
High (0.6 - 0.8)	<1	<1	3	5

### Ground-truthed Vegetation Communities/Habitat

The corridor flora survey ground-truthed the land cover mapping to confirm the presence of natural or modified habitat in accessible areas of the proposed access roads. *Table 4-4* below summarises the habitat description for segments of the access road, as provided in the draft field report from the corridor flora survey (Phengsintham 2013).

**Table 4.4** *Vegetation descriptions from road corridor flora survey (Phengsintham 2013)*

Road Segment	Vegetation Description
Ban Nomsomboun to Huay Ngua PPA (km 0+000 to km 5+720)	Primarily modified habitat on left and right sides, except TSP no5 on the left hand side, where regeneration forest occurs across for approximately 500 m of the access road.

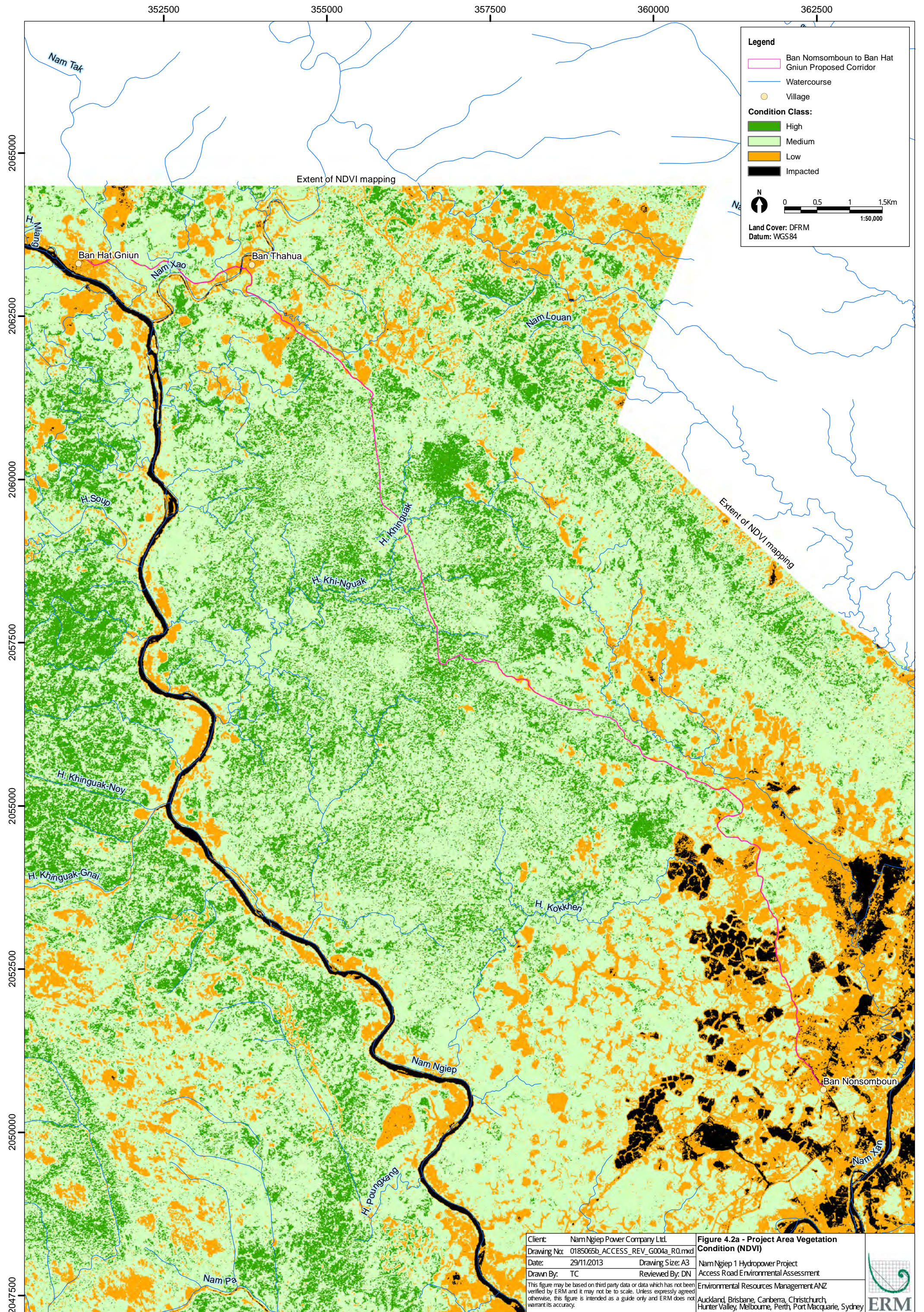


Road Segment		Vegetation Description
Inside Nguua PPA	Huay	<p>Huay Nguua PPA primarily consisted of lower mixed deciduous forest (LMD). Within the corridor, the average DBH in LMD is 38 cm and average distance 9.3 m. In comparison, outside the corridor, the average DBH was 34.5 cm and the average distance 7.8m.</p> <p>A total of 114 Mai Yang Khao have previously been recorded. 21 items were cleared by the EDL (pole installation), 29 exist within the road corridor; and the remaining will be preserved by NNP1PC and PAFO.</p> <p>Removal of Mai Yang Khao could be replaced by replanting the species inside the PPA, supporting the provincial office to improve Huay Nguua PPA through reforestation and providing a check point during road construction.</p>
JICA road (km 22+000 to dam site at km 31+320)		<p>JICA road passes through Ban Hat Gnuin and Hatsaykham villages.</p> <p>The sections is primarily modified forest, except two points (TSP no35 and no40), which are small patches of UMD. The Average DBH 43 cm and average distance 7.08 m for TSP no35.</p> <p>This vegetation type represented the dense vegetation (UMD) at the site, but the forest was disturbed by historical logging activities, shifting cultivation (ray) and other agricultural activities.</p>
P2 and T12		<p>Three TSPs were established. The area between ICA road and TSP no43 was primarily Fallow Forest. Between TSP no43 and TSP no45 vegetation was primarily disturbed UMD to the right of the road, and Fallow Forest to the left of the road.</p> <p>This vegetation represented the highest quality dense vegetation, however the forest was disturbed by historical logging activities, shifting cultivation (ray) and fired in May 2013.</p>
T7, T8 and T9 Access Road		<p>Eight TSPs were surveyed in these access roads. The area included young fallow forest, plantation area and mixed deciduous forest. The average DBH in UMD was 44.8 cm and the average distance 9.48m. In comparison, outside the corridor the average DBH was 28 cm and distance about 6.36m.</p>

Source: direct summary of Draft Land Use Study prepared by Pheng Phengsintham (Local botanist and Lecturer of the National University of Laos) (November 2013).

Ground-truthing results for the Ban Nomsomboun to Ban Hat Gnuin section of the proposed road identified substantially less natural habitat (47% natural habitat) than detected in land cover mapping (61% natural habitat). Similarly, ground-truthing of the JICA Road results (11% natural habitat) were less than indicated on land cover mapping (22% natural habitat).





Client: Nam Ngiep Power Company Ltd.  
 Drawing No: 0185065b\_ACCESS\_REV\_G004a\_R0.mxd  
 Date: 29/11/2013 Drawing Size: A3  
 Drawn By: TC Reviewed By: DN

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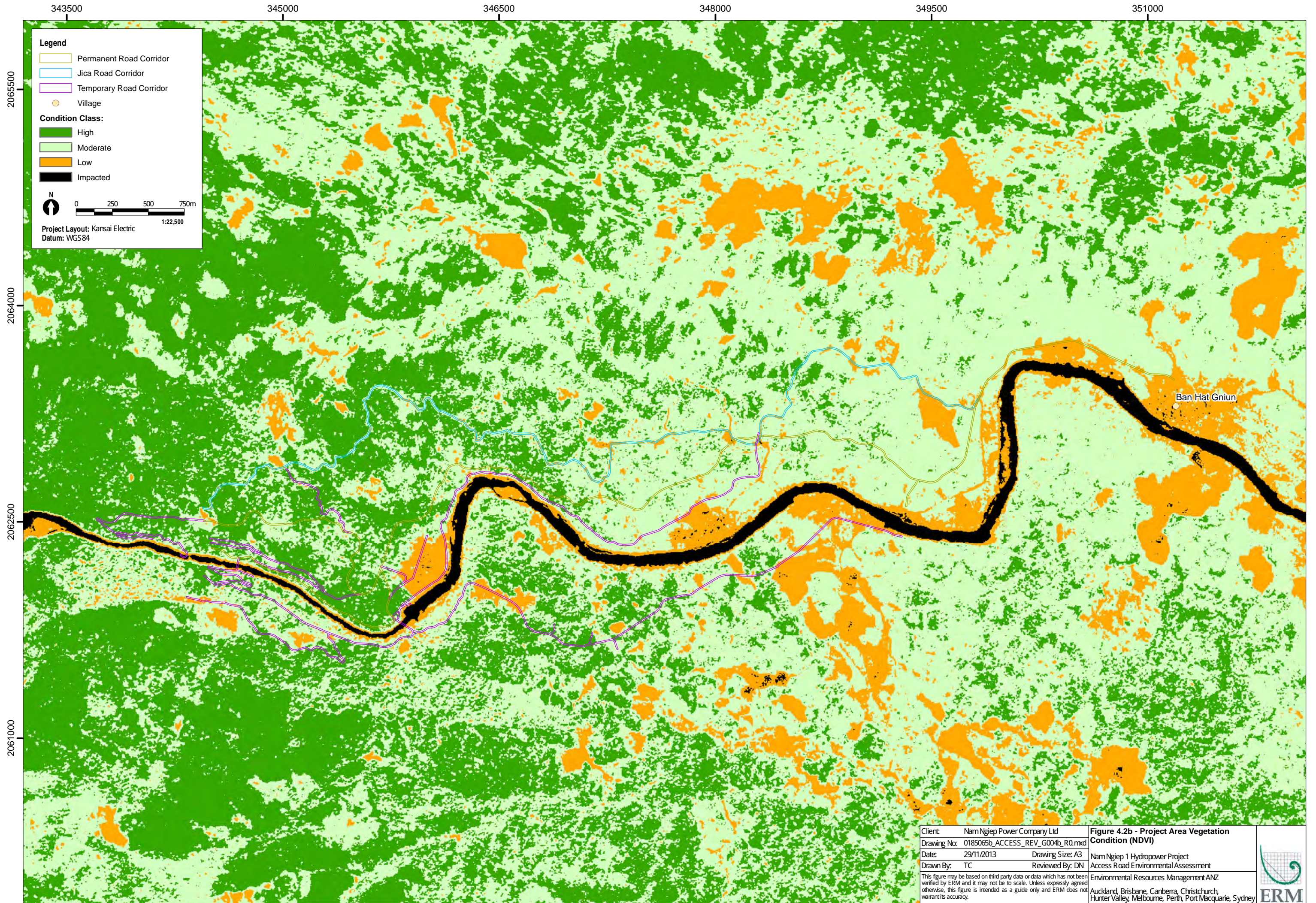
**Figure 4.2a - Project Area Vegetation Condition (NDVI)**

Nam Ngiep 1 Hydropower Project  
 Access Road Environmental Assessment

Environmental Resources Management ANZ  
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 Hunter Valley, Melbourne, Perth, Port Macquarie, Sydney







**Legend**

- Permanent Road Corridor
- Jica Road Corridor
- Temporary Road Corridor
- Village

**Condition Class:**

- High
- Moderate
- Low
- Impacted

N

0 250 500 750m

1:22,500

Project Layout: Karsai Electric  
Datum: WGS84

Client:	Nam Ngiep Power Company Ltd	<b>Figure 4.2b - Project Area Vegetation Condition (NDVI)</b>
Drawing No:	0185065b_ACCESS_REV_G004b_R0.mxd	
Date:	29/11/2013	Nam Ngiep 1 Hydropower Project Access Road Environmental Assessment
Drawn By:	TC	
	Reviewed By: DN	Environmental Resources Management ANZ
<small>This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.</small>		<small>Auckland, Brisbane, Canberra, Christchurch, Hunter Valley, Melbourne, Perth, Port Macquarie, Sydney</small>





## 4.2.2

### *Flora Species*

The climatic conditions (low temperature, high humidity and high winds) have led to dense growth of several plant species such as rosewood, mai kebe, mai ngang (*Dipterocarpus alatus*), maid tae (*Sindora cochinchinensis*), mai peuy (*Lagerstroemia calyculata*, *Lagerstroemia floribunda*) and mai bark (*Anisoptera costata*) (Provincial Conservation Division, 2010).

Sampling undertaken during 2013 surveys by TISTR recorded 451 species of vascular plants in the Huay Ngua PPA sampling locations. Vegetation is dominated by mixed deciduous forest with some areas of mixed evergreen forest and secondary growth of mixed deciduous forest. Canopy cover is approximately 60-70 per cent. The forest canopies are divided in 3 classes. The dominant species recorded by TISTR in each canopy strata are summarised in *Table 4-5* and a flora species list is provided in *Annex F*.

**Table 4.5** *Dominant Flora Species in Huay Ngua PPA*

Canopy class	Dominant species
Top canopy (20-35m)	<i>Anisoptera costata</i> , <i>Lagerstroemia calyculata</i> , <i>Shorea roxburghii</i> , <i>Iringia malayana</i> , <i>Alstonia glaucescens</i> , <i>Schima wallichii</i> , <i>Vitex pinnata</i> , <i>Stereospermum fimbriatum</i>
Middle canopy (10-20m)	<i>Acronychia pedunculata</i> , <i>Peltophorum dasyrachis</i> , <i>Nauclea orientalis</i> , <i>Microcos tomentosa</i> , <i>Mallotus paniculatus</i> , <i>Gonocaryum lobbianum</i> , <i>Cratoxylum formosum</i>
Lower canopy (<10m)	<i>Croton cascarillicdes</i> , <i>Breynia glauca</i> , <i>Ardisia helferiana</i> , <i>Glycosmis pentaphylla</i> , <i>Melicope pteleifolia</i> , <i>Allophylus cobbe</i> , <i>Salacia chinensis</i>

The botanical inventory collected within the disturbance footprint by NUL identified 139 species of vascular plants (Phengsintham 2013) that included one Bryophyta species, nine Pteridophyta species, 102 Dicotyledones species, 25 monocotyledons species and three mushroom species.

#### *IUCN Listed Species*

A total of 12 plant species listed under the IUCN Red List were recorded during vegetation surveys in Huay Ngua PPA in 2013 by TISTR, during DFRM road corridor survey and the NUL vegetation ground-truthing survey. The IUCN listed species are shown in *Table 4-6* and include:

- one species listed as critically endangered;
- six species listed as endangered; and
- five species listed as vulnerable.



**Table 4.6 IUCN Listed Flora Species Reported**

Scientific Names	IUCN Status	TISTR (PPA)	DFRM (Road)	NUL (Road)
<i>Dipterocarpus turbinatus</i>	CR	✓		
<i>Afzelia xylocarpa</i>	EN	✓		
<i>Anisoptera costata</i>	EN	✓	✓	✓
<i>Dalbergia oliveri</i>	EN	✓		
<i>Dipterocarpus alatus</i>	EN	✓	✓	✓
<i>Shorea roxburghii</i>	EN	✓		
<i>Vatica cinerea</i>	EN		✓	
<i>Cycas pectinata</i>	VU	✓		
<i>Dalbergia cochinchinensis</i>	VU	✓		
<i>Hopea odorata</i>	VU	✓		
<i>Syzygium vestitum</i>	VU	✓		
<i>Ternstroemia wallichian</i>	VU	✓		

Mai yang khao (*Dipterocarpus turbinatus*) and mai bak (*Anisoptera costata*), the IUCN species detected within the disturbance area by NUL are economic trees and can be used for house construction (Phengsintham 2013). The DFRM corridor survey identified 159 *Dipterocarpus turbinatus* stems and 254 *Anisoptera costata* stems in the Proposed Road and surrounds (DFRM, 2013). The more detailed survey by NUL of the defined Proposed Road alignment confirmed 29 stems to be disturbed.

#### 4.2.3 Fauna Species

A total of 38 terrestrial species of fauna from 19 families, and 31 genera were recorded from the field surveys in 2013 surveys in Huay Ngua PPA by TISTR. Species diversity of animals recorded in this area was low in comparison to other areas surveyed nearby however this is expected to be due to the lack of secondary data, all records were obtained by direct observation during the field surveys.

Common fish species detected in the Nam Xan River during surveys in 2013 by TISTR included Spiny barb (*Mystacoleucus marginatus*), Sikuk barb (*Sikukia gudgeri*), Horseface loach (*Acanthopsis choirorhynchos*), Long finn mystus (*Mystus singaringan*). Of these species the Sikuk barb and Long finn mystus are known full migrant species.

The Houy Ngua Provincial Preserved Area Management Plan reports (indirect data) fauna species occurring within the PPA to include wild pig, munjac, clouded leopard (*Pardofelis nebulosa*), civet, flying squirrel as well as Green peafowl (*Pavo muticus*), Hill myna (*Gracula religiosa*), Red junglefowl (*Gallus gallus*) and the Siamese fireback (*Lophura diardi*).

Overall, the TISTR surveys and indirect data reported:

- Nine amphibian species;

- Fifty-nine bird species;
- Twenty-seven mammal species;
- Nine reptile species; as well as
- Thirty-nine fish species (including five species considered to be migratory).

*Annex G* provides the full species list.

#### *Restricted Species*

Species listed as Restricted under the Regulation of the Ministry of Agriculture and Forestry No. 0360/MAF includes wild animals and fish which are rare, endangered, high conservation value, and special significance to the economy and national environment.

The 2013 TISTR surveys (direct data) and indirect data sources identified the following species listed as Restricted in the Regulation of the Ministry of Agriculture and Forestry No. 0360/MAF:

- Two mammal species;
- Six bird species;
- One reptile;
- One fish;
- No amphibians.

**Table 4.7** *No. 0360/MAF Restricted Fauna Species Reported*

Common Name	Scientific Name	Direct Data	Indirect Data	No. 0360/MAF Status
<b>Mammals</b>				
Leopard	<i>Panthera pardus</i>		✓	Restricted
Asiatic golden cat	<i>Pardofelis temminckii</i>		✓	Restricted
<b>Birds</b>				
Greater hornbill	<i>Buceros bicornis</i>		✓	Restricted
Greater coucal	<i>Centropus sinensis</i>	✓	✓	Restricted
Siamese fireback	<i>Lophura diardi</i>		✓	Restricted
Silver pheasant	<i>Lophura nycthemera</i>		✓	Restricted
Grey peacock-pheasant	<i>Polyplectron bicalcaratum</i>		✓	Restricted
Red-breasted parakeet	<i>Psittacula alexandri</i>	✓	✓	Restricted
<b>Reptiles</b>				
Reticulated python	<i>Broghammerus reticulatus</i>		✓	Restricted
<b>Fish</b>				
	<i>Wallago leeri</i>		✓	Restricted

## IUCN Listed Species

Three IUCN Red Listed critically endangered, endangered or vulnerable fauna species were recorded within the Huay Ngua PPA area during 2013 surveys by TISTR while PAFO surveys identified 16 species listed as critically endangered, endangered or vulnerable on the IUCN Red List that may occur within the Huay Ngua PPA.

**Table 4.8 IUCN Listed Fauna Species Reported**

Common Name	Scientific Name	Direct Data	Indirect Data	IUCN Status/No.060/MAF Status
<b>Mammals</b>				
Asian elephant	<i>Elephas maximus</i>		✓	EN
Fishing cat	<i>Prionailurus viverrinus</i>		✓	EN
Gaur	<i>Bos gaurus</i>		✓	VU
Malayan sun bear	<i>Helarctos malayanus</i>		✓	VU
Clouded leopard	<i>Neofelis nebulosa</i>		✓	VU
Sambar deer	<i>Rusa unicolor</i>			VU/R
Himalayan black bear	<i>Ursus thibetanus</i>		✓	VU/R
Large spotted civet	<i>Viverra megaspila</i>		✓	VU
<b>Birds</b>				
White-winged duck	<i>Cairina scutulata</i>		✓	EN
Green peafowl	<i>Pavo muticus</i>		✓	EN
Imperial eagle	<i>Aquila heliaca</i>		✓	VU
<b>Reptiles</b>				
Big-headed turtle	<i>Platysternon megacephalum</i>		✓	EN/R
Impressed tortoise	<i>Manouria impressa</i>		✓	VU
<b>Fish</b>				
Giant barb	<i>Catlocarpio siamensis</i>		✓	CR
Striped catfish	<i>Pangasianodon hypophthalmus</i>			EN
Thicklipped barb	<i>Probarbus labeamajor</i>		✓	EN
Bandan sharp-mouth barb	<i>Scaphognathops bandanensis</i>	✓		VU
Jaguar loach	<i>Yasuhikotakia splendida</i>	✓		VU
CR = Critically endangered, EN = Endangered, VU = Vulnerable				
No. 060/MAF Status: R - Restricted				

## 4.3

### *SOCIAL AND CULTURAL VALUES*

It is evident that villagers in the Project area regularly use local terrestrial and aquatic biodiversity – e.g. as a food source. However, the dependence on natural resources varies by village and is largely associated with accessibility. For example, remote villages tend to rely more heavily on medicinal plants as access to pharmaceuticals is limited.

The following section describes the uses and cultural values placed on (and/or associated with) biodiversity by local villagers in the broader NNP1 Project area. Much of the data is from village and market surveys undertaken by ERM in February and March 2013.

#### 4.3.1

##### *Hunting and Gathering*

Villagers, both Loas and Hmong people, hunt and gather. This is done primarily for household consumption. However, when surplus exists, it is sold within the village or neighbouring villages.

Although the norm is to consume the materials locally, there are a small number of species that are collected for sale. Access to markets from villages is limited due to poor road access, so external sales are to intermediaries who travel to the villages.

Hunting for small animals is common across all villages. Villagers rarely admitted to hunting larger animals as all were aware this is illegal. Bamboo traps are predominantly used for capturing squirrels and rats, though hunting dogs, firearms and knives are also reportedly used.

Hmong families tend to hunt together while lowland Laos hunt individually or in small groups of either men or women. Hunting activity is no longer a daily activity, and is only triggered when a change from chicken or fish is desired or a ceremony requires it (i.e. a wedding or Hmong New Year). Villagers will generally travel as far as the need to hunt and gather though based on survey data this is unlikely to be further than 3-5 kilometres from the village (i.e. walking distance).

Villagers have noted that availability of naturally occurring resources, especially forest animals and fish, has been declining in recent years.

#### 4.3.2

##### *Medicinal Plants and Materials*

Usage, and therefore dependence, appears to be predicated on access to health services – the easier the access to pharmaceuticals, the lower the usage of natural medicines. In the Project area, villages have indicated a preference for pharmaceuticals but said natural medicines were generally used in the first instance.



#### 4.3.3 *Timber Products*

Timber products are actively sourced from the forests by villagers and commercial operators. For instance the local villagers were observed sourcing and processing hardwood into planks near the proposed dam site.

#### 4.3.4 *Fishing*

When compared to hunting, fishing occurs on a more regular basis. This is largely because of the close proximity of villages to waterways.

Fishing may have been more important for income generation in earlier times though with greater availability of alternative protein sources and reported reduction in stock availability and size, villages have adapted.

Fish is generally caught only for household consumption, but it is also a common item used in inter-household exchange and transactions. Surplus fish tends to be sold at below market rates suggesting such transactions may more likely be part of a local gift economy rather than a commercial transaction. This being said, it was common to hear that small fish are eaten at home while big fish, when found, are sold.

The most common fishing method is with a cast weighted net, an item commonly seen in most houses. Larger nets are used during the rainy season to catch larger fish that swim up river from the Mekong River. At Hatsaykham, the survey team observed other methods such as scaring fish into a net hung across a short section of the river and gathering by hand. Other equipment observed in villages included lines, hooks and spear guns. Fishing takes place at established riverside sites at which small shelters are built.

#### 4.3.5 *Cultural Services*

Most of the villages surveyed in the Project area have been settled only relatively recently signalling a lesser dependence on cultural services provided within proximate ecosystems. While length of residence is not an exclusive factor in determining usage and dependence, the less time people have to form attachments to aspects of an ecosystem, the less significant these features are likely to be. Indeed the relatively new nature of the villages acts to sever any bonds that people may have with prehistoric features within the environment such as tangible objects (i.e. stone tools, brass or ceramic objects) and intangible knowledge (i.e. creation myths or site specific rituals). This is not to say that the cultural values villagers derive from the ecosystem are insignificant, it is to signal that what values they do use are likely severable and reproducible elsewhere.

Numerous locally collected polished stone tools have been found in the Project area indicating human occupation in the area occurred between 4,000 and 12,000 years ago. However, most of the existing villages were settled in the early-1980s and 1990s.

The most significant social, religious and cultural sites people were able to identify (during the surveys) in villages in the Project area were grave sites. Reflecting the severable nature of connections people have with grave sites, villagers indicated that the ancestor spirits associated with such grave sites are transferrable to a new location through the performance of a complex ceremony conducted by the village shaman (called a Yao in the surveyed villages).

Each of the Hmong villages visited in the lower reservoir zone had a shaman residing there. Each house has a small shrine that is used by the shaman for ceremonies. The shaman is essentially a conduit between the human and spirit worlds. Sickness among Hmong is believed to be the result of contact with evil spirits. At risk of overgeneralising, the shaman's role is to free a person's spirit (or soul) from the malevolence brought through this contact with spirit world. The shaman was identified in these villages as the person most dependent on the naturally occurring forest though little detail was able to be collected about the extent of this dependence. Naturally occurring bamboo is used by both Lao and Hmong to make an animist symbol that is hung above doorways to ward off evil spirits.

*Modified Habitat*

Modified habitat is altered natural habitat, often formed by the removal of native species for harvesting, land conversion and/or introduction of alien flora and fauna species (ADB, 2012).

Land cover mapping for the Project area identified a number of vegetated cover classes. The old fallow land, young fallow land, rice paddy, slash and urban classes are considered to be modified habitats. *Figure 4.1* shows the distribution of these modified land uses within the Project area.

*Natural Habitat*

Natural habitat is an environment where the biological communities are largely formed by native plant and animal species and where human activity has not modified the areas primary ecological functions (ADB, 2012).

Land cover mapping for the Project area identified a number of vegetation cover classes. The deciduous forest, evergreen forest and bamboo are considered to be natural habitats for the purposes of this assessment. *Figure 4.1* shows the distribution of the natural habitat land uses within the Project area.

*Critical Habitat*

Critical habitat is an area that has high biodiversity value. It includes:

- habitat required for the survival of critically endangered or endangered species;
- areas having special significance for endemic or restricted-range species;
- sites that are critical for the survival of migratory species;
- areas supporting globally significant concentrations or numbers of individuals of congregatory species;
- areas with unique assemblages of species or that are associated with key evolutionary processes or provide key ecosystem services; and
- areas having biodiversity of significant social, economic, or cultural importance to local communities.

For this Project, critical habitat criteria described in the IFC PS6 Guidance Note have been used to guide the determination of critical habitat for each candidate species. The criteria include:

- Criterion 1: Critically endangered and or endangered species (Tier 1 and Tier 2 sub-criteria for habitat for these species);

- Criterion 2: Endemic and/or restricted-range species (Tier 1 and Tier 2 sub-criteria for habitat for these species);
- Criterion 3: Migratory and/or congregatory species (Tier 1 and Tier 2 sub-criteria for habitat for these species);
- Criterion 4: Highly threatened and/or unique ecosystems;
- Criterion 5: Key evolutionary processes.

Assessment of the Project area has not identified any highly threatened and/or unique ecosystems, or key evolutionary processes. As such the assessment focusses on the relevance of Criterion 1-3. Each of the candidate species has been assessed for the critical habitat determination criteria 1-3 using direct and indirect data sources.

The species information was collated and analysed against the relevant critical habitat criteria (*Annex H*). A summary of the analysis is provided below. The summary includes an identification of the landcover types likely to be suitable habitat for the species, estimate of the extent of habitat within the direct impact area of the Project, and summary of the assessment.

The species screened against the determination criteria and quantitative thresholds include IUCN listed species, species listed as Restricted in the Regulation of the Ministry of Agriculture and Forestry No. 0360/MAF and species considered to be migratory.

Throughout the assessment it was identified that a number of species, although candidates according to the above criteria, are not native species to Lao PDR. Although the conservation status of these species is recognised globally, they are not necessarily considered priorities for conservation efforts outside their native distribution.



**Table 4.9 Candidate Species Critical Habitat Assessment Summary**

Species	Habitat Type Codes	Record		Record Location	Habitat within project area (ha)	Key Threats	Likely Critical Habitat in Project area	Assessment Outcome
		Criteria	Direct In-direct					
<b>Flora</b>								
<i>Azelia xylocarpa</i>	EF, DF	1	✓	Upper and lower Nam Ngiep, main dam inundation, re-regulation dam inundation, resettlement area, Huay Ngua PPA	21	Harvest for timber, medicinal, pulp	No	Specialists advice from Dr Pheng Phengsintham indicates that the species distribution in Lao PDR includes Vientiane capital, Phouhin Namno National Biodiversity Conservation Area (pers. comm. 7/12/2013). Given the distribution of known records it is considered unlikely that the Project area sustains >10 per cent of the global population (Tier 1), or, habitat of significant important or containing nationally important concentrations (Tier 2).
<i>Anisoptera costata</i>	EF, DF	1	✓	Huay Ngua PPA, lower Nam Xan, access road	21	Economic value, use in construction	NA	Not native to Lao PDR.
<i>Dalbergia oliveri</i>	EF, DF	1	✓	Upper Nam Ngiep, main dam inundation, re-regulation dam inundation, resettlement area, Huay Ngua PPA, upper Nam Xan	21		NA	Not native to Lao PDR.
<i>Dipterocarpus alatus</i>	EF, DF	1	✓	Upper and lower Nam Ngiep, Huay Ngua PPA, lower Nam Xan, access road	21	Habitat loss, harvest fur timber and resin use and medicinal	NA	Not native to Lao PDR.

Species	Habitat Type Codes	Criteria	Record		Record Location	Habitat within project area (ha)	Key Threats	Likely Critical Habitat in Project area	Assessment Outcome
			Direct	In-direct					
<i>Dipterocarpus turbinatus</i>	EF, DF	1	✓		Upper Nam Ngiep, main dam inundation, re-regulation dam inundation, Huay Ngua PPA, lower Nam Xan	21	Harvest for resin	No	This species has been noted within a number of the Project area survey locations and affords a distribution across a number of countries outside Lao PDR. Given the distribution of known records it is considered unlikely that the Project area sustains >10 per cent of the global population (Tier 1), or, habitat of significant important or containing nationally important concentrations (Tier 2).
<i>Shorea roxburghii</i> White meranti	EF, DF, B	1	✓		Upper and lower Nam Ngiep, resettlement area, Huay Ngua PPA, upper and lower Nam Xan	28		No	This species has been noted within a number of the Project area survey locations and affords a distribution across a number of countries outside Lao PDR. Given the distribution of known records it is considered unlikely that the Project area sustains >10 per cent of the global population (Tier 1), or, habitat of significant important or containing nationally important concentrations (Tier 2).
<i>Vatica cinerea</i>	B, SB	1	✓		Access road	8		NA	Not native to Lao PDR.
<b>Mammals</b>									
<i>Elephus maximus</i> Asian elephant	EF, DF, SB, OFL, YFL, B	1		✓	Upper Nam Ngiep, Huay Ngua PPA, Nam Xan	46	Hunting	No	The location of the indirect records is mainly to the east of the Project area and to the north, outside the Project area. Similarly there are a number of locations noted for the species other countries. As such, the Project area is not considered likely to be part of one of 10 discrete management units (Tier 1) or an area of significant importance (Tier 2).

Species	Habitat Type Codes	Record		Record Location	Habitat within project area (ha)	Key Threats	Likely Critical Habitat in Project area	Assessment Outcome
		Criteria	Direct					
<i>Panthera pardus</i> Leopard	EF, DF	1	✓	Upper Nam Ngiep, Huay Ngua PPA	21	Hunting	No	Given the large range of the species, uncertainty of records and secondary information from local village representatives it is unlikely that the Project area and immediate surrounds supports greater than 10 per cent of the global population (Tier 1) or habitat of significant importance (Tier 2). The key threat to the species is hunting and although current information does not confirm critical habitat and there is uncertainty of the relevance of the village interview data, the precautionary approach should be considered and the threats to the species should be managed throughout the Project construction and operation and within any Biodiversity Offset Design.
<i>Pardofelis temminckii</i> Asiatic golden cat	EF, DF	1	✓	Upper and lower Nam Ngiep, Huay Ngua PPA	21	Hunting	No	This species plausibly persists, perhaps widely, in the Project area, but this is equally true of much of Lao PDR. The Project area is only a small proportion of the nation's total such habitat and as such would not be expected to constitute one of 10 discrete management units (Tier 1) or an area of significant importance (Tier 2).
<i>Prionailurus viverrinus</i> Fishing cat	W	1	✓	Huay Ngua PPA, Nam Xan, Upper Nam Ngiep	<1	Wetland destruction and degradation	No	There is no reason to think that Fishing cat inhabits the Project area, but equally it cannot be excluded that it does so. However, the Project area's habitat is not distinct in any way from typical Lao hill-country. The Project area is only a small proportion of the nation's total such habitat and as such would not be expected to constitute one of 10 discrete management units (Tier 1) or an area of significant importance (Tier 2).
<b>Birds</b>								

Species	Habitat Type Codes	Criteria	Record		Record Location	Habitat within project area (ha)	Key Threats	Likely Critical Habitat in Project area	Assessment Outcome
			Direct	In-direct					
<i>Buceros bircornis</i> Great hornbill	EF, DF	1	✓		Huay Ngua PPA, Nam Xan	21	Hunting	No	Great hornbill plausibly still occurs in the Project area but probably only in low numbers. Its status is similar across large parts of Lao PDR. The Project area is only a small proportion of the nation's total such habitat and as such would not be expected to constitute one of 10 discrete management units (Tier 1) or an area of significant importance (Tier 2).
<i>Cairina scutulata</i> White winged duck	W	1	✓		Upper Nam Ngiep, Huay Ngua PPA	<1	Hunting, habitat degradation	No	White winged duck might possibly still occur in the Project area but at best only in very low numbers. Despite major loss of habitat in the last half century, tracts similar in extent and condition to the Project area remain in many parts of Lao PDR. The Project area is only a small proportion of the nation's total such habitat and as such would not be expected to constitute one of 10 discrete management units (Tier 1) or an area of significant importance (Tier 2).
<i>Centropus sinensis</i> Greater coucal	EF, DF, SB	1	✓	✓	Upper and lower Nam Ngiep, resettlement site, Huay Ngua PPA, upper and lower Nam Xan	22	Hunting	No	Greater coucal is probably abundant over the deforested and degraded parts of the Project area. This is so across Lao PDR so the Project area is only a small proportion of the nation's total such habitat and as such would not be expected to constitute one of 10 discrete management units (Tier 1) or an area of significant importance (Tier 2).
<i>Lophura diardi</i> Siamese fireback	EF, B, SB	1	✓		Huay Ngua PPA, Nam Xan	10	Habitat conversion	No	Siamese fireback is very likely to occur, perhaps widely, in the Project area. Nonetheless, the Project area constitutes an insignificant proportion of suitable habitat across Lao PDR, so does not constitute critical habitat.



Species	Habitat Type Codes	Record Criteria		Record Location	Habitat within project area (ha)	Key Threats	Likely Critical Habitat in Project area	Assessment Outcome
		Direct	In-direct					
<i>Pavo muticus</i> Green peafowl	EF, DF, B, SB	1	✓	Huay Ngua PPA	29	Hunting	No	Assuming that the interview reports are in error, there is no reason to consider that the Project area constitutes critical habitat. However, the rather anomalous survival of the small population around Ban Nakhaty, Phou Khao Khoay NPA, emphasises the possibility that other remnants may also survive, and it cannot be excluded that the Project area might support one. Such a population could be significant at the national level rather than a global level.
<i>Polyplectron bicalcaratum</i> Grey peacock pheasant	EF	1	✓	Huay Ngua PPA, Nam Xan	2	Habitat conversion	No	Grey Peacock Pheasant is very likely to occur, perhaps widely and commonly, in the Project area. Nonetheless, the Project area constitutes an insignificant proportion of suitable habitat across Lao PDR, so does not constitute critical habitat.
<i>Psittacula alexandri</i> Red-breasted parakeet	DF	1	✓	Huay Ngua PPA	19	Trade	No	Accepting the likelihood of this species' occurrence in the Project area, it is however unlikely, that in the context of the much larger numbers remaining in parts of Central and South Lao PDR, that the Project area could comprise critical habitat.
<b>Reptiles</b>								
<i>Brogghammerus reticulatus</i> Reticulated python	EF, DF, SB	1	✓	Upper and lower Nam Ngiep, Huay Ngua PPA, resettlement site, upper and lower Nam Xan	22	Exploitation	No	Given that the Lao PDR population is not considered to be of global significance and that it is widespread it is unlikely that the Project area sustains greater than 10 per cent of the global population or is one of 10 discrete management sites globally for the species (Tier 1). The baseline information does not provide an indication that the habitat is of significant importance, or that records are part of an important concentration (Tier 2).

Species	Habitat Type Codes	Record		Record Location	Habitat within project area (ha)	Key Threats	Likely Critical Habitat in Project area	Assessment Outcome
		Criteria	Direct					
<i>Platysternon megacephalum</i> Big-headed turtle	W	1	✓	Upper Nam Ngiep, Huay Ngua PPA, upper Nam Xan	<1	Hunting	No	The species inhabits narrow stream (<1m wide) which is likely to be restricted in headwaters of waterways. The key threat to the species will relate to an improvement of access to the area for illegal wildlife collection rather than an impact to habitat. Although current information does not confirm critical habitat, the Project may contribute to the species threats. As such the precautionary approach should be considered and the threats to the species should be managed throughout the Project construction and operation and within any Biodiversity Offset Design.
<b>Fish</b>								
<i>Catlocarpio siamensis</i> Giant barb	W	1, 3	✓	Huay Ngua PPA	<1	Over-harvest, habitat fragmentation	Unlikely	The species was not detected during seasonal or targeted fast water habitat surveys within the Project area. Potential habitat for the species is more likely to occur downstream of the reservoir, and as such the Project threat relates to the modification of the topography of its habitat and alteration of the flow pattern (especially disruption of daily and annual cycle) impacting spawning sites and the reproduction of the species. Environmental Flows Assessment identifies flow release regime to manage downstream flows for maintaining normal river functions to manage this threat to potential habitat.

Species	Habitat Type Codes	Record		Record Location	Habitat within project area (ha)	Key Threats	Likely Critical Habitat in Project area	Assessment Outcome
		Criteria	Direct In-direct					
<i>Pangasianodon hypophthalmus</i> Striped catfish	W	1, 3	✓	Huay Ngua PPA	<1	Exploitation, habitat degradation	Unlikely	Species profile information suggests that the species utilises main or larger river channels and floodplain areas and undertakes long distance migrations and as such more confirmation of presence of the species is required. If the species is present downstream of the reservoir where this habitat occurs, the alteration of the flow pattern (especially disruption of daily and annual cycle) may have an indirect impact. Environmental Flows Assessment identifies flow release regime to manage downstream flows for maintaining normal river functions to manage this threat to potential habitat and monitoring would be required.
<i>Probarbus labeamajor</i> Thicklipped barb	W	1, 2, 3	✓	Huay Ngua PPA	<1	Exploitation, habitat degradation	No	The species is not known to occur in the Project area part of the catchment. Species profile information suggests that the species utilises main or larger river channels. Should the record be correct, the habitat in the lower reaches of the Nam Ngiep River may be susceptible to indirect impacts from the propose dam, however the area is unlikely to represent >10% of the habitat within the Mekong. The Project area is not considered to be critical habitat for the species (Tier 1).
<i>Wallago leeri</i>	W	2	r	Huay Ngua PPA	<1		NA	Species habitat is listed as rocky rapids in large streams and rivers. Fish have been previously been misidentified in the Mekong as <i>W. leeri</i> that are more likely <i>W. micropogon</i> . Targeted fast water habitat survey did not detect the species <i>W. micropogon</i> .

The baseline biodiversity assessment and screening identified a number of fish species for assessment as candidate critical habitat species, including migratory species. Species profiles have been collated and provided in *Annex H* for context however the Project is not considered likely to influence these aquatic species or their habitat. The construction of bridges and culverts is required within the Proposed Road to improve all-weather accessibility to the proposed dam site. The structures constructed include one permanent bridge (across Nam Xao) and two permanent culverts (at Nam Tak and Nam Miang), with an additional temporary bridge planned for construction. The Proposed Road IEE outlines the design measures for environmental protection for the bridges and culverts. Design includes management of hydrology and soil erosion to limit indirect impacts up and downstream. Based on the Project activities it is not considered likely that aquatic habitats will be permanently impacted and as such these species are not considered candidates for critical habitat for the Proposed Road.

#### *Habitat Summary*

A summary of the area of each habitat type within the Project area in accordance with ADB SPS definitions is provided in *Table 4-10*.

**Table 4.10** *Area of Habitat Types within the Project Area*

Habitat Type	Estimate within Project Area (ha)*
Natural Habitat	28
Modified Habitat	19
Other	1

\*Estimate derived from land cover mapping based on 9-10 m disturbance width.

The NUL road flora survey provided an opportunity to ground-truth the spatial data (land cover) to more accurately understand the extent of natural and modified habitat within the Proposed Road. Ground-truthing results for the Ban Nomsomboun to Ban Hat Gniun section of the proposed road identified substantially less natural habitat (47% natural habitat) than detected in land cover mapping (61% natural habitat). Similarly, ground-truthing of the JICA Road results (11% natural habitat) were less than indicated on land cover mapping (22% natural habitat).



**5.1****APPROACH**

The assessment of impacts was undertaken using a standardised impact assessment (Mitigation Hierarchy) approach that follows key steps:

1. **Evaluate** the significance of the impacts by considering the magnitude of the impacts (nature, scale and duration) and the nature of the receptor (*sensitivity*) (*Table 5-1* and *Table 5-2* outline the significance criteria matrix);
2. **Mitigate** any potential impacts evaluated as *Moderate* or *Major* and determine alternatives for any impacts evaluated as *Critical* (*Section 6.1*); and
3. Identify the **Residual** biodiversity values impacted to determine if potential significant impact remains after mitigation (*Section 6.3*);
4. Identify the requirements for **Biodiversity Offsetting** (*Section 6.4*).

**5.1.1****Significance Criteria**

The Project impacts identified have been assessed for their significance against each potentially occurring habitat and species according to the criteria provided in *Table 5-1* and *Table 5-2*.

**Table 5.1** *Habitat Impact Assessment - Significance Criteria*

Habitat Sensitivity/Value		Magnitude of Effect			
		Negligible	Small	Medium	Large
<b>Low</b>	Habitats with no or local designation/recognition; habitats of significance for species of Least Concern; habitats which are common and widespread within the region.	Negligible	Negligible	Minor	Moderate
<b>Medium</b>	Habitats within nationally designated or recognised areas; habitats of significant importance to globally Vulnerable, Near Threatened or Data Deficient species; habitats of significant importance for nationally restricted range species; habitats supporting nationally significant concentrations of migratory species and/or congregatory species; nationally threatened or unique ecosystems.	Negligible	Minor	Moderate	Major
<b>High</b>	Habitats within internationally designated or recognised areas; habitats of significant importance to globally Critically Endangered or Endangered species; habitats of significant importance to endemic and/or globally restricted-range species; habitats supporting globally significant concentrations of migratory species and/ or congregatory species; highly threatened and/or unique ecosystems, areas associated with key evolutionary species.	Negligible	Moderate	Major	Critical
<b>Magnitude of Effect Definition</b>					
<i>Negligible</i>	<i>Effect is within the normal range of variation</i>				
<i>Small</i>	<i>Affects a small area of habitat, but without the loss of viability/function of the habitat</i>				
<i>Medium</i>	<i>Affects a sufficient proportion of the habitat that the viability/function of part of the habitat or the entire habitat is reduced, but does not threaten the long-term viability of the habitat or species dependent on it.</i>				
<i>Large</i>	<i>Affects the entire habitat or a significant proportion of the habitat to the extent that the viability/function of the entire habitat is reduced and the long-term viability of the habitat and the species dependent on it are threatened.</i>				

**Table 5.2 Assessment of risks to Species**

Species Sensitivity/Value		Magnitude of Effect			
		Negligible	Small	Medium	Large
Low	Species which are included on the IUCN Red List of Threatened Species as Least Concern (LC) (IUCN 2011).	Not significant	Not significant	Minor	Moderate
Medium	Species included on the IUCN Red List of Threatened Species as Vulnerable (VU), Near Threatened (NT) or Data Deficient (DD) (IUCN 2011). Species protected under national legislation. Nationally restricted range species. Nationally important number of migratory or congregatory species.	Not significant	Minor	Moderate	Major
High	Species included on the IUCN Red List of Threatened Species as Critically Endangered (CR) or Endangered (EN) (IUCN 2011). Species having a globally Restricted Range (ie plants endemic to a site or found globally at fewer than 10 sites, fauna having a distribution range (or globally breeding range for bird species) less than 50,000 km <sup>2</sup> . Internationally important numbers of migratory or congregatory species. Key evolutionary species.	Not significant	Moderate	Major	Critical
<b>Magnitude of Effect Definition</b>					
Negligible	<i>Effect is within the normal range of variation.</i>				
Small	<i>Affects a small proportion of a population, but does not substantially affect other species dependent on it, or the populations of the species itself</i>				
Medium	<i>Affects a sufficient proportion of a species population that it may bring about a substantial change in abundance and/or reduction in distribution over one or more generations, but does not threaten the long term viability of that population or any population dependent on it.</i>				
Large	<i>Affects an entire population or species at sufficient scale to cause a substantial decline in abundance and/or change in distribution beyond with natural recruitment (reproduction, immigration from unaffected areas) may not return that population or species, or any population or species dependent upon it, to its former level within several generations, or when there is no possibility of recovery.</i>				

The scoping of project impacts identified a number of potential impacts to biodiversity values, including:

- Permanent and temporary loss of habitat;
- Disturbance and displacement of resident species due to noise, light, and dust;
- Creation of a barrier to fauna movement, including terrestrial and aquatic;
- Fragmentation of habitat;
- Edge effects;
- Degradation of habitat as a result of introduction of, and competition with, alien species;
- Degradation of habitat in the event of release of hazardous substances or pollution; and
- Mortality as a result of vehicle strike.

The Project area and adjacent areas contain biodiversity and conservation values. Baseline studies identified a diversity of flora and fauna species, and ecosystems, including some species listed on the IUCN Red List of threatened species. Where species records are considered to be misidentification these species have not been considered in impact assessment.



**Table 5.3** *Assessment of Impacts to Natural and Modified Habitats*

Impact	Description	Comment	Sensitivity	Magnitude	Significance
Temporary loss of habitat	Temporary disturbance of terrestrial and aquatic habitat in areas required to facilitate construction. Temporary disturbance will mainly be associated with waterway crossings and in-stream infrastructure construction (bridges).	Construction activities will require clearing of some vegetation to widen the existing road corridor which will remove habitat adjacent to the road. The habitats are common and widespread within the region (Low sensitivity) and the loss will be limited to that necessary for construction. The areas to be temporarily disturbed are considered unlikely to impact the viability or functioning of adjacent ecosystems (Small magnitude). Where possible topsoil will be managed locally and natural regeneration or rehabilitation using native species will be undertaken in areas not required for the operation of the Project. For waterway crossings, water exclusion dams may be required during construction leading to a loss of habitat locally and restriction of movement by aquatic species.	Low	Small	<b>Negligible</b>
Permanent loss of habitat	Permanent loss of 49 ha of habitat within the corridor footprint. Habitat loss includes 28 ha of natural habitat.	The Project area is approximately 49 ha, with the area of natural habitat within mapped as approximately 28 ha. In the context of the surrounding area, the habitats are representative of the larger catchment and not considered unique. A diversity of flora and fauna species were reported to occur in the Huay Ngua PPA (based on ecological surveys or village surveys), including IUCN listed species (sensitivity medium) in the disturbance area and the habitat for these populations will be locally reduced. Approximately 57% of the footprint is mapped as natural habitat however ground-truthing confirmed that conditions at the site are more degraded than expected and the actual area of natural habitat is less. Similarly, in the context of the extent of the PPA the removal is not likely to threaten the long-term viability of the habitat and biodiversity (magnitude small). Habitat for threatened species is specifically assessed in <i>Table 5-4</i> .	Medium	Small	<b>Minor</b>

Impact	Description	Comment	Sensitivity	Magnitude	Significance
Temporary disturbance to fauna behaviours	Disturbance and displacement of resident fauna due to noise, light and/or vibration as a result of construction activities (excavation, blasting, clearing, spoil disposal, camps, plant and vehicle movement).	Noise and light disturbances have the potential to influence fauna breeding, roosting or foraging behaviour of native fauna. The consequences of these influences are dependent on the extent of disturbance but in extreme cases these factors can influence local populations if breeding and communication is inhibited. Excessive noise can impede fauna communication and deter the use of habitats nearby. Similarly, introducing light sources has the potential to deter foraging and dispersal activities of nocturnal species. The Project area has an existing road where human activity is likely to induce a base level of disturbance in directly adjacent areas however the construction activities are likely to increase these types of disturbance.	Low	Small	Negligible
Permanent disturbance to fauna behaviours	Disturbance and displacement of resident fauna due to noise and light as a result of the operation facilities (power plants, offices and resettlement area).	Noise and light disturbances have the potential to influence fauna breeding, roosting or foraging behaviour. The consequences of these influences are dependent on the extent of disturbance but in extreme cases these factors can influence local populations. Excessive noise can impede fauna communication and deter the use of habitats nearby. Similarly, introducing light sources has the potential to deter foraging and dispersal activities of nocturnal species. The Project area has an existing road where human activity is likely to induce a base level of disturbance in directly adjacent areas however the construction activities are likely to increase these types of disturbance.	Low	Small	Negligible
Barrier to movement and habitat fragmentation	Barrier to terrestrial fauna movement and habitat fragmentation	The Project area has an existing road that is likely to create a barrier to movement for some fauna groups. The widening of the corridor may further restrict movement of groups currently crossing the corridor to move in an east-west direction. Surveys of the PPA recorded a number of IUCN listed species however most are highly mobile and unlikely to be impacted by widening of the corridor (sensitivity low). Area of new road will introduce a new corridor barrier however the road will not	Low	Small	Negligible

Impact	Description	Comment	Sensitivity	Magnitude	Significance
		be fenced and it is likely that most fauna groups will continue to move through the landscape. Temporary roads will be rehabilitated to return the continuous forest cover.			
	Barrier to aquatic fauna movement and habitat fragmentation	A number of watercourse crossing are required to facilitate the access road construction. The construction design and activities has considered the requirement to maintain flow within the watercourses. A number of IUCN listed species and other native have been identified within the Project area that are migratory (sensitivity medium). Bridge and other crossing infrastructure has been designed to maintain existing flows such that there is not barrier to movement in the long term (magnitude small).	Medium	Small	Minor
Edge effects	The construction and inundation associated with the Project will generate newly disturbed forest edges around the margins of the reservoir and at the infrastructure locations.	Edge effects are an indirect impact of land clearing. Where vegetation clearing occurs, adjacent vegetation and habitats are exposed to increased noise, light, dust and wind environment as well as increased competition from predators and invasive species. In extreme cases some of these effects have potential to alter the habitat characteristics of the ecotone and influence suitability for native flora and fauna. 'New' habitat edges will be created where clearing occurs adjacent to the existing road and in sections of new road. In general, the habitats that may be impacted are common and widespread within the region (low sensitivity) and the impact is not likely to impact the viability/function of adjacent habitats (small magnitude).	Low		Negligible
Degradation of habitat	Introduction of alien species and competition with native communities	Invasive or alien species have the potential to be introduced or spread throughout the Project area through increased movement of people, vehicles, machinery, vegetation and soil. An increase in the prevalence of weeds or other pests has the potential to reduce the quality of habitat for some native flora and fauna, including threatened species (sensitivity medium). Invasive flora species can rapidly germinate in disturbed areas whereby affecting the ability of native vegetation communities to re-establish. Alien animals also have the potential to be introduced or increased in abundance. These animals may adversely impact	Medium	Small	Minor

Impact	Description	Comment	Sensitivity	Magnitude	Significance
		native fauna as a result of increased competition for resources, predation or habitat degradation. Vehicle movement and activities which introduce a risk of invasion will be focussed along access track and construction areas (magnitude small).			
	Accidental release of hazardous substances stored or used during construction and operation phases.	The Project components include the storage and handling of hazardous materials, including refuelling. Accidental release or spill of these materials can be toxic to flora and fauna locally and downstream if substances are released into the aquatic environment. The waterways of the region experience substantial flows and as such it is likely that an accidental spill can be diluted such that impacts are localised (magnitude small) however the catchment provides habitat for nationally and globally listed species (Sensitivity medium).	Medium	Small	<b>Minor</b>
	Erosion and runoff at waterways crossings leading to downstream degradation of water quality, and aquatic habitats.	<p>A range of Project activities have the potential to lead to indirect impacts to native flora, fauna and habitats. In general this includes dust and runoff impacts during construction as well as longer term edge effects and noise impacts of the operation of the facilities.</p> <p>During construction, land preparation has the potential to generate dust which may settle on vegetation adjacent to the construction area. Excessive dust deposition on flora may act to suppress growth through limiting photosynthesis and the dusted foliage may also become unpalatable to foraging fauna. The construction activities will be temporary and short lived, and dust generation is likely to be localised to active work areas. Rainfall will generally remove dust from foliage.</p> <p>Land preparation will create exposed bare earth areas that are vulnerable to erosion (wind and/or runoff) until infrastructure construction or replanting is completed to stabilise the surface. Erosive processes transport and deposit sediment to downstream habitats (both aquatic and terrestrial). The indirect impact has potential to degrade downstream habitat areas or change habitat characteristics, and as such influencing suitability for native flora and fauna</p>			<b>Minor</b>



Impact	Description	Comment	Sensitivity	Magnitude	Significance
		<p>communities.</p> <p>The waterways in the region experience substantial flows and as such it is likely that an accidental spill can be diluted such that impacts are localised (magnitude small) however the catchment provides habitat for nationally and globally listed species (sensitivity medium).</p>			
Fauna mortality		<p>Fauna mortality can occur during vegetation clearing activities in the event individuals are struck by vehicles and machinery. Animals that are unable to disperse during clearing activities are vulnerable to being injured or destroyed through interaction with machinery or falling debris.</p> <p>It is likely that most individuals will disperse (sensitivity low) from clearing locations into adjacent habitats however some less mobile species may experience a localised reduction (magnitude small) in abundance during this period, such as amphibians, reptiles and small mammals.</p> <p>Fauna mortality can also occur as a result of hunting, poaching and collection for trade. The upgrade of the access road and construction of new access pathways will improve access to the region, thus increasing the opportunity for these activities. Hunting, poaching and collection are threats identified for many of the species highlighted in this report.</p>	Low	Small	Negligible

**Table 5.4** *Assessment of Impacts on Conservation Significant Biodiversity Values*

Value	Impacts	Sensitivity	Magnitude	Significance
IUCN Listed Critically Endangered and Endangered Species Habitat (terrestrial)	<p>Forest suitable for the endangered IUCN listed flora and fauna species (sensitivity high) is within the Project area. An assessment of critical habitat status in accordance with the IFC PS6 and ADB Sourcebook guideline identified it is unlikely the Project area contains critical habitat.</p> <p>The plant species habitat preferences include the natural habitats represented within the Project area and surrounds. The Project area contains 28 ha of natural habitat.</p> <p>Mammal species that may occur in the Project area include the Asian elephant. The deciduous forest areas of the Project area are potential habitat for this species (19 ha). The Asian elephant is a highly mobile species an important areas are known to occur outside the Project area and to the west of the disturbance area and as such the impact to the species is not considered to be substantial.</p>	High	Small	<b>Moderate</b>
IUCN Listed Vulnerable and nationally listed Restricted species Habitat (terrestrial)	<p>Habitat suitable for vulnerable IUCN listed species will be directly impacted by the Project. This area is dominated by natural habitat in particular deciduous forest. The Project area contains 28 ha of natural habitat.</p> <p>The plant species habitat preferences include the natural habitats represented within the Project area and surrounds.</p> <p>Desktop review identified the mammal species that may be impacted include the gaur, Malayan sun bear, clouded leopard, Sambar deer, Himalayan black bear and large spotted civet. The disturbance area is dominated by natural habitat in particular deciduous forest of which most of these species may inhabit. The majority of the mammal species are highly mobile and it is unlikely that home ranges are contained within the disturbance area. Ground-truthing of the Project area identified that the alignment is dominated by existing road and also areas of relatively poor habitat condition.</p> <p>Bird species that may be impacted include the greater coucal, greater hornbill, Siamese fireback, silver pheasant, grey-peacock pheasant and red-breasted parakeet.</p> <p>Habitat availability in the wider catchment is well represented and the impact area is limited in the context of the locality.</p>	Medium	Medium	<b>Moderate</b>

Value	Impacts	Sensitivity	Magnitude	Significance
IUCN Listed Critically Endangered and Endangered Species Habitat (aquatic)	<p>A number of watercourse crossing are required to facilitate the access road construction. The construction activities have managed the maintenance of flow and sediment and erosion control to limit impacts to upstream and downstream habitats.</p> <p>The big headed turtle would utilise some areas of aquatic habitat within the Project area. Little is known about the population of the species however preferred habitat includes narrow fast flowing, cool, rocky mountain brooks and streams. The area of this habitat to be impacted will be limited to watercourse crossing locations, which in many cases have an existing road influence. The impact to this species should it occur is not considered to be substantial.</p> <p>The giant barb and striped catfish may move through the habitats within the Project area however the magnitude of impact is considered to be negligible given the small area of impact and other management measures utilised to maintain flow and limit impacts upstream and downstream.</p>	High	Negligible	<b>Not Significant</b>
IUCN Listed Vulnerable species habitat, nationally listed Restricted species habitat, endemic and migratory species habitat (aquatic)	<p>A number of watercourse crossing are required to facilitate the access road construction. The construction design and activities has considered the requirement to maintain flow within the watercourses.</p> <p>A number of IUCN listed species and migratory species have been identified within the watercourses that the Project area intersects (sensitivity medium). Bridge and other crossing infrastructure have been designed to maintain existing flows such that there is not barrier to movement in the long term (magnitude small).</p>	Medium	Small	<b>Minor</b>

### 5.3

#### ANALYSIS OF ALTERNATIVES OPTION

The mitigation hierarchy of avoid, minimise, mitigate and compensate, recognises the preference to avoidance mechanisms in managing environmental impacts. In accordance with these principles a preliminary study of re-routing outside PPA was considered.

Figure 5.1 shows the route investigated. The alternative considered ('Alternative Road') is an existing route which runs to the north side of the proposed road between Ban Sisavat and Ban Thafuea. The Alternative Road was constructed for use by French and US troops in the 1960s to access to Ban Hat Gnium. However, the Alternative Road is no longer in use.

The Alternative Road diverges from the Proposed Road in the central third section of the alignment, deviating to the north for 1.5 - 2 km before aligning north-west for 5 - 6 km and rejoining the study area corridor.

The Alternative Road mostly consists of footpaths connecting to Ban Tahuea as very narrow passways. Passways are not accessible in wet seasons due to flooding, and villagers only use the Alternative Road for agricultural purposes. The Alternative Road is also located close to or within the boundary of Phou Ngou Provincial Protection Forest, though there is a buffer zone of about 50 to 100 m between Huay Ngua PPA and Phou Ngou Provincial Protection Forest according to the Provincial Department of Natural Resource and Environment.

#### 5.3.1 Alternative Road Biodiversity Values

##### Vegetation and Habitats

The land cover types mapped within the Alternative Road are summarised in Table 5-5. Vegetation condition with the alternative route option is summarised in Table 5-6. To allow for comparison with the Proposed Road, the areas calculated encompass the route between Ban Nomsomboun and Ban Hat Gnium.

Table 5.5 Land cover types within the Alternative Road

Type (code)	Description	Total within Alt. Road (ha)
Deciduous forest (DF)	Deciduous forest occurs when deciduous tree species represent more than 50% of the stand. The forest storeys are not as dense as those of evergreen type. Most often bamboo occurs in this type of forest. Deciduous Forest includes both Upper and Lower deciduous forest types and this definition is based on relative altitude, forest occurring above 200 m is classified as Upper Mixed deciduous Forest and deciduous forest occurring at an altitude 200 m and below is classified as Lower Deciduous Forest.	11



Type (code)	Description	Total within Alt. Road (ha)
Old fallow land (OFL)	Land that has been ploughed and tilled and left un-seeded during a growing season.	9
Young fallow land (YFL)	Land that has been recently ploughed and tilled and left un-seeded during a growing season.	0
Rice paddy (RP)	Areas permanently being used for rice cultivation.	1
Slash and burn (SB)	Slash-and-burn is a description of land that has been subjected to an agricultural technique which involves cutting and burning of forests or woodlands to create fields.	<1
Urban (U)	Urban Areas include all areas being used for permanent settlements such as villages, towns, public gardens etc. It also includes roads having a width of more than 5 m and areas under electric high power lines. Any type of land under high power lines, except Rice Paddy, should be classified as Urban Areas.	<1
Water (W)	The land cover class Water includes rivers, water reservoirs (i.e. ponds and dams for irrigation and hydro power) and lakes. Water reservoirs and lakes with an area of 0.5 ha and rivers should be at least 10m wide to be classified as Water.	0
Shadow*	Shadow indicates limitations in the dataset from shadows and cloud contained in the aerial imagery.	1
Cloud*	Cloud indicates limitations in the dataset from shadows and cloud contained in the aerial imagery.	<1

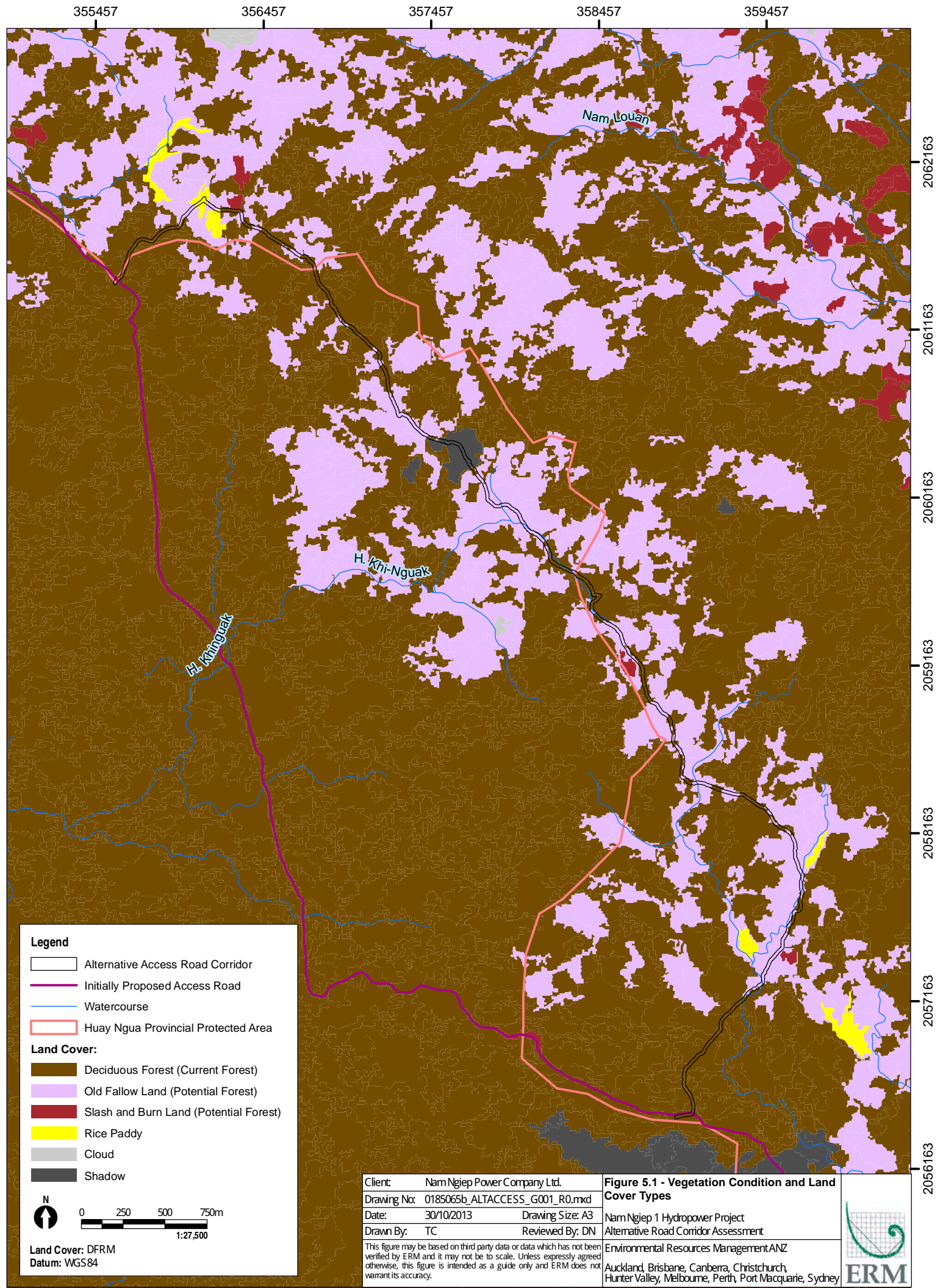
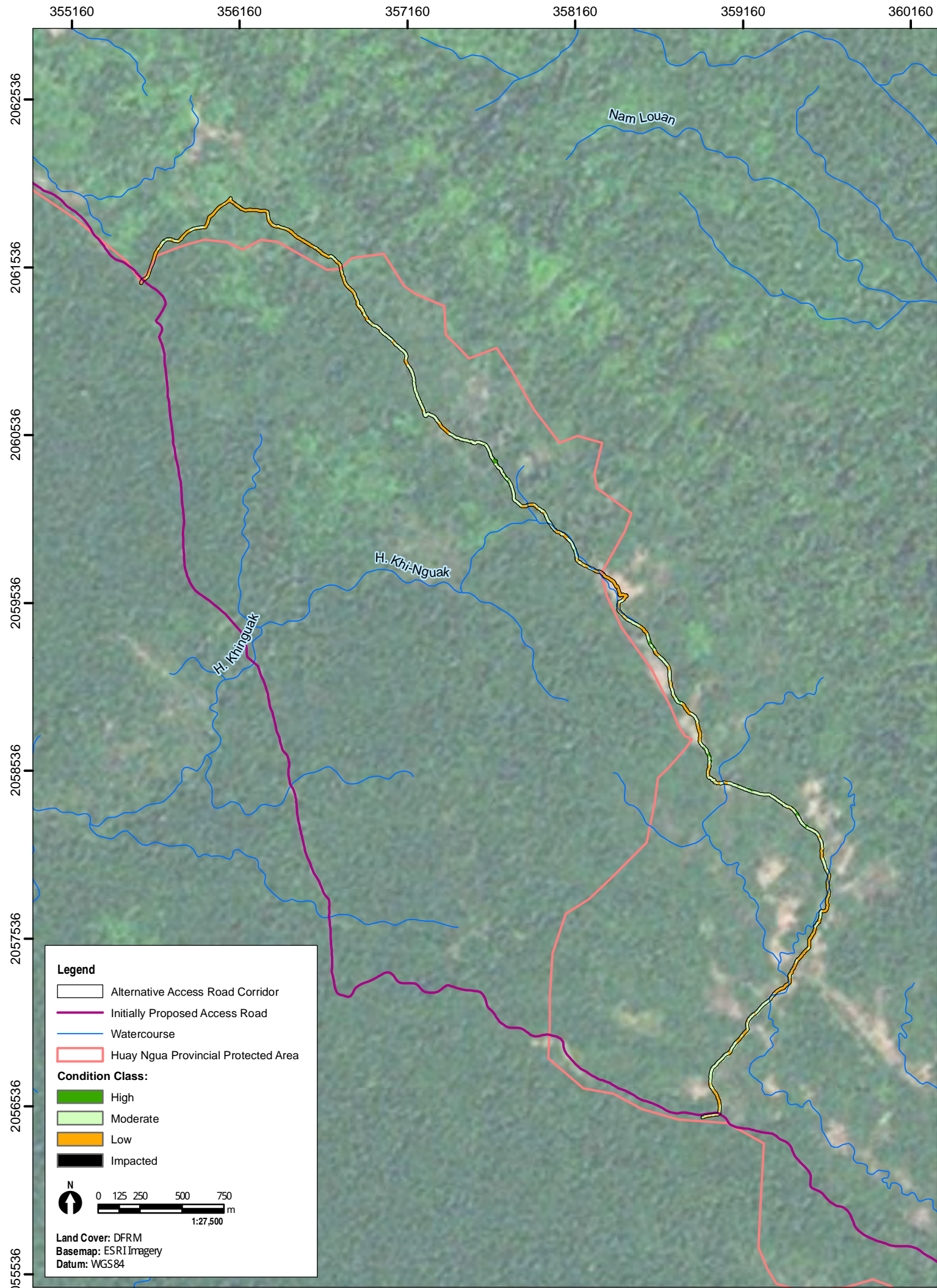
*Alt. Road area is the area potentially directly impacted by construction and operation*

**Table 5.6** *Vegetation Condition in the Alternative Road*

Condition Category (NDVI range)	Area within Alt. Option (ha)
Impacted (- to 0)	<1
Low (0 to 0.4)	13
Moderate (0.4 to 0.6)	8
High (0.6 to 0.8)	<1

*Alt. Road area is the area potentially directly impacted by construction and operation*





Client:	Nam Ngiep Power Company Ltd.	<b>Figure 5.1 - Vegetation Condition and Land Cover Types</b>
Drawing No:	0185065b_ALTACCESS_G001_R0.mxd	
Date:	30/10/2013	Drawing Size: A3
Drawn By:	TC	Reviewed By: DN
<small>This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.</small>		Nam Ngiep 1 Hydropower Project Alternative Road Corridor Assessment Environmental Resources Management ANZ Auckland, Brisbane, Canberra, Christchurch, Hunter Valley, Melbourne, Perth, Port Macquarie, Sydney





## Flora and Fauna Species

Based on the similarity in land cover types and proximity to the proposed road, it is considered likely that the species identified during the baseline assessment of the proposed road corridor have potential to occur in the habitats of the Alternative Road. It is expected that the habitat values for the flora and fauna biodiversity will be similar. *Table 5.7* compares the area of disturbance for each of the critical habitat candidate species for each alignment option. The outcomes suggest slightly less disturbance for one species (Asian elephant) at the Proposed Road option.

**Table 5.7** *Threatened Species Habitat Access Road Route Comparative Analysis – Land Cover (Ban Nomsomboun and Ban Hat Gnium)*

Species	Common Name	Habitat Type Codes	Proposed Road (ha)	Alternative Road (ha)
<b>Flora</b>				
<i>Azelia xylocarpa</i>		EF, DF	11	11
<i>Anisoptera costata</i>		EF, DF	11	11
<i>Dalbergia oliveri</i>		EF, DF	11	11
<i>Dipterocarpus alatus</i>		EF, DF	11	11
<i>Dipterocarpus turbinatus</i>		EF, DF	11	11
<i>Shorea roxburghii</i>	White meranti	EF, DF, B	11	11
<i>Vatica cinerea</i>		B, SB	<1	<1
<b>Mammals</b>				
<i>Elephas maximus</i>	Asian elephant	EF, DF, SB, OFL, YFL, B	17	21
<i>Panthera pardus</i>	Leopard	EF, DF	11	11
<i>Pardofelis temminckii</i>	Asiatic golden cat	EF, DF	11	11
<i>Prionailurus viverrinus</i>	Fishing cat	W	-	-
<b>Birds</b>				
<i>Buceros bircornis</i>	Great hornbill	EF, DF	11	11
<i>Cairina scutulata</i>	White winged duck	W	-	-
<i>Centropus sinensis</i>	Greater coucal	EF, DF, SB	12	12
<i>Lophura diardi</i>	Siamese fireback	EF, B, SB	<1	<1
<i>Pavo muticus</i>	Green peafowl	EF, DF, B, SB	12	12
<i>Polyplectron bicalcaratum</i>	Grey peacock pheasant	EF	-	-
<i>Psittacula alexandri</i>	Red-breasted parakeet	DF	11	11
<b>Reptiles</b>				
<i>Broghammerus reticulatus</i>	Reticulated python	EF, DF, SB	12	12
<i>Platysternon megacephalum</i>	Big-headed turtle	W	-	-
<b>Fish</b>				
<i>Catlocarpio siamensis</i>	Giant barb	W	-	-
<i>Pangasianodon hypophthalmus</i>	Striped catfish	W	-	-
<i>Probarbus labeamajor</i>	Thicklipped barb	W	-	-
<i>Wallago leeri</i>		W	-	-

### 5.3.2 *Route Options Comparison - Biodiversity*

The proposed road and Alternative Road display similar biodiversity values with the key difference relating to the area of habitat disturbance. Baseline assessment did not identify species or habitat types unique to any particular route option. Comparison of land cover types within each of the route options is provided in *Table 5-7*. *Table 5-8* provides a comparison of vegetation condition (NDVI) for the route options.

**Table 5.8** *Access Road Route Comparative Analysis – Land Cover (Ban Nomsomboun and Ban Hat Gniium)*

Land Cover/Code	Habitat	Proposed Road (ha)	Alternative Road (ha)
Deciduous forest	N	11	11
Old fallow land	M	5	9
Young fallow land	M	0	0
Rice paddy	M	1	1
Slash and burn	M	<1	<1
Urban	M	<1	<1
Water	-	0	0
Shadow*	-	<1	1
Cloud*	-	<1	<1
<b>Total</b>		<b>18</b>	<b>22</b>

*N = natural habitat; M = modified habitat*

**Table 5.9** *Access Road Route Comparative Analysis – Vegetation Condition (Ban Nomsomboun and Ban Hat Gniium)*

Condition Category (NDVI range)	Proposed Road (ha)	Alternative Road (ha)
Impacted (- to 0)	<1	<1
Low (0 to 0.4)	11	13
Moderate (0.4 to 0.6)	6	8
High (0.6 to 0.8)	<1	<1

The area of disturbance for each of the route options is similar. Specific to natural habitat disturbance, both options are estimated to disturb 11 ha, though the overall disturbance area is smaller for the Proposed Road (18 ha).











### 5.3.3 *Route Options – Other Factors*

The Alternative Road was checked by site reconnaissance on 2 and 3 October 2013. A comparison of specifications for each plan is shown in *Table 5-9*. Photos of the Proposed Road and Alternative Route are provided in *Table 5-10*.

**Table 5.10** *Specifications of Proposed Road and Alternative Route*

	<b>Proposed Road</b>	<b>Alternative Route</b>
Construction period	Built by French support in 1993 The road between Ban Sisavat and Ban Thafuea is often flooded during the rainy season and French improved accessibility to Ban Thafuea and shifted the road alignment, higher elevation than that of the Alternative Route constructed in 1960s.	Originally built by French and US troops in 1960s. After completion of the existing road, this road looks to be no longer used.
Existing road width	5 m to 10 m	1.0 m to 3.5m
Total length (Ban Nomsomboun to Ban Hat Gnium)	21.2 km [(PPA) 11.8 km + 10.4km]	22.7 km [(PPA) 8.7 km + 14.0 km]
Total length passing through PPA	11.8 km	8.7 km
Road condition	Dirt road	Dirt road and footpath
Accessibility during rainy season	Accessible by car	Inaccessible during the wet season
Road users	Villagers, collectors of wood and tree butcher	Villagers but for access to agricultural land only
Land use inside PPA	Forest	Forest and paddy field
UXO and land use survey	Conducted	Not yet conducted
Electricity	22 KV transmission line is under construction along the road	No plan
Method of access road construction	Improvement of existing dirt road by increasing road width and creating pavement.	Almost a new road and careful consideration of drainage is required

**Table 5.11** *Photos of Proposed Road and Alternative Route.*

Proposed Road	Alternative Route
	
	
	
	

*Source: NNP1 October 2013*

The assessment of the Proposed Road and Alternative Route indicated that each scenario would have similar environmental and social impacts. These impacts are outlined in *Table 5-11*.

**Table 5.12** *Screening of environment and social impacts, and feasibility of Proposed Road and Alternative Route*

<b>Proposed Road</b>	<b>Alternative Route</b>	<b>Conclusion</b>
<b>Natural Environment</b>		
Land along the existing road alignment has already been developed with houses or agriculture lands. IEE for was conducted and ESMMP-CP is prepared.	The road used by villagers is narrow and has only limited usage, mostly by people walking or riding a motorbike. Vegetation cover has almost recovered to the equivalent of natural conditions. IEE and ESMMP-CP have not yet been completed.	Alternative Plan will be required more land/ forest clearance works.
<b>Affected area inside PPA</b>		
Road length within PPA: 11.8 km Affected area: 3.54 ha. This is calculated as: Road construction width 8m less Existing road width 5 m = 3m 3m x 11.8 km	Road length within PPA: 8.7 km Affected area: 3.91ha. This is calculated as: Expanded road width 8 m less existing road width 3.5 m = 4.5 m 4.5 m x 8.7 km	Alternative Route will require more forest clearance within PPA.
<b>Environmental Impacts</b>		
If an access road is constructed, there may be a negative impact to biodiversity in protected areas (for example, easy access to illegal logging) as well as a positive impact (improved management of protected areas through NNP1 offset program).	If an access road is constructed, there may be a negative impact to biodiversity in protected areas (for example, easy access to illegal logging) as well as a positive impact (improved management of protected areas through NNP1 offset program).	Each road passes through and near protected areas. Similar impacts for each scenario.
<b>Land acquisition</b>		
There is no private land between KM 8.3 and KM15.5 of Access Road "junction to Access Road"	Based on initial estimates of the road width, including backfilling to reach sufficient height of the road to protect it from flooding, would require the acquisition of approximately 46,000 m <sup>2</sup> of paddy rice fields and some areas of other privately held land along the alternative route.	Alternative Plan will require more land acquisition and thus affect more Project Affected Peoples "PAPs" directly through the loss of paddy rice fields and other lands.

Proposed Road	Alternative Route	Conclusion
<b>Existing right of way inside PPA</b>		
Bolikhamxay Province has already set the right of way within the PPA with a width of 30 m along the Access Road.	Not yet set and actual width of the road on site may be deemed as right of way.	Proposed Road preferred.
<b>Construction Approval</b>		
Approved its construction by GoL already	Not yet approved	Planning process for Proposed Road is further progressed.
<b>Construction cost (Ban Nomsomboun to Ban Hat Gnium)</b>		
USD 4.2M	Preliminary estimate Approximately USD 6.9 M Total road length is 1km longer than Proposed Road. The Alternative Road passes through lowland "paddy field" which is inundated during the wet season, and natural forest. A higher embankment, more soil improvement, box culvert, and pipe culvert will be needed.	The construction cost of Alternative Plan is much higher than that of Original Plan.

#### 5.3.4

#### *Conclusions of Alternative Scenarios*

The assessment of alternatives for the access road between Ban Nomsomboun and Ban Hat Gnium show no significant difference between the Proposed Road route and the Alternative Road route in terms of biodiversity, environmental and social impacts to Huay Ngua PPA. Project team discussions have indicated a preference for the Proposed Road, based on engineering considerations. Mitigation and recommendations for minimising and managing impacts to biodiversity have been developed based on the Proposed Road case.



## 6.1

## OVERVIEW

The Project area is approximately 49 ha which is dominated by mapped deciduous forest and old fallow land. The loss of this habitat area is unavoidable to achieve the Proposed Road and as such the direct loss of habitat cannot be mitigated and compensatory measures will be required for this impact.

Primarily, a Biodiversity Action Plan (BAP) will be developed to document a strategy for refining the mitigation and management approach to conservation of biodiversity values, including key objectives, specific measures for the IUCN listed threatened species with potential to occur in the Project area, performance indicators and responsible parties.

This report has identified habitat for a number of IUCN and nationally listed species within the Project area. An assessment against critical habitat criteria suggests it is unlikely that the Project contains any areas considered to be critical habitat, however it has been identified that potential habitat occurs. Although a disturbance to critical habitat is unlikely, measures to manage impacts to potential habitat will be developed.

The plan will provide the strategy to developing and implementing any mitigation measures as well as the strategy to achieving a suitable offset for the values that will be lost.

This Section provides information likely to be incorporated in the BAP. Due to the relatively small area to be impacted, and that there is currently an existing road, the management measures below provide a sound basis upon which to document more detailed measures and responsibilities.

## 6.2

## MITIGATION MEASURES

Disturbance to habitat in modified and natural habitat areas has potential to have impacts on the local biodiversity and downstream biodiversity as well as impacts to priority biodiversity values. Mitigation measures can be implemented to manage the disturbance so that biodiversity values are not significantly impacted or impacts are reduced by the application of the mitigation hierarchy (avoid, minimise, mitigate and, in some cases, compensate). The biodiversity impact assessment (*Section 5*) identified potential impacts to both modified and natural habitats however the modified habitat types were not identified to play a significant role in habitat suitability for priority biodiversity values.

Management measures specific to managing the natural environment will be incorporated into the Project EMMP and these will include (but not be limited to) those identified in *Table 6-1*. These general environmental management measures will assist in reducing the potential for degradation of habitat,

behaviour disturbance, fauna mortality and habitat fragmentation for native species. Management relating to priority biodiversity values will be developed through the implementation of the BAP. *Table 6-2* identifies measures specific to the priority species that have been identified with potential to occur for inclusion in the BAP and further development.

**Table 6.1** *Mitigation and Management Measures*

Nature of Impact	Overview of Measures
Loss of habitat	<ul style="list-style-type: none"> <li>• Strict rules against logging outside the approved construction areas and against wildlife hunting and poaching will be imposed on project staff, workers, and all contractors and personnel engaged in or associated with the Project, with penalties levied for anyone caught carrying and using fire arms, or using animal snares and traps, including fines and dismissal, and prosecution under the laws of the Lao PDR;</li> <li>• The design and layout plan will be prepared to minimise tree cutting and protected area disturbance where possible. The Project owner shall be directly responsible for dissemination to its staff and workers of all rules, regulations and information concerning these restrictions, as well as the punishment that can be expected if any staff or worker or other person associated with the Project violate rules and regulations;</li> <li>• The planned clearance area for the construction works shall be clearly identified and marked to avoid accidental clearing;</li> <li>• Construction Contractor, in association with the Forest Guard, will schedule and implement routine inspection program throughout construction period to monitor clearing extent;</li> <li>• Cleared vegetation shall be stockpiled in accordance with a site Vegetation Management Plan in previously disturbed areas only;</li> <li>• All topsoil will be saved and used for site revegetation;</li> <li>• Disturbed areas shall be rehabilitated as soon as possible following construction activities;</li> <li>• Construction Contractor will establish biological resource management program and management plan to manage the construction activities to be conducted and monitor compliance with relevant permits and environmental regulations in order to prevent potential impacts to terrestrial ecology, in particular, vegetation and wildlife; and</li> <li>• In natural habitat areas to be cleared, microhabitat features such as hollow logs will be relocated to adjacent natural habitat areas rather than being destroyed where possible.</li> </ul>
Disturbance to fauna behaviour	<ul style="list-style-type: none"> <li>• Construction vehicles and machinery will be maintained in accordance with industry standard to minimise unnecessary noise generation;</li> <li>• Traffic signs will be installed on all roads throughout construction areas depicting speed limits;</li> <li>• For construction and operation areas requiring night-time lighting, lights will be used only where necessary and will be directed toward the subject area and away from habitat areas where possible; and</li> <li>• Commitment will be made to raise awareness of values of natural habitat areas to construction work force and make arrangements for restriction of poaching.</li> </ul>
Barrier to movement and habitat fragmentation	<ul style="list-style-type: none"> <li>• The Project shall implement landscaping and re-vegetation after completion of construction in suitable areas;</li> <li>• Replanting will occur at the outer portions of the road corridor;</li> <li>• Monitoring and maintenance of revegetated areas will be undertaken to manage effectiveness</li> </ul>

Nature of Impact	Overview of Measures
Edge effects	<ul style="list-style-type: none"> <li>• Dust suppression techniques will be utilised during construction, to control the dispersion of dust created by clearing lands;</li> <li>• The Project shall implement landscaping and re-vegetation after completion of construction using native species where possible;</li> <li>• To avoid/minimize releasing sediment load into the river, erosion control measures will be implemented and maintained e.g. using silt fence and temporary re-vegetation to minimize sediment transport from steep slope releasing to the waterways; and</li> <li>• Weed and pest management measures should be implemented in accordance with a Project weed and pest management plan to avoid introduction of weeds to natural and modified habitat areas.</li> </ul>
Degradation of habitat	<ul style="list-style-type: none"> <li>• Construction and domestic waste will be appropriately stored and disposed of to avoid attracting native and alien species to the construction areas;</li> <li>• For areas in direct runoff path to a watercourse, sediment and erosion control devices will be installed prior to commencement of vegetation clearance or earthworks and maintained until vegetation replanting can occur to stabilise disturbed surfaces;</li> <li>• Monitoring of erosion and sediment control will be conducted to inspect the proper function of devices</li> <li>• Oil, chemical and solid waste will be stored, and handled and disposed of by appropriately licenced waste management contractors;</li> <li>• Weed and pest management measures should be implemented in accordance with a Project weed and pest management plan to avoid introduction of weeds to natural and modified habitat areas;</li> <li>• Speed limits to maximum of 40 km/hr for construction vehicles will be enforced to limit noise and dust generation;</li> <li>• Construction materials and chemicals will be appropriately secured and locked down during flood season to avoid accidental release to the natural environment;</li> <li>• Emergency response plan and procedures will be prepared and implemented for both construction and operation activities of the Project. This will include emergency drills and education of Project workers.</li> </ul>
Fauna mortality	<ul style="list-style-type: none"> <li>• Speed limits to maximum of 40 km/hr for construction vehicles will be enforced to minimise potential for fauna strike;</li> <li>• Commitment will be made to raise awareness of values of natural habitat areas to construction and operation work force and arrangements will be made for restriction of poaching and forest product collection;</li> <li>• Hunting wild animals will be strictly prohibited to apply for all staff;</li> <li>• UXO clearance and certification will be implemented for the whole construction area; and</li> <li>• Construction activities will only be commenced within the UXO clearance boundary.</li> </ul>

**Table 6.2 Summary of Priority Biodiversity Values Management Measures**

<b>Value/Species</b>	<b>Specific management measures</b>
IUCN listed flora species	<ul style="list-style-type: none"> <li>• Survey identified the presence of two IUCN listed flora species within the disturbance corridor. These species are listed under IUCN will need to be specifically managed within the Biodiversity Action Plan and replanting or propagation may be appropriate</li> <li>• Weed management measures should be implemented in accordance with a Project weed and pest management plan to avoid introduction of weeds to natural and modified habitat areas</li> <li>• Investigate opportunity for replanting the listed species including seed collection and propagation for relocation to offset locations</li> </ul>
Asian elephant	<ul style="list-style-type: none"> <li>• Raise awareness of the species to discourage poaching and contribute to management of human-elephant conflict through education of construction team members and local villagers</li> <li>• Rehabilitation of any disturbed areas as soon as practical after clearing</li> </ul>
Leopard, Asiatic golden cat, Fishing cat	<ul style="list-style-type: none"> <li>• Raise awareness of the species to discourage poaching and contribute to management through education of construction team members and local villagers</li> <li>• Rehabilitation of any disturbed areas as soon as practical after clearing</li> </ul>
Great hornbill, White winged duck, Greater coucal, Siamese fireback, Green peafowl, Grey peacock pheasant, Red-breasted parakeet	<ul style="list-style-type: none"> <li>• Raise awareness of the protection of the species to trade (live birds and feathers) through education of construction team members</li> <li>• Rehabilitation of any disturbed areas as soon as practical after clearing</li> </ul>
Reticulated python	<ul style="list-style-type: none"> <li>• Raise awareness of the species to discourage poaching and contribute to management through education of construction team members and local villagers</li> <li>• Rehabilitation of any disturbed areas as soon as practical after clearing</li> </ul>
Big-headed turtle	<ul style="list-style-type: none"> <li>• Rehabilitation of any disturbed areas as soon as practical after clearing</li> <li>• Raise awareness of the protection of the species from hunting/foraging by construction teams</li> <li>• Pre-clearing survey for presence of individuals prior to tree felling</li> <li>• Compensatory measures for unavoidable habitat loss (see Section 6.4) including watershed management to assist in maintain the quality of existing catchment habitats</li> </ul>
IUCN listed and migratory fish species	<ul style="list-style-type: none"> <li>• Maintain appropriate downstream flows through suitable watercourse crossing structure design</li> <li>• Limit impacts to water quality through appropriate sediment and erosion control during construction</li> <li>• Raise awareness of the protection of the species to discourage overfishing of the species where possible</li> <li>• Establish watershed management to assist in maintain the quality of existing catchment habitats</li> </ul>



### 6.3

#### *RESIDUAL IMPACTS ON BIODIVERSITY VALUES*

Mitigation and management approaches have been considered to avoid, minimise and mitigate potential impacts to biodiversity as a result of Project activities. In general, many of the indirect impacts to biodiversity values can be minimised, such as behavioural disturbances, degradation of habitats, edge effects and barriers to terrestrial fauna movement. The next step of the mitigation hierarchy necessitates consideration biodiversity offsets for residual impacts.

The residual impacts identified relate to unavoidable footprint of 49 ha. Direct disturbance to habitats will be minimised where possible however this impact assessment has identified an unavoidable loss of approximately 28 ha<sup>1</sup> of natural habitat and 19 ha of modified habitat. *Table 6-3* summarises the breakdown of land cover types that will be permanently removed or altered.

**Table 6.3** *Land cover types within the Project Area*

Land cover Type	Total Area (ha)
Deciduous Forest	19
Evergreen Forest	2
Bamboo	7
Old Fallow Land	12
Young Fallow Land	5
Rice Paddy	1
Slash and Burn Land	1
Urban	<1
Water	<1
Shadow	1
Cloud*	<1
<b>Total</b>	<b>49</b>

### 6.4

#### *OFFSETS*

The Biodiversity Offset Design Report provides an analysis of the approach to offset identified residual biodiversity values in accordance with the Business and Biodiversity Offset Program (BBOP) documents:

- Biodiversity Offset Design Handbook (BBOP 2012a); and
- *Resource Paper: No Net Loss and Loss-Gain Calculations in Biodiversity Offsets* (BBOP 2012b).

The Biodiversity Offset Design Report includes the:

<sup>1</sup> As discussed this is an upper estimate.

- methodology and approach to the design of the biodiversity offset (including loss/gain calculations);
- recommended biodiversity offset package (including locations and supplementary environmental contributions);
- proposed delivery mechanisms for the biodiversity offset;
- framework for operational management plans, stakeholder participation programs, monitoring and evaluation arrangements, governance roles and requisite capacities;
- recommended budgets and financial arrangements; and
- analysis of benefit mechanisms and potential compensation requirements.

The impacted habitats and species for the access road have been considered in the assessment of biodiversity offsets for the entire project. This means that offsets required for the access road will be in addition to the offsets required for the inundation area, transmission line and associated facilities.

## RECOMMENDATIONS

The impact assessment evaluated potential impacts relating to a permanent loss of natural habitat, including for endangered IUCN listed species as a Moderate Impact. All other potential impacts are considered to be Negligible or Minor Impact.

Mitigation and minimisation of potential Project impacts identified a number of mechanisms to reduce impacts to biodiversity as a result of the Project, in particular indirect impacts.

In accordance with IFC PS6, an assessment of impact to critical habitat for IUCN listed species was undertaken. The outcomes identified that it is unlikely that the Project area is critical habitat for the candidate species identified.

Other key recommendations of this assessment include preparation and implementation of both a construction and operation Environmental Management Plan. The management plan should include:

- Measures to avoid introduction and spread of weeds or pest animal species to the local area;
- Measures to manage existing weed populations if encountered during construction;
- Emergency spills response procedures;
- Details of education and awareness programs for the workforce relating to threatened species, native species and natural habitat values; and
- Rehabilitation and regeneration procedures.

To accompany the management plan, monitoring procedures should also be developed. Monitoring programs recommended include water quality monitoring and weed monitoring. The monitoring programs should incorporate:

- Monitoring method;
- Equipment required;
- Frequency of monitoring;
- Data analysis or benchmarks for compliance; and
- Reporting requirements.

Compensatory measures will be required to offset the residual impacts that cannot be avoided. The Offset Plan will incorporate the required management and monitoring procedures specific to compensatory measures that are designed and implemented for the Project.

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Annex A

# Proposed Road Component Descriptions

## **A.1** *EXISTING ROAD FROM BAN NOMSOMBOUN TO BAN HAT GNIUN*

Works on the road from Ban Nomsomboun to Ban Hat Gniun will aim to improve all-weather accessibility and riding quality. Current road width varies between 5 and 10 metres (m) with the final width designed to be 5.7 m. Roads will be upgraded through structural overlays; bridges and culverts will be rehabilitated or constructed; and road levels will be raised where required in flood prone areas. Given the very low traffic volumes on the access road, improvement works will take priority over road widening. The road passes through Huay Ngua PPA from km 6+700 to km 18+400. The road is currently recognised as a formal road by the Provincial government (See *Annex C*).

An Alternative Road route was investigated and is discussed in Section 5.3.

### **A.1.1** *JICA Road (Ban Hat Gniun to Dam Site)*

The existing road is very steep and, due to the complex topography, long-term use of the road would require substantial maintenance and repair costs. Instead, the road will be upgraded to allow temporary access to the left bank of the dam site during construction. The current width of the road varies between 4.5 m and 13.5 m with the final width designed to maintain the existing width. Due to a delay in commencement of civil works, the use of JICA road is required to begin excavation of the main dam while a more suitable permanent road is being constructed to improve the overall NNP1 construction schedule. The current road is surrounded by modified and natural habitat.

### **A.1.2** *P1 and P2 (Ban Hat Gniun to dam site)*

Due to the unsuitability of JICA Road for a permanent access road, an alternative permanent road is required. The proposed permanent route (P1) originates from Ban Hat Gniun, by way of the left bank of the re-regulation power house and the administration office, to the power house with switch yard and the dam crest, separately at the left bank. Almost 2 km (at 5.7 m width) of road exists in these segments with an additional 9 km to be created (3.7 m to 9 m width).

### **A.1.3** *Temporary Roads (Ban Hat Gniun to dam site)*

The temporary roads are the roads which will only be used during construction, and are required to support the construction of the dam and associated infrastructure. The main temporary road is T5. The T5 road is required to access the gorge area (Location H, *Figure 1.1*) for the construction of the temporary bridge (Point H to F, *Figure 1.1*) and P2 road. The temporary bridge and P2 road are required for the construction of the diversion tunnel, and will assist in recovering the construction schedule. This road will only be used during the construction period and will be flooded after impounding the re-regulation pond. Other temporary roads will be rehabilitated and revegetated in accordance with the ESMMP-CP for the access road network.



#### A.1.4 *Bridges and Culverts*

The construction of bridges and culverts is required to improve all-weather accessibility to the project site. As of November 2013, one permanent bridge and two permanent culverts have been constructed.

**Table A.1** *Details of bridges and culverts*

Name	Status	Description
Nam Xao	Permanent, constructed 2013	Plate girder bridge, L=40 m, W=5.5 m
Nam Thak	Permanent, constructed 2013	Box culvert, L=11.35 m, W= 12 m
Nam Miang	Permanent, constructed 2013	Box culvert, L=11.35 m, W= 11 m
Temporary bridge	Temporary bridge, planned for construction	Plate girder, L= 90 m, W= 5 m

Source: NNP1PC November 2013

#### A.1.5 *Supporting Infrastructure*

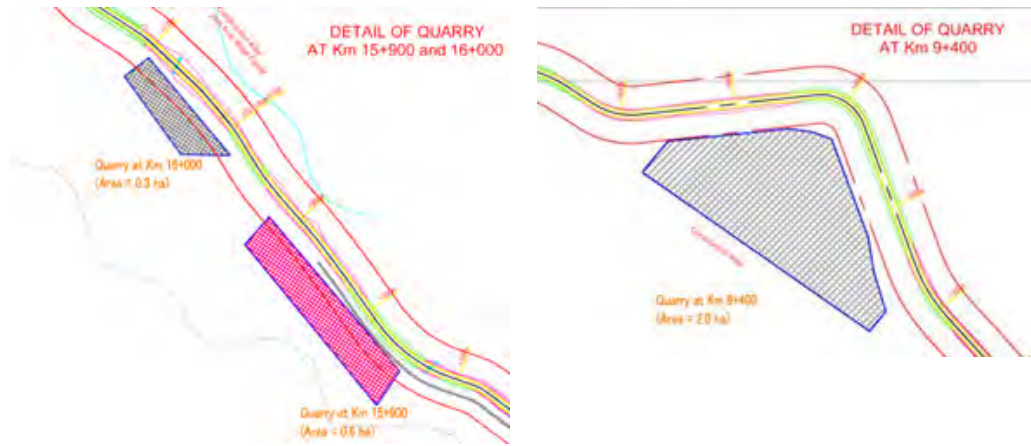
In addition to road upgrades and construction, supporting infrastructure is required. This includes bridges, as well as temporary infrastructure, such as a worker camp, a quarry, a moveable crushing plant, batching plant, spoil area and borrow area. Details of supporting infrastructure are provided in the table below.

**Table A.2** *Details of supporting infrastructure*

Name	Description	Location
Worker camps	Two workers camps will be constructed in separate locations, totalling 2 ha of land.	STA 20 km, STA 23.5 km (Draft). Location is a minimum of 1.3 km from existing villages.
Quarry	Estimated extracted quantity; 120,000 m <sup>3</sup> . STA 9.4km - 2.0ha; STA 15.9km - 0.6 ha; STA 16.0km - 0.3 ha.	Quarries are located at STA 9.4 km, 15.9 km and 16.0 km, adjacent the existing permanent road from Ban Nomsomboun to Ban Hat Gnium within Huay Ngua PPA. There is no candidate site outside the PPA. (See <i>Error! Reference source not found.</i> ).
Batching Plant	To be used for construction of temporary bridge. Specification not yet decided.	Planned to install near RCC plant yard - Location E in Figure 2.4
Crushing Plant	Gravel to be crushed by movable crushing facility.	Moveable facility will be located at the quarry in use (STA 9.4 km, 15.9 km, 16.0 km (See <i>Error! Reference source not found.</i> )).
Spoil area	To be disposed in fill section. Estimated disposal capacity; 0.8 M m <sup>3</sup> .	To be disposed in fill section STA 28.1 km, along permanent road P1 on Figure 2.4.
Borrow area	Extracted soil volume approximately 86,000 m <sup>3</sup> , across a 3.4 ha area.	Around STA 18.5 km and STA 21.7 km and STA 22.6 km (Draft).

Source: NNP1PC (November 2013)

Figure A.1 Quarry locations in relation to access road (NNP1PC - September 2013)



Annex B

## Stakeholder Engagement

## **B.1**            *STAKEHOLDER ENGAGEMENT*

### **B.1.1**        *Stakeholder Identification*

*Table* identifies the external stakeholders that may have an interest in or be affected by the construction and operation of the Proposed Road. This includes the villages that will be directly and indirectly affected by development of the Proposed Road.

**Table B.1**     *Summary of Stakeholders*

<b>Group</b>	<b>Stakeholder</b>
Government of Lao PDR	Prime Minister's Office Ministry of Natural Resources and the Environment Ministry of Agriculture Ministry of Communication, transport, Post and Construction Ministry of Industry and Commerce Ministry of Labor and Social Welfare Ministry of Information and Culture Ministry of Education Ministry of Health Ministry of Energy and Mines
Provincial Authorities	Bolikhamxay Province
District Authorities	Bolikhan District
Project Affected Persons	Ban Nomsomboun villagers Ban Thaheua villagers Ban Hat Gniun villagers Ban Hatsaykham villagers Ban Sisavath villagers
Village members/ sectors	Village headman and deputy Village security Police Health volunteers Youth Lao Women's Union Front for National Construction

### **B.1.2**        *Consultation Activities*

The stakeholders set out in the above have been engaged as part of the impact assessment and management planning for the Proposed Road. This includes impacts associated with temporary resettlement, such as compensation.

The table below provides a list of relevant consultation activities that have been conducted over the past few years.



**Table B.2** *Summary of Consultation Activities*

<b>Activity</b>	<b>Date</b>	<b>Purpose</b>	<b>Attendees</b>
Consultation meeting	11 July 2013	Discuss environmental impacts associated with the construction period and proposed management measures.	Representatives from Ban Hat Gniun and Ban Hatsaykham
Consultation Meeting	9 April 2013	Discuss environmental impacts associated with the construction period and proposed management measures.	Bolikhan District Vice Governor Bolikhan District Administration Office Bolikhan District Energy and Mines Bolikhan District Public Works and Transportation Bolikhan District Natural Resources and Environment Hatxaykhan Village Deputy Chief, Public Security and Personal Inspection Ban Thaheua Village Chief, Deputy Chief, Personal Inspection and Front for National Construction Ban Sisavath Village Chief Ban Nomsomboun Village Chief, Deputy Chief, District Army Office
Consultation meeting	June 2012	Discuss alignment of access road, including resettlement and compensation	Ban Sisavath villager representatives Government representatives
Consultation meeting	26 September 2011	Discuss potential social impacts, including resettlement and compensation	Ban Hat Gniun villagers Government representatives
Consultation meeting	26 September 2011	Discuss potential social impacts, including resettlement and compensation	Ban Thaheua villagers Government representatives
Consultation meeting	25 September 2011	Discuss potential social impacts, including resettlement and compensation	Ban Hatsaykham villagers Government representatives
Consultation meeting	16 January 2008	Discuss potential social impacts, including resettlement and compensation	Bolikham District villagers Government representatives
Consultation meeting	29 October 2007	Discuss potential social impacts, including resettlement and compensation	Ban Hat Gniun villagers Government representatives

The meetings held on 9 April 2013 and 11 July 2013 were pre-arranged with local villagers and relevant authorities. The meetings included an introduction to NNP1PC and the Project and an overview of the predicted environmental impacts and corresponding mitigation measures. This information was delivered through a presentation provided by the representatives of NNP1PC.

The table below summarises the key concerns and issues raised during the consultation activities above.

**Table B.3** *Summary of Consultation Outcomes*

Issue	Concern/ Issue	Owner's Response
Land access	There is concern amongst stakeholders that project affected people will lose their access/ use of the 'right of way'. There is also concern about potential encroachment on indigenous lands.	Based on a land use survey, the Owner confirmed that people may be affected by the access road. The number of actual affected people depends on the final road design, which is to be determined at a later date.
Noise	There is concern about the generation of noise as a result of construction activities.	The Owner will install sound control devices in heavy machinery, as appropriate.
Dust	There is concern about the generation of dust as a result of construction activities.	The Owner will spray water by using water tank truck during construction period.
Water	There is concern about potential impacts to water quality, such as increased turbidity due to erosion. This could negatively impact on the presence of fish in local waterways.	The Owner's response was guided by the entitlement matrix.
Compensation	There were concerns about fair and equitable compensation for local of land - e.g. reduction in agricultural land, access to cemeteries.	Based on a land use survey, the Owner confirmed that people may be affected by the access road. The number of actual affected people depends on the final road design, which is to be determined at a later date along with compensation
Employment	There is a desire to see employment opportunities for local people.	The Owner will employ Lao citizens in accordance with Concession Agreement. As for the local people, Construction Contractor will employ as much as practicable.
Safety	There is concern about the potential for traffic accidents to increase. This is associated with an increase in construction traffic as well as improved road conditions (e.g. improved access). Traffic management measures were recommended (e.g. safety signage, speed limits).  This was of particular concern given the proximity of the access road schools and residential areas.	The Owner will take necessary measures to prevent road accidents by installing traffic sign and setting limited speed zone, etc.

The outcomes of the engagement have informed development of the management plans for the Proposed Road. This includes management of

resettlement, which has included development of approaches to compensation. The outcomes have also informed development of a grievance management mechanism, which provides an avenue for local villagers (including affected people) and government authorities can lodge complains and concerns.

Approval from the Provincial government was granted in April 2013 to upgrade the existing road.

### **B.1.3** *Information Sources*

The information presented in the Tables above has been drawn from a desktop review of the following documentation:

- Environmental and Social Monitoring and Management Plan for Access Road Construction and Other Preliminary Works – Volume I: Obligations, Plans and Programs – August 2013 (Prepared by ERM);
- Nam Ngiep 1 Hydropower Project Social Impact Assessment Report -May 2012 (Prepared by Sriburi T., Kroutnoi L., Suntornvongsagul K., Rujiravanich S., and Mehl C.B.); and
- Nam Ngiep 1 Hydropower Project Resettlement and Ethnic Minority Development Plan Draft Report – May 2012 (Prepared by Sriburi T., Kroutnoi L., Suntornvongsagul K., Rujiravanich S., and Mehl C.B.); and
- Consent forms that have been signed by relevant stakeholders associated with temporary resettlement.

Annex C

Approval From The  
Provincial Government To  
Construction The Road



Annex D

## Species Specialist Input

**Table D1**      **Species Specialist Input**

<b>Specialist</b>	<b>Relevant Species</b>	<b>Comment</b>
Pheng Phengsintham (National University of Laos)	Flora species	Engaged to ground truth the access road and provide specialist comment for some candidate threatened flora species
Ajay Desai (Asian Elephant Specialist Group)	Asian elephant	Provided comment relating to the global and regional population, behaviours and threats. Provided advice to contact Lao PDR elephant specialist
Kham khoun Khounboline (WWF Greater Mekong)	Asian elephant	Provided specialist comment relating to the known elephant populations near the Nam Ngiep River and proximal important areas for the species
Dr Will Duckworth (Independent Researcher)	All mammals, birds and some reptiles	Engaged to review species profiles and comment on critical habitat status for bird and mammal species. Provided specialist comment and feedback to refine species profiles
Dr Peter Paul van Dijkp (Tortoise and Freshwater Turtle Specialist Group)	Big headed turtle	Provided specialist comment relating to likely habitat areas in the Project area based on habitat preference and threats to the species as a result of the Project.
Richard Hearne (IUCN SSC Duck Specialist Group)	White-winged duck	No advice
Baz Hughes (Wildfowl and Wetlands Trust)	White-winged duck	No advice
Professor Gordon McGregor Reid	Fish species	Provided contacts
Dr Maurice Kottelat	Fish species	Engaged to review species profiles and comment on critical habitat status for fish species. Highlighted data gaps and subsequently engaged to undertake fast water habitat survey and report findings. Provided specialist comment for all fish species and feedback to refine species profiles.

Annex E

Nam Ngiep One Power  
Company Limited Botanist  
Report

Annex F

## TISTR Flora Survey Results



Family	Scientific Name	IUCN Status
Alangiaceae	<i>Alangium chinense</i>	
Anacardiaceae	<i>Rhus succedanea</i>	
Annonaceae	<i>Melodorum fruticosum</i>	
Annonaceae	<i>Polyalthia cerasoides</i>	
Annonaceae	<i>Polyalthia parviflora</i>	
Annonaceae	<i>Xylopia vielana</i>	
Apocynaceae	<i>Alstonia glaucescens</i>	
Bignoniaceae	<i>Stereospermum cylindricum</i>	
Celastraceae	<i>Lophopetalum duperreanum</i>	
Dilleniaceae	<i>Dillenia obovata</i>	
Dipterocarpaceae	<i>Anisoptera costata</i>	EN
Dipterocarpaceae	<i>Dipterocarpus alatus</i>	EN
Dipterocarpaceae	<i>Hopea ferrea</i> Laness	
Dipterocarpaceae	<i>Shorea roxburghii</i>	EN
Dipterocarpaceae	<i>Shorea thorelii</i>	
Dipterocarpaceae	<i>Vatica odorata</i>	
Ebenaceae	<i>Diospyros lanceifolia</i>	
Ebenaceae	<i>Diospyros mollis</i>	
Ebenaceae	<i>Diospyros sp.</i>	
Elaeocarpaceae	<i>Elaeocarpus sphaericus</i>	
Euphorbiaceae	<i>Antidesma sp.</i>	
Euphorbiaceae	<i>Aporaosa villosa</i>	
Euphorbiaceae	<i>Baccaurea ramiflora</i>	
Euphorbiaceae	<i>Balakata sp.</i>	
Euphorbiaceae	<i>Cleidion spiciflorum</i>	
Euphorbiaceae	<i>Croton cascarillicdes</i>	
Euphorbiaceae	<i>Croton roxburghii</i>	
Euphorbiaceae	<i>Drypetes cambodica</i>	
Euphorbiaceae	<i>Gonocaryum lobbianum</i>	
Euphorbiaceae	<i>Macaranga denticulata</i>	
Euphorbiaceae	<i>Mallotus paniculatus</i>	
Fagaceae	<i>Lithocarpus auriculatus</i>	
Gramineae	<i>Gigantochloa albociliata</i>	
Guttiferae	<i>Calophyllum thorelli</i>	
Guttiferae	<i>Cratoxylum formosum</i>	
Guttiferae	<i>Garcinia speciosa</i>	
Icacinaceae	<i>Gonocaryum lobbianum</i>	
Irvingiaceae	<i>Irvingia malayana</i>	
Irvingiaceae	<i>Irvingia malayana</i>	
Labiatae	<i>Gmelina arborea</i>	
Labiatae	<i>Vitex peduncularis</i>	
Labiatae	<i>Vitex pinnata</i>	
Labiatae	<i>Vitex scabra</i>	
Lauraceae	<i>Cryptocarya costata</i>	
Lauraceae	<i>Litsea glutinosa</i>	
Leguminosae-Caesalpinoideae	<i>Azelia xylocarpa</i>	EN
Leguminosae-Caesalpinoideae	<i>Peltophorum dasyrachis</i>	
Leguminosae-Mimosoideae	<i>Adenanthera lucidior</i>	

Family	Scientific Name	IUCN Status
Leguminosae-Mimosoideae	<i>Archidendron clypearia</i>	
Leguminosae-Papilionoideae	<i>Callerya atropurpurea</i>	
Leguminosae-Papilionoideae	<i>Dialium cochinchinensis</i>	
Leguminosae-Papilionoideae	<i>Millettia leucantha</i>	
Leguminosae-Papilionoideae	<i>Pterocarpus macrocarpus</i>	
Leguminosae-Caesalpinoideae	<i>Peltophorum dasyrachis</i>	
Lythraceae	<i>Lagerstroemia calyculata</i>	
Malvaceae	<i>Talipariti macrophyllus</i>	
Meliaceae	<i>Sandoricum koetjape</i>	
Moraceae	<i>Artocarpus rigidus</i> subsp. <i>rigidus</i>	
Moraceae	<i>Ficus annulata</i>	
Moraceae	<i>Ficus callosa</i>	
Moraceae	<i>Ficus hispida</i> var. <i>hispida</i>	
Moraceae	<i>Ficus tinctoria</i> subsp. <i>gibbosa</i>	
	<i>Cleistocalyx nervosum</i> var. <i>nervosum</i>	
Myrtaceae	<i>Syzygium antisepticum</i>	
Myrtaceae	<i>Syzygium oblatum</i>	
Polygalaceae	<i>Xanthophyllum lanceatum</i>	
Proteaceae	<i>Helicia nilagirica</i>	
Rubiaceae	<i>Gardinia sootepensis</i>	
Rubiaceae	<i>Mitragyna diversifolia</i>	
Rubiaceae	<i>Nauclea orientalis</i>	
Rubiaceae	<i>Rothmannia wittii</i>	
Rutaceae	<i>Acronychia pedunculata</i>	
Sterculiaceae	<i>Pterospermum acerifolium</i>	
Sterculiaceae	<i>Pterospermum littorale</i>	
Sterculiaceae	<i>Pterospermum megalocarpum</i>	
Theaceae	<i>Schima wallichii</i>	
Theaceae	<i>Ternstroemia wallichiana</i>	VU

Annex G

## TISTR Fauna Survey Results

Family/Common Name	Scientific Name	Huay Ngua (PAFO)	Huay Ngua (TSTR 2013)	Lao Status	IUCN Status
<b>Mammals</b>					
Black giant squirrel	<i>Ratufa bicolor</i>	X			NT
Pallas's squirrel	<i>Callosciurus erythraeus</i>	X			LC
Large brown flying squirrel	<i>Petaurista philippensis</i>	X			LC
Large bamboo rat	<i>Rhizomys sumatrensis</i>	X		P	LC
Asiatic golden cat	<i>Pardofelis temminckii</i>	X		R	NT
Leopard	<i>Panthera pardus</i>	X		R	NT
Himalayan black bear	<i>Ursus thibetanus</i>	X			VU
Sun bear	<i>Helarctos malayanus</i>	X			VU
Asiatic brush-tailed porcupine	<i>Atherurus macrourus</i>	X			LC
Malayan porcupine	<i>Hystrix brachyura</i>	X			LC
Lesser bamboo bat	<i>Tylonycteris pachypus</i>		X		LC
Wild boar	<i>Sus scrofa</i>	X			LC
Sambar	<i>Rusa unicolor</i>	X			VU
Striped-back weasel	<i>Mustela strigidorsa</i>	X			LC
Roosevelts' muntjac	<i>Muntiacus rooseveltorum</i>	X			
Red-cheeked squirrel	<i>Dremomys rufigenis</i>	X			LC
Red muntjac	<i>Muntiacus muntjak</i>	X			LC
Lesser mouse deer	<i>Tragulus javanicus</i>	X			
Large spotted civet	<i>Viverra megaspila</i>	X			VU
Jungle cat	<i>Felis chaus</i>	X			LC
Irrawaddy squirrel	<i>Callosciurus pygerythrus</i>	X			LC
Gaur	<i>Bos gaurus</i>	X			VU
Fishing cat	<i>Prionailurus viverrinus</i>	X			EN
Clouded leopard	<i>Neofelis nebulosa</i>	X			VU
Black flying squirrel	<i>Aeromys tephromelas</i>	X			
Bermore's squirrel	<i>Menetes bermorei</i>	X			LC
Asian elephant	<i>Elephas maximus</i>	X			EN
<b>Birds</b>					
Shikra	<i>Accipiter badius</i>		X		LC
Common myna	<i>Acridotheres tristis</i>	X			LC
Common kingfisher	<i>Alcedo atthis</i>	X			LC
White breasted waterhen	<i>Amaurornis phoenicurus</i>	X			LC
Garganey	<i>Anas querquedula</i>	X			LC
Imperial eagle	<i>Aquila heliaca</i>	X			VU
Scaly-breasted partridge	<i>Arborophila chloropus</i>	X			LC
Spot-bellied eagle owl	<i>Bubo nipalensis</i>	X			LC



Family/Common Name	Scientific Name	Huay Ngua (PAFO)	Huay Ngua (TSTR 2013)	Lao Status	IUCN Status
Great hornbill*	<i>Buceros bicornis</i>	X		R	NT
Plaintive cuckoo	<i>Cacomantis merulinus</i>		X		LC
Woolly-necked stork	<i>Ciconia episcopus</i>	X			LC
White-winged duck	<i>Cairina scutulata</i>	X			EN
Greater coucal	<i>Centropus sinensis</i>	X	X	R	LC
Emerald dove	<i>Chalcophaps indica</i>		X		LC
Tickell's blue-flycatcher	<i>Cyornis tickelliae</i>		X		LC
Scarlet-backed flowerpecker	<i>Dicaeum cruentatum</i>		X		LC
Greater racket-tailed drongo	<i>Dicrurus paradiseus</i>		X		LC
Asian koel	<i>Eudynamis scolopacea</i>	X			
Red junglefowl	<i>Gallus gallus</i>	X			LC
Hill myna	<i>Gracula religiosa</i>	X	X	P	LC
Brahminy kite	<i>Haliastur indus</i>	X			LC
Brown-backed needletail	<i>Hirundapus giganteus</i>		X		LC
Black-naped monarch	<i>Hypothymis azurea</i>		X		LC
Lesser fish eagle	<i>Ichthyophaga humilis</i>	X			NT
Grey-headed fish eagle	<i>Ichthyophaga ichthyaetus</i>	X			NT
Grey-eyed bulbul	<i>Iole propinqua</i>		X		LC
Scaly-breasted munia	<i>Lonchura punctulata</i>		X		LC
Siamese fireback	<i>Lophura diardi</i>	X		R	LC
Silver pheasant	<i>Lophura nycthemera</i>	X		R	LC
Pin-striped tit-babbler	<i>Macronous gularis</i>		X		LC
Lineated barbet	<i>Megalaima lineata</i>		X		LC
Green-eared barbet	<i>Megalaima faiostricta</i>		X		LC
Coppersmith barbet	<i>Megalaima haemacephala</i>		X		LC
Great barbet	<i>Megalaima virens</i>	X			LC
Asian brown flycatcher	<i>Muscicapa dauurica</i>		X		LC
Painted stork	<i>Mycteria leucocephala</i>	X			NT
Cotton pygmy goose	<i>Nettapus coromandelianus</i>	X			LC
Common tailorbird	<i>Orthotomus sutorius</i>		X		LC
Collared scops-owl	<i>Otus bakkamoena</i>		X	P	LC
Green peafowl	<i>Pavo muticus</i>	X			EN
Puff-throated babbler	<i>Pellorneum ruficeps</i>		X		LC
Asian golden weave	<i>Ploceus hypoxanthus</i>	X			
Little cormorant	<i>Phalacrocorax niger</i>	X			LC
Grey peacock-pheasant*	<i>Polyplectron bicalcaratum</i>	X		R	LC
White-browed scimitar-babbler	<i>Pomatorhinus schisticeps</i>		X		LC

Family/Common Name	Scientific Name	Huay Ngua (PAFO)	Huay Ngua (TSTR 2013)	Lao Status	IUCN Status
Red-breasted parakeet	<i>Psittacula alexandri</i>	X	X	R	LC
Blossom-headed parakeet	<i>Psittacula roseata</i>		X	P	LC
Black-headed bulbul	<i>Pycnonotus atriceps</i>		X		LC
Black-crested bulbul	<i>Pycnonotus melanicterus</i>		X		LC
Streak-eared bulbul	<i>Pycnonotus blanfordi</i>		X		LC
Crested argus	<i>Rheinardia ocellata</i>	X			LC
Crested serpent-eagle	<i>Spilornis cheela</i>		X		LC
Spotted dove	<i>Stigmatopelia chinensis</i>	X	X	P	LC
Red collared dove	<i>Streptopelia tranquebarica</i>	X			LC
Orange-breasted green-pigeon	<i>Treron bicinctus</i>		X	P	LC
Barred buttonquail	<i>Turnix suscitator</i>	X			
Hoopoe	<i>Upupa epops</i>	X			LC
Red-wattled lapwing	<i>Vanellus indicus</i>	X			LC
<b>Reptiles</b>					
Reticulated python	<i>Broghammerus reticulatus</i>	X		R	
Common garden lizard	<i>Calotes versicolor</i>		X		
Radiated snake	<i>Elaphe radiata</i>	X			
Tokay gecko	<i>Gekko gekko</i>		X		
Common house gecko	<i>Hemidactylus frenatus</i>		X		LC
Impressed tortoise	<i>Manouria impressa</i>	X			VU
Big-headed turtle	<i>Platysternon megacephalum</i>	X			EN
Asian water dragon	<i>Physignathus cocincinus</i>	X			
Common water monitor	<i>Varanus salvator</i>	X			LC
<b>Amphibians</b>					
Common Asiatic toad	<i>Bufo melanostictus</i>	X			LC
Asian Grass frog	<i>Fejervarya limnocharis</i>		X		LC
Dark-sided frog	<i>Hylarana nigrovittata</i>		X		LC
Bony-headed toad	<i>Ingerophrynus galeatus</i>		X		LC
Malaysian narrowmouth toad	<i>Kaloula pulchra</i>		X		LC
Large-headed frog	<i>Limnonectes kuhlii</i>		X		LC
Berdmore's narrow-mouthed frog	<i>Microhyla berdmorei</i>		X		LC
Common lowland frog	<i>Rana rugulosa</i>	X			LC
Unidentified	<i>Rana sp.</i>		X		
<b>Fish</b>					
Horseface loach	<i>Acantopsis choirorhynchos</i> <sup>#</sup>		X		LC

Family/Common Name	Scientific Name	Huay Ngua (PAFO)	Huay Ngua (TSTR 2013)	Lao Status	IUCN Status
Goonch	<i>Bagarius yarrelli</i>	X			NT
Java barb	<i>Barbonymus gonionotus</i> #		X		LC
	<i>Catlocarpio siamensis</i>	X			CR
Dwarf snakehead	<i>Channa gachua</i>		X		LC
Small scaled mud carp	<i>Chitala blanci</i>	X			
	<i>Cirrhinus microlepis</i>	X			
Mud carp	<i>Cirrhinus molitorella</i>	X			NT
Walking catfish	<i>Clarias batrachus</i> #		X		LC
Laos danio	<i>Devario laoensis</i>		X		LC
Redtail catfish	<i>Hemibagrus nemurus</i>		X		LC
	<i>Hemisilurus mekongensis</i>	X			LC
Black tail catfish	<i>Hermibagrus wycki</i>	X			LC
	<i>Lepidocephalichthys furcatus</i>		X		
	<i>Luciosoma bleekeri</i> #	X			LC
Tiretrack spiny eel	<i>Mastacembelus armatus</i> #		X		LC
	<i>Mastacembelus favus</i> #		X		LC
Bleekers sheatfish	<i>Micronema bleekeri</i>	X			
	<i>Monotretes leiurus</i>		X		LC
Spiny barb	<i>Mystacoleucus atridorsalis</i> #		X		LC
	<i>Mystacoleucus marginatus</i>		X		LC
	<i>Mystus singaringan</i> #		X		LC
Long finn mystus	<i>Nemacheilus pallidus</i>		X		LC
	<i>Nemacheilus platiceps</i>		X		
	<i>Notopterus notopterus</i>	X			NT
Clown knifefish	<i>Opsarius koratensis</i>		X		LC
	<i>Oxyeleotris mos morata</i> #	X			LC
Striped catfish	<i>Pangasianodon hypophthalmus</i>	X			EN
Black-spotted catfish	<i>Pangasius larnaudiei</i>	X			LC
Yellow tail brook barb	<i>Poropuntius deauratus</i>		X		EN
	<i>Probarbus labeamajor</i>	X			EN
Bumblebee catfish	<i>Pseudomystus siamensis</i> #		X		LC
	<i>Puntius rhombeus</i>		X		LC
Sidestripe rasbora	<i>Rasbora paviana</i>		X		LC
Bandan sharp-mouth	<i>Scaphognathops</i>		X		VU

Family/Common Name	Scientific Name	Huay Ngua (PAFO)	Huay Ngua (TSTR 2013)	Lao Status	IUCN Status
barb	<i>bandanensis</i>				
Sikuk barb	<i>Sikukia gudgeri</i> #		X		
	<i>Wallago leeri</i>	X		R	
Freshwater garfish	<i>Xenentodon cancila</i> #		X		
	<i>Yasuhikotakia splendida</i>		X		VU
Lao Status: R - Reserved species (Category 1); P - Protected species (Category 2) under the Regulation of the Ministry of Agriculture and Forestry No. 0360/MAF					
IUCN Status: CR - Critically endangered; EN - Endangered; VU - Vulnerable; NT - Near threatened; LC - Least concern					
# represented migratory species					



Annex H

## Critical Habitat Candidate Species Profiles

Species	<i>Afzelia xylocarpa</i>
<b>Candidate Criteria</b>	Criterion 1 - The species is listed as Endangered on the IUCN Red List
<b>Record</b>	<p><i>Direct</i></p> <p>TISTR 2013 survey recorded the species at the main dam inundation, re-regulation dam inundation, resettlement area, transmission line, Huay Ngua and upper and lower Nam Ngiep sampling plots.</p> <p>NUL ground-truthing of the access road did not detect the species within the search areas.</p> <hr/> <p><i>Indirect</i></p> <p>-</p>
<b>Distribution</b>	The species is native to Cambodia, India, Lao PDR, Myanmar, Thailand and Viet Nam. TISTR survey detected the species at a number of locations throughout the Nam Ngiep catchment and it was also detected in upper and lower Nam Xan sampling plots. Specialists advice from Dr Pheng Phengsintham indicates that the distribution in Lao PDR includes Vientiane capital, Phouhin Namno National Biodiversity Conservation Area (pers. comm. 7/12/2013).
<b>Population</b>	Limited information is available regarding the population size of the species locally and globally however the direct data indicates a number of records locally.
<b>Habitat</b>	This tree is reported to grow in dense forest habitats and in transitional areas between evergreen and dry open dipterocarp forest. Altitude range of 100-650m in areas with uniform rainfall range, 1000-1500mm/year, a dry season of 5-6 months, mean annual temperature of 20-32°C is listed. Flowers March-April, fruiting September-December.
<b>Threats</b>	In Viet Nam the timber is values for carpentry. Other reports suggest the tree is harvested for medicinal purposes, pulp for cigarettes as well as wood turning
<b>Summary</b>	This species has been noted within a number of sampling plots during survey of the Nam Ngiep and Nam Xan catchment hence it appears that the species is disturbed across the region. The species is also known from Vientiane and a protected area in the south of Lao PDR. Given the distribution of known records it is considered <b>unlikely that the Project area sustains &gt;10 per cent of the global population (Tier 1), or, habitat of significant important or containing nationally important concentrations (Tier 2)</b> . Measures such as planting and management of harvesting threats locally will assist in managing the local population of the species.
<b>References</b>	<p>Nghia, N.H. 1998. <i>Afzelia xylocarpa</i>. In: IUCN Red List of Threatened Species. Version 2013.1. <a href="http://www.iucnredlist.org">www.iucnredlist.org</a> Downloaded on 26 August 2013.</p> <p>Danida Forest Seed Centre Seed Leaflet No. 6 September 2000 <i>Afzelia xylocarpa</i> (Kurz) Craib</p>

Species	<i>Anisoptera costata</i>
<b>Candidate Criteria</b>	Criterion 1 - The species is listed as Endangered on the IUCN Red List
<b>Record</b>	<p><i>Direct</i></p> <p>TISTR 2013 survey recorded the species in a sampling plot within the Huay Ngua PPA survey in lower mixed deciduous forest habitat. The species was also detected in the upper Nam Xan and upper Nam Ngiep survey locations. DFRM road corridor survey identified 254 stems of the species. NUL ground-truthing survey identified the species within and outside of the road corridor.</p> <hr/> <p><i>Indirect</i></p> <p>-</p>
<b>Distribution</b>	The species is native to Brunei, Cambodia, Indonesia, Malaysia, Myanmar, Philippines, Singapore, Thailand and Viet Nam (Ashton, 1998c). It is not reported to be native to Lao PDR. TISTR survey detected the species at a number of locations throughout the Nam Ngiep catchment.
<b>Population</b>	Limited information is available regarding the population size of the species locally and globally however the recent survey noted the species as a dominant tree species within the Proposed Road and in the adjacent area.
<b>Habitat</b>	It is reported to grow in semi-evergreen dipterocarp, evergreen and humid lowland forest.
<b>Threats</b>	The species is an economic tree and used for house construction.
<b>Summary</b>	<p>This species was detected in the Huay Ngua PPA survey locations (by TISTR 2013) and more recently during ground-truthing of the disturbance corridor (by NUL 2013).</p> <p>The species is not native to Lao PDR and as such is not considered a priority biodiversity value. <b>The species is not a candidate for critical habitat within the Project area.</b></p>
<b>References</b>	Ashton, P. 1998. <i>Anisoptera costata</i> . In IUCN 2013. IUCN Red List of Threatened Species Version 2013.1. <a href="http://www.iucnredlist.org">www.iucnredlist.org</a> . Downloaded on 12 September 2013.

Species	<i>Dalbergia oliveri</i>
<b>Candidate Criteria</b>	Criterion 1 - The species is listed as Endangered on the IUCN Red List
<b>Record</b>	<p><i>Direct</i></p> <p>TISTR 2013 survey recorded in a sampling plot within the Huay Ngua PPA survey in lower mixed deciduous forest habitat. The species was also detected in the main dam, re-regulation dam, resettlement site, transmission line, lower Nam Xan and upper Nam Ngiep survey locations.</p> <p>DFRM survey and NUL ground-truthing did not detect the species within the search areas.</p> <hr/> <p><i>Indirect</i></p> <p>-</p>
<b>Distribution</b>	This species is not native to Lao PDR. It is native to Myanmar, Thailand and Viet Nam. TISTR survey detected the species at a number of locations throughout the Nam Ngiep catchment.
<b>Population</b>	Limited information is available regarding the population size of the species locally and globally.
<b>Habitat</b>	It is reported to be scattered among dense evergreen and semi-deciduous forest of up to 1200 m elevation.
<b>Threats</b>	
<b>Summary</b>	This species was detected in the PPA survey locations (2013) however was not recorded within the disturbance area for the Project during ground truthing. The species is not native to Lao PDR and as such is not considered a priority biodiversity value. <b>The species is not a candidate for critical habitat within the Project area.</b>
<b>References</b>	Nghia, N.H. 1998. <i>Dalbergia oliveri</i> . In: IUCN Red List of Threatened Species. Version 2013.1. <a href="http://www.iucnredlist.org">www.iucnredlist.org</a> Downloaded on 26 August 2013.

Species	<i>Dipterocarpus alatus</i>
<b>Candidate Criteria</b>	Criterion 1 - The species is listed as Endangered on the IUCN Red List
<b>Record</b>	<p><i>Direct</i></p> <p>TISTR 2013 survey recorded in a sampling plot within the Huay Ngua PPA survey in lower mixed deciduous forest habitat. The species was also detected in the, upper Nam Xan, upper Nam Ngiep and lower Nam Ngiep survey locations.</p> <p>DRFM survey detected 159 <i>Dipterocarpus turbinatus</i> stems within the search area.</p> <p>NUL ground-truthing survey identified the species along the JICA Road and outside of the road corridor.</p> <hr/> <p><i>Indirect</i></p> <p>-</p>
<b>Distribution</b>	This species is not native to Lao PDR. It is native to Bangladesh, Cambodia, India, Myanmar, Philippines, Thailand and Viet Nam. The species is common in Southeast Asian countries. Phengsintham (2013) notes recording the species in several Lao PDR provinces including Vientiane capital, Bolikhamxay, Khammouane, Savannekhet, Saravane, Champasak and Attapeu.
<b>Population</b>	Limited information is available regarding the population size of the species locally and globally however the NUL survey noted the species both within the Proposed Road and in the adjacent area.
<b>Habitat</b>	In Indo-China and Thailand the species occurs gregariously along river banks, and in the Philippines it is found in mixed dipterocarp forest. It is a tropical tree of dense evergreen and mixed dense forest.
<b>Threats</b>	The major threat to the species is habitat loss. In Cambodia it is a valued construction timber and resin used for proofing and traditional medicine.
<b>Summary</b>	This species was detected in the PPA survey locations (2013) as well as the DFRM and NUL surveys. The species is not native to Lao PDR and as such is not considered a priority biodiversity value. <b>The species is not a candidate for critical habitat within the Project area.</b>
<b>References</b>	Ashton, P. 1998. <i>Dipterocarpus alatus</i> . In IUCN 2013. IUCN Red List of Threatened Species Version 2013.1. <a href="http://www.iucnredlist.org">www.iucnredlist.org</a> . Downloaded on 21 August 2013.



Species	<i>Dipterocarpus turbinatus</i>
<b>Candidate Criteria</b>	Criterion 1 - The species is listed as Critically Endangered on the IUCN Red List
<b>Record</b>	<p><i>Direct</i></p> <p>TISTR 2013 survey recorded in a sampling plot within the Huay Ngua PPA survey in lower mixed deciduous forest habitat. The species was also detected in the main dam, re-regulation dam, lower Nam Xan and upper Nam Ngiep survey locations.</p> <p>DFRM survey and NUL ground-truthing did not detect the species within the search areas.</p> <hr/> <p><i>Indirect</i></p> <p>-</p>
<b>Distribution</b>	The species is native to Bangladesh, Cambodia, India, Lao PDR, Myanmar, Thailand and Viet Nam. TISTR survey detected the species at a number of locations throughout the Nam Ngiep catchment. Hossain and Nath note that in Bangladesh the species scattered in the tropical ever-green forests and tropical semi evergreen forests of Chittagong, Chittagong Hill Tracts, Cox's Bazar and Sylhet while in Myanmar the species has a comparatively wide distribution in tropical semi evergreen forests and tropical moist deciduous forest. Dr Pheng Phengsintham indicated that the distribution in Lao PDR includes Vientiane province (pers. comm. 7/12/2013).
<b>Population</b>	Limited information is available regarding the population size of the species locally and globally.
<b>Habitat</b>	The species is found in mixed deciduous, evergreen and semi-evergreen forests. It is reported to often occur in wet dense forest.
<b>Threats</b>	In some countries the resin of the tree is used to prepare torches.
<b>Summary</b>	This species has been noted within the PPA boundary and affords a distribution across a number of countries outside Lao PDR. It was not recorded within the disturbance area for the Project during ground-truthing. Given the distribution of known records it is considered <b>unlikely that the Project area sustains &gt;10 per cent of the global population (Tier 1), or, habitat of significant important or containing nationally important concentrations (Tier 2).</b>
<b>References</b>	<p>Ashton, P. 1998. <i>Dipterocarpus turbinatus</i>. In IUCN 2013. IUCN Red List of Threatened Species Version 2013.1. <a href="http://www.iucnredlist.org">www.iucnredlist.org</a>. Downloaded on 21 August 2013.</p> <p>Hossain, M. K. and Nath, P.K. Part II Species Descriptions: <i>Dipterocarpus turbinatus</i> Gaertn. Institute of Forestry and Environmental Sciences, Chittagong University, Bangladesh</p>

Species	<i>Shorea roxburghii</i> , White Meranti
<b>Candidate Criteria</b>	Criterion 1 - The species is listed as Endangered on the IUCN Red List
<b>Record</b>	<p><i>Direct</i></p> <p>TISTR 2013 survey recorded in a sampling plot within the Huay Ngua PPA survey in lower mixed deciduous forest habitat. The species was also detected in the resettlement site, transmission line, upper and lower Nam Xan, and upper and lower Nam Ngiep survey locations.</p> <p>DFRM survey and NUL ground-truthing did not detect the species within the search areas.</p> <hr/> <p><i>Indirect</i></p> <p>-</p>
<b>Distribution</b>	The species is native to Cambodia, India, Lao PDR, Malaysia, Myanmar, Thailand and Viet Nam. TISTR survey detected the species at a number of locations throughout the Nam Ngiep catchment. Phengsintham (2013) notes recording the species in several Lao PDR provinces including Vientiane capital, Savannekhet and Road no 13.
<b>Population</b>	Limited information is available regarding the population of the species, though healthy regenerating subpopulations are reported in the south of India.
<b>Habitat</b>	The species is considered unusual for its adaptation to withstand adverse climatic conditions and soil types. It occurs in dry evergreen or deciduous forest and bamboo forest, often on sandy soils,
<b>Threats</b>	
<b>Summary</b>	This species has been noted within the PPA boundary however was not recorded within the disturbance area for the Project during ground-truthing. The species is not native to Lao PDR and as such is not considered a priority biodiversity value. <b>The species is not a candidate for critical habitat within the Project area.</b>
<b>References</b>	Ashton, P. 1998. <i>Shorea roxburghii</i> . In IUCN 2013. IUCN Red List of Threatened Species Version 2013.1. <a href="http://www.iucnredlist.org">www.iucnredlist.org</a> . Downloaded on 12 September 2013.

Species	<i>Vatica cinerea</i>
<b>Candidate Criteria</b>	Criterion 1 - The species is listed as Endangered on the IUCN Red List
<b>Record</b>	<p><i>Direct</i></p> <p>TISTR 2013 survey did not record the species. DFRM survey detected one individual in the search area. NUL ground-truthing did not detect the species within the search area.</p> <hr/> <p><i>Indirect</i></p> <p>-</p>
<b>Distribution</b>	This species is not native to Lao PDR. Is native to Cambodia, Malaysia, Myanmar, Thailand and Viet Nam.
<b>Population</b>	Limited information is available regarding the size of the population of the species and habitat preferences.
<b>Habitat</b>	This small species is reported to flourish in exposed areas, occurring on rocky, dry land and in bamboo forest.
<b>Threats</b>	
<b>Summary</b>	<p>One individual of the species was detected in the PPA. The species is not native to Lao PDR and as such is not considered a priority biodiversity value. <b>The species is not a candidate for critical habitat within the Project area.</b></p>
<b>References</b>	Ashton, P. 1998. <i>Vatica cinerea</i> . In IUCN 2013. IUCN Red List of Threatened Species Version 2013.1. <a href="http://www.iucnredlist.org">www.iucnredlist.org</a> . Downloaded on 12 September 2013.

Species	<i>Elephas maximus</i> , Asian elephant
<b>Candidate Criteria</b>	Criterion 1 - The species is listed as Endangered on the IUCN Red List and is listed as Restricted in the Regulation of the Ministry of Agriculture and Forestry No. 0360/MAF.
<b>Record</b>	<p><i>Direct</i></p> <p>TISTR 2013 biodiversity survey did not record the species.</p> <hr/> <p><i>Indirect</i></p> <p>The Huay Ngua MP (2010) notes presence of the species within the provincial preserver area.</p> <p>Stakeholder village surveys in 2013 recognised the species is not commonly encountered in Ban Pakyong and never seen in Ban Pou, Ban Xomxuen and Nam Xan villages.</p> <p>The Project EIA (2007) notes the species occurrence within and outside the Project area based on a secondary data source though no location is specified.</p>
<b>Distribution</b>	<p>The species is native to Bangladesh, Bhutan, Cambodia, China, India, Indonesia, Lao PDR, Malaysia, Myanmar, Nepal, Sri Lanka, Thailand and Viet Nam (Choudhury et al. 2008). Populations in Lao PDR are now numerically insignificant compared with those of south Asia, but in the context of even steeper declines in Vietnam and China and similar ones in Cambodia, they are highly significant in the maintenance of ancestral range.</p> <p>The species in Lao PDR is reported to be widely, but very patchily distributed in forested areas (highlands and lowlands) with potentially important populations Nam Phouy west of the Mekong and in northern Lao PDR; in Phou Phanang and Phou Khao Khoay in Vientiane Province; Nakai Nam Theun NPA and surrounding in Khammouane Province; Phou Xang He NPA in Savannakhet Province; Dong Ampham, Dong Khanthung, Xe Pian, close to Cambodian border; and Nam Et, Nam Xam, Phou Dendin, and Nam Ha in the north, close to the Vietnamese and Chinese borders. However recent information on most of these areas is sparse.</p> <p>Near the Project area, potentially important elephant populations have been reported at Phou Phanang and Phou Khao Khoay to the west (approximately 20 km) and Nam Xan.</p> <p>An area to the east (approximately 20 km) of Huay Ngua PPA is considered important for a population of elephants that links to Nam Kading National Protected Area (pers comm. Kham khoun Khounboline 19/11/2013).</p>
<b>Population</b>	<p>It was estimated in 2003 that the global population of the species is between 41,410 and 52,345 (however this has been contested) which includes between 500 and 1000 in Lao PDR.</p> <p>Estimate of national population is expected to be larger than the 200-500 estimated in Lair (1997) and the Lao PDR population has been considered to be the most important national population for conservation in Indochina. However, ongoing declines in Lao PDR and recent discoveries in Cambodia suggest this statement may require modification.</p>
<b>Habitat</b>	<p>The species is found in many habitat types up to atleast 1200 m, remaining widely distributed in forested, hilly areas. The species is a generalist occurring in grassland, evergreen forest, semi-evergreen forest, moist deciduous forest, dry deciduous forest, dry thorn forest, scrublands and cultivated and secondary forests.</p> <p>The Asian elephant is an herbivore requiring large amounts of food per day. Their dung contributes to germinating seed dispersal. The home range varies but is considered to be large with ranges in excess of 60,000 ha recorded in India and only 16,000 ha range in Sri Lanka.</p>
<b>Threats</b>	<p>The overwhelming threat to the species in Lao PDR and surroundings is hunting, both for trade and resulting from crop destruction. Subsidiary threats include habitat loss, degradation and fragmentation, chiefly because these increase the likelihood of human-elephant conflict and enhance the ease of</p>

<b>Species</b>	<b><i>Elephas maximus</i>, Asian elephant</b>
	poaching. Large areas of prime elephant habitat in Lao PDR have already lost the species.
<b>Summary</b>	The location of the indirect records is mainly to the east of the Project area and to the north, outside the Project area. Similarly there are a number of locations noted for the species other countries. As such, the <b>Project area is not considered likely to be part of one of 10 or fewer habitat areas or required to sustain greater than 10 per cent of the global population (C1 Tier 1)</b> . The Project area is not a known important area in Lao PDR for the species however suitable habitat exists.
<b>References</b>	<p>Choudhury, A., Lahiri Choudhury D.K., Desai, A., Duckworth, J.W., Easa, P.S., Johnsingh, A.J.T., Fernando, P., Hedges, S., Gunawardena, M., Kurt, F., Karanth, U., Lister, A., Menon, V., Riddle, H., Rubel, A. and Wikramanayake, E. (IUCN SSC Asian Elephant Specialist Group) 2008. <i>Elephas maximus</i>. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2013.1. &lt;<a href="http://www.iucnredlist.org">www.iucnredlist.org</a>&gt;. Downloaded on 03 September 2013.</p> <p>Duckworth, J.W., Salter, R.E. and Khounbolin, K. 1999. Wildlife in Lao PDR 1999 Status Report. Vientiane: IUCN-The World Conservation Union/Wildlife Conservation Society/Centre for Protected Areas and Watershed Management.</p>



Species	<i>Panthera pardus</i> , Leopard
<b>Candidate Criteria</b>	Criterion 1 - The species has an elevated protection status nationally and is listed as Restricted in the Regulation of the Ministry of Agriculture and Forestry No. 0360/MAF.
<b>Record</b>	<p><i>Direct</i></p> <p>TISTR 2013 biodiversity survey did not directly record the species.</p> <hr/> <p><i>Indirect</i></p> <p>The Huay Ngua MP (2010) notes presence of the species within the provincial preserved area.</p> <p>Biodiversity village interviews in 2013 apparently recognised the species has been seen in the upper Nam Ngiep area.</p> <p>The Project EIA (2007) does not note the species.</p> <p>Note: Verbal village information on cats is close to impossible to assign to species despite the often overconfident presentation in interview reports. These reports are thus no more than weakly indicative of Leopard presence in the Project area.</p>
<b>Distribution</b>	The species also occurs across most of sub-Saharan Africa, as remnant populations in north Africa, and in the Arabian peninsula and Sinai/Judean Desert (Egypt/Israel/Jordan), south-western and eastern Turkey and through southwest Asia and the Caucasus into the Himalayan foothills, India, China and the Russian Far East as well as Java and Sri Lanka. The species distribution includes Lao PDR. In the 1990s there were rather few confirmed records during extensive surveys (Duckworth et al. 1999) but methods were not very suitable for finding the species. There have been few records since (again in part reflecting the limited application of suitable methods). However, the extreme rarity with which big cat signs are now found in most of Lao PDR means that the species's distribution in the country is probably now highly fragmented.
<b>Population</b>	<p>There is no reliable global population estimate, and population estimates for India and Africa are considered unreliable. Many populations west of southeast Asia are believed to be increasing, and there are high levels of human-leopard conflict.</p> <p>In Lao PDR the identification of the species by local reports and signs is challenging and many claims are over-confident (as proven almost whenever skins or other relicts are available to be examined). The species might still be widespread in the Bolikhamxay province though at very low density (IEWMP 2006).</p>
<b>Habitat</b>	In south-east Asia, the species is found in all forest types, from tropical rainforest to the temperate deciduous and alpine coniferous (up to 5,200 m in the Himalaya), and also in dry scrub and grasslands.
<b>Threats</b>	The massive declines in Indochina have been driven at least almost entirely by hunting. Suitable habitat remains widespread in Lao PDR but mostly no longer supports the species, at least at potentially viable levels.
<b>Summary</b>	<p>Given the large range of the species, certainty of records and secondary information from local village representatives it is <b>unlikely that the Project area and immediate surrounds supports greater than 10 per cent of the global population or habitat of significant importance.</b></p> <p>The key threat to the species is hunting and although current information does not confirm critical habitat and there is uncertainty of the relevance of the village interview data, the precautionary approach should be considered and the threats to the species should be managed throughout the Project construction and operation and within any Biodiversity Offset Design.</p>
<b>References</b>	Henschel, P., Hunter, L., Breitenmoser, U., Purchase, C., Khorozyan, I., Bauer, H., Marker, L., Sogbohossou, E. and Breitenmoser-Wursten, C. 2008. <i>Panthera pardus</i> . In: IUCN 2013. IUCN Red List of Threatened Species. Version 2013.2. <a href="http://www.iucnredlist.org">www.iucnredlist.org</a> Downloaded 3 November 2013

Species	<i>Panthera pardus</i> , Leopard
	Duckworth, J.W., Salter, R.E. and Khounboline, K. 1999. Wildlife in Lao PDR 1999 Status Report. Vientiane: IUCN-The World Conservation Union/Wildlife Conservation Society/Centre for Protected Areas and Watershed Management.

Species	<i>Pardofelis temminckii</i> , Asiatic golden cat
<b>Candidate Criteria</b>	Criterion 1 – The species has an elevated protection status nationally and is listed as Restricted in the Regulation of the Ministry of Agriculture and Forestry No. 0360/MAF.
<b>Record</b>	<p><i>Direct</i></p> <p>TISTR 2013 biodiversity survey did not record the species. A shot individual was photographed in the lower Nam Ngiep in early 1999 that had reportedly been killed in a village near chickens, though specific location details are unavailable.</p> <hr/> <p><i>Indirect</i></p> <p>The Huay Ngua MP (2010) notes presence of the species within the provincial preserved area. Biodiversity village interviews in 2013 recognised the species has been seen in the upper Nam Ngiep area, upper and lower Nam Xan however was not noted near Huay Ngua. Stakeholder village surveys in 2013 apparently recognised the species, reporting it is common at Ban Kanyong however never encountered at all other villages surveyed: Ban Pou, Ban Xomxuen, Ban Pakyong, Ban Pekheuang and Ban Don. The Project EIA (2007) notes the species occurrence outside the Project area based on a secondary data source though no location is specified. Note: Verbal village information on cats is close to impossible to assign to species despite the often overconfident presentation in interview reports. These reports are thus no more than weakly indicative of Asian golden cat presence in the Project area. However, the 1999 record from in/near the area, the species's known use of such habitats and its somewhat higher resilience to human activities than of the big cats all suggest it should be in the Project area, and may perhaps be widespread.</p>
<b>Distribution</b>	The species occurs from the Himalayan foothills into China and south-east Asia, and is native to: Bangladesh; Bhutan; Cambodia; China; India; Indonesia (Sumatera); Lao PDR; Malaysia; Myanmar; Nepal; Thailand; Viet Nam.
<b>Population</b>	In 1990s surveys in Lao PDR Golden Cat was the second-most widely recorded cat species, with several records from outside the protected area system, suggesting a high population. However, recent camera-trapping in Nakai-Nam Theun NPA suggests that a decade of heavy snaring has now greatly depleted populations in the surveyed parts of that protected area. While Golden Cat evidently remained common in Nam Et-Phou Loey until at least few years ago, this exceptional area retained even Tigers. Nakai-Nam Theun NPA is likely to be a better predictor for the typical situation in Lao PDR, and it may be that numbers across Lao PR are typically now much lower than in the 1990s.
<b>Habitat</b>	The species is primarily found in forest habitats ranging from tropical and subtropical evergreen to mixed and dry deciduous forest; it is evidently very tolerant of degradation and perhaps, where not hunted, of fragmentation.
<b>Threats</b>	The species is threatened in Lao PDR by indiscriminate snaring and other forms of hunting, driven largely by illegal trade in the species' pelt and bones.
<b>Summary</b>	This cat plausibly persists, perhaps widely, in the Project area, but this is equally true of much of Lao PDR. <b>The Project area is only a small proportion of the nation's total such habitat and as such would not be expected to constitute critical habitat.</b>
<b>References</b>	<p>Sanderson, J., Mukherjee, S. Wilting, A., Sunarto, S., Hearn, A., Ross, J. and Khan, J.A. 2008. <i>Pardofelis temminckii</i>. In: IUCN 2013. IUCN Red List of Threatened Species. Version 2013.2. <a href="http://www.iucnredlist.org">www.iucnredlist.org</a> Downloaded 3 November 2013</p> <p>Duckworth, J.W., Salter, R.E. and Khounbolin, K. 1999. Wildlife in Lao PDR 1999 Status Report. Vientiane: IUCN-The World Conservation Union/Wildlife Conservation Society/Centre for Protected Areas and Watershed Management.</p>

Species	<i>Prionailurus viverrinus</i> , Fishing cat
<b>Candidate Criteria</b>	Criterion 1 - The species is listed as Endangered on the IUCN Red List and is listed as Restricted in the Regulation of the Ministry of Agriculture and Forestry No. 0360/MAF.
<b>Record</b>	<p><i>Direct</i></p> <p>TISTR 2013 biodiversity survey did not record the species.</p> <hr/> <p><i>Indirect</i></p> <p>The Huay Ngua MP (2010) notes presence of the species within the provincial preserved area.</p> <p>Stakeholder village surveys in 2013 apparently recognised the species, reporting it is common in Ban Kanyong and Ban Don of Nam Xan while noted the species as less common Ban Pou and Ban Pakyong of Nam Ngiep River.</p> <p>The Project EIA (2007) notes the species occurrence within and outside the Project area based on a secondary data source though no location is specified.</p> <p>Note: Verbal village information on cats is close to impossible to assign to species despite the often overconfident presentation in interview reports. Fishing cat is so widely misidentified in South-east Asia (e.g. Duckworth <i>et al.</i> 2010) yet so universally reported in verbal village information that these reports should not be taken as even weakly indicative of Fishing cat presence in the Project area. In fact, there is no confirmation that the species occurs in Lao PDR at all. Most of the valid recent records from southeast Asia are from coastal areas, and while there are historical specimens from a few inland areas, there are too few inland records to make a habitat-based prediction of Fishing cat's likely status in the Project area.</p>
<b>Distribution</b>	The species is native to Bangladesh, Bhutan, Cambodia, India, perhaps Indonesia, perhaps Lao PDR, Myanmar, Nepal, Sri Lanka, Thailand and Viet Nam. The species is primarily found in wetland habitats, which are increasingly being settled, degraded and converted; its occurrence may now be highly localised in southeast Asia, and is almost certainly so, away from the coast. The species has not been seen captive or in trade in Lao PDR suggesting that it is extremely rare or not likely to occur (pers comm. Will Duckworth 15/11/2013).
<b>Population</b>	Population estimates are not well understood. There are very few reports from Lao, all either certain or plausible errors. It is possible that the species is extinct or never occurred in Lao PDR; it is inconceivable that, if present, it is other than extremely rare. This is also true of Cambodia even though a sizeable number of captive animals have been reported in this latter country. In southeast Asia recent records are infrequent suggesting a decline in populations.
<b>Habitat</b>	Past statements on habitat use in SE Asia are confounded by incorporation of information from misidentified animals. Almost all recent SE Asian records are from the coast, although a few historical specimens prove inland occurrence. All such latter records seem to have been from the level lowlands, in areas with many standing waterbodies. The species is thought to feed mainly on fish but also small rodents, reptiles and amphibians. Home ranges reported in Nepal ranged between 400 and 1600 ha.
<b>Threats</b>	Main threats to the species include wetland destruction and degradation.
<b>Summary</b>	There is no reason to think that Fishing cat inhabits the Project area, but equally it cannot be excluded that it does so. However, the Project area's habitat is not distinct in any way from typical Lao hill-country, and <b>so there is no reason to conclude that the Project area could be considered critical habitat for the species.</b> This assessment remains particularly provisional given the uncertainty surrounding the species's distribution and habitat use in inland SE Asia.
<b>References</b>	Mukherjee, S., Sanderson, J., Duckworth, W., Melisch, R., Khan, J., Wilting, A., Sunarto, S. and Howard, J.G. 2010. <i>Prionailurus viverrinus</i> . In: IUCN 2013.

Species	<i>Pardofelis temminckii</i> , Asiatic golden cat
	<p>IUCN Red List of Threatened Species. Version 2013.1. &lt;<a href="http://www.iucnredlist.org">www.iucnredlist.org</a>&gt;. Downloaded on 03 September 2013.</p> <p>Duckworth, J.W., Salter, R.E. and Khounboline, K. 1999. Wildlife in Lao PDR 1999 Status Report. Vientiane: IUCN-The World Conservation Union/Wildlife Conservation Society/Centre for Protected Areas and Watershed Management.</p>



Species	<i>Buceros bircornis</i> , Great hornbill
<b>Candidate Criteria</b>	Criterion 1 - The species has an elevated protection status nationally and is listed as Restricted in the Regulation of the Ministry of Agriculture and Forestry No. 0360/MAF.
<b>Record</b>	<p><i>Direct</i></p> <p>TISTR 2013 biodiversity survey did not record the species.</p> <hr/> <p><i>Indirect</i></p> <p>The Huay Ngua MP (2010) notes presence of the species within the provincial preserved area.</p> <p>Biodiversity village interviews in 2013 apparently recognised the species, reporting it as less commonly encountered in upper and lower Nam Xan however did not recognise its presence in Nam Ngiep and Huay Ngua visited areas.</p> <p>The Project EIA (2007) notes the species occurrence outside the Project area based on a secondary data source though no location is specified.</p> <p>Note: Verbal village information on hornbills is difficult to assign to species despite the often overconfident presentation in interview reports. These reports are thus no more than weakly indicative of Great Hornbill presence in the Project area. In most of Lao PDR Great Hornbill is much more declined than Wreathed Hornbill, and most village reports of 'great hornbills' and taken by the interviewers to mean Great Hornbill in fact probably refer to Wreathed Hornbill.</p>
<b>Distribution</b>	The species has a wide distribution, occurring in China, India, Nepal, Bhutan, Bangladesh, Myanmar, Thailand, Lao PDR, Vietnam, Cambodia, Malaysia and Indonesia. Surveys in the 1990s recorded the species in a fair number in areas across Lao PDR, although almost invariably in small numbers (Duckworth et al. 1999); there is recent information only from few areas, reflecting patchy survey but some local extirpations are likely to have occurred in the intervening period.
<b>Population</b>	Although the species has a large range it occurs at low densities and is patchily distributed. In Lao PDR, the species was formerly common but now (although still widespread) is scarce. Based on population estimates in India, the species global population is estimated at 10,000 to 70,000 individuals. It is probably best placed in the band 20,000-49,999 individuals.
<b>Habitat</b>	This species frequents evergreen, semi-evergreen and mixed deciduous forests, ranging out into open deciduous areas to visit fruit trees and ascending slopes to at least 1,560 m. The species is perhaps most common in unlogged forest.
<b>Threats</b>	The primary threat to the species in Lao PDR is hunting; many large tracts of prime habitat support only small numbers, or none, because of this threat.
<b>Summary</b>	Great hornbill plausibly still occurs in the Project area but probably only in low numbers. Its status is similar across large parts of Lao PDR. <b>The Project area is small in proportion to the nation's total suitable habitat and as such is most unlikely to constitute critical habitat.</b>
<b>References</b>	<p>BirdLife International. 2013. <i>Buceros bircornis</i>. In: IUCN 2013. IUCN Red List of Threatened Species. Version 2013.1. &lt;www.iucnredlist.org&gt;. Downloaded on 04 September 2013.</p> <p>Duckworth, J.W., Salter, R.E. and Khounboline, K. 1999. Wildlife in Lao PDR 1999 Status Report. Vientiane: IUCN-The World Conservation Union/Wildlife Conservation Society/Centre for Protected Areas and Watershed Management.</p>

<b>Species</b>	<b><i>Cairina scutulata</i>, White winged duck</b>
<b>Candidate Criteria</b>	Criterion 1 – The species is listed as Endangered on the IUCN Red List
<b>Record</b>	<p><i>Direct</i></p> <p>TISTR 2013 biodiversity survey did not record the species.</p> <hr/> <p><i>Indirect</i></p> <p>The Huay Ngua MP (2010) notes presence of the species within the provincial preserved area.</p> <p>Stakeholder village surveys in 2013 apparently recognised the species, reporting it as common in Ban Xomxuen and Ban Pakyong of the Nam Ngiep River though never seen in Ban Pou. In Nam Xan River villagers responded that the species is common in Ban Kanyong and Ban Don and very common in Ban Pakheuang.</p> <p>The Project EIA (2007) notes the species occurrence outside the Project area based on a secondary data source though no location is specified.</p> <p>Note: Verbal village information on ducks and other swimming birds is impossible reliably to assign to species despite the often overconfident presentation in interview reports. In particular, inept interview teams almost invariably record White-winged Duck almost anywhere in Lao PDR that villagers report ducks of any species. Given that the considerable specific search effort for White-winged Duck in the 1990s and to a lesser extent in the 2000s found only few areas to support the species, and that competently executed interview surveys very rarely find reports that conform in morphological and behavioural aspects with White-winged Duck, it is obvious that most purported White-winged Duck interview claims are in error. The same is assumed to hold here. However, the habitat is suitable for the species, and would surely have held it previously, and it cannot be excluded that small numbers remain.</p>
<b>Distribution</b>	The species is native to Bangladesh, Cambodia, India, Indonesia, Lao PDR, Myanmar, Thailand and Viet Nam. Duckworth et al (1999) note 2 – 3 population centres for the species in Lao PDR. There are no recent (post-1950) records or convincing reports of the species in Lao PDR from north of the Nakai plateau, there are also no historical reports, but in the light of highly limited survey efforts, the species is assumed to have been overlooked in the many Mekong tributary systems upstream of the Nam Kading to at least the Nam Sang. Recent intensive activity in the Nam Theun catchment suggests that very small numbers may survive for some years in areas where conventional survey under practical levels of effort cannot guarantee to find them, even by sign. Therefore, the actual status (extirpated vs reduced to very small numbers) in north Lao PDR in and since the 1990s cannot be determined.
<b>Population</b>	Estimates of global population report 450 individuals in India, low hundreds in Myanmar, 100 in Cambodia and 150 in Indonesia. Precautionary estimates places the global population between 350 and 1500 individuals. Total numbers in Lao PDR are likely to be no more than a few dozen, and probably now are many fewer.
<b>Habitat</b>	The species occur in stagnant or slow-flowing wetlands (natural and artificial) within or adjacent to evergreen, deciduous or swamp forest. Individuals roost and nest in the tree hollows. The species is secretive and forages at night on seeds, aquatic plants, grain, rice, small fish and invertebrates. Duckworth et al (1999) note records from slower moving stretches of forested streams and rivers, and pools in forests, up to 600 m.
<b>Threats</b>	The primary threat to the species in Lao PDR is hunting, apparently mainly for local use; many large tracts of prime habitat support only small numbers, or none, because of this threat. The threat from hunting is exacerbated by the species's habitat use: riverine and riparian forest habitats, and are among those most heavily used and degraded by human activity. Thus, although there

<b>Species</b>	<i>Cairina scutulata</i> , White winged duck
	seems to be no trade demand for the species in Lao PDR, incidental/opportunistic hunting occurs throughout its Lao PDR range at levels sufficient for widespread local extirpation.
<b>Summary</b>	White winged duck might possibly still occur in the Project area but at best only in very low numbers. Despite major loss of habitat in the last half century, tracts similar in extent and condition to the Project area remain in many parts of Lao PDR. The Project area is only a small proportion of the national's total suitable habitat and as such it is <b>unlikely to constitute critical habitat</b> .
<b>References</b>	<p>BirdLife International. 2012c. <i>Cairina scutulata</i>. In: IUCN 2013. IUCN Red List of Threatened Species. Version 2013.1. &lt;<a href="http://www.iucnredlist.org">www.iucnredlist.org</a>&gt;. Downloaded on 04 September 2013.</p> <p>Duckworth, J.W., Salter, R.E. and Khounboline, K. 1999. Wildlife in Lao PDR 1999 Status Report. Vientiane: IUCN-The World Conservation Union/Wildlife Conservation Society/Centre for Protected Areas and Watershed Management.</p>

Species	<i>Centropus sinensis</i> , Greater coucal
<b>Candidate Criteria</b>	Criterion 1 – The species has an elevated protection status nationally and is listed as Restricted in the Regulation of the Ministry of Agriculture and Forestry No. 0360/MAF.
<b>Record</b>	<p><i>Direct</i></p> <p>TISTR 2013 biodiversity survey recorded the species in Huay Ngua PPA. The survey also detected the species in the upper and lower Nam Ngiep, resettlement site, and upper and lower Nam Xan.</p> <hr/> <p><i>Indirect</i></p> <p>The Huay Ngua MP (2010) notes presence of the species within the provincial preserved area.</p>
<b>Distribution</b>	This species has an extremely large distribution and is native to: Bangladesh, Bhutan, Brunei Darussalam, Cambodia, China, India, Indonesia, Lao PDR, Malaysia, Myanmar, Nepal, Pakistan, Philippines, Singapore, Sri Lanka, Thailand, and Viet Nam.
<b>Population</b>	The global population size has not been quantified, but the species is reported to be common almost everywhere throughout its range. National population sizes have been estimated at c.100-10,000 breeding pairs and c.50-1,000 individuals on migration in China; and c.100-10,000 breeding pairs in Taiwan. It is widespread and generally abundant, including in areas with very heavy human use and bird hunting pressure, across Lao PDR.
<b>Habitat</b>	Habitat is noted to be forest edge, scrub, tall secondary growth and grassland including ponds and villages.
<b>Threats</b>	There are no threats to Greater coucal populations in Lao PDR. Although it is often hunted, it seems resilient to current levels, and while populations may be below carrying capacity in heavily settled areas, there has been no significant contraction of range. The species has doubtless benefitted hugely from the major conversion and degradation of Lao PDR's forests over the last century.
<b>Summary</b>	Greater coucal is probably abundant over the deforested and degraded parts of the Project area. <b>This is so across Lao PDR however the Project area constitutes an insignificant proportion of the nation's total suitable habitat and as such does not constitute critical habitat.</b>
<b>References</b>	<p>BirdLife International. 2012. <i>Centropus sinensis</i>. In: IUCN 2013. IUCN Red List of Threatened Species. Version 2013.1. &lt;<a href="http://www.iucnredlist.org">www.iucnredlist.org</a>&gt;. Downloaded on 04 September 2013.</p> <p>Duckworth, J.W., Salter, R.E. and Khounboline, K. 1999. Wildlife in Lao PDR 1999 Status Report. Vientiane: IUCN-The World Conservation Union/Wildlife Conservation Society/Centre for Protected Areas and Watershed Management.</p>

Species	<i>Lophura diardi</i> , Siamese fireback
<b>Candidate Criteria</b>	Criterion 1 – The species has an elevated protection status nationally and is listed as Restricted in the Regulation of the Ministry of Agriculture and Forestry No. 0360/MAF.
<b>Record</b>	<p><i>Direct</i></p> <p>TISTR 2013 biodiversity survey did not record the species.</p> <hr/> <p><i>Indirect</i></p> <p>The Huay Ngua MP (2010) notes presence of the species within the protected area.</p> <p>Biodiversity village surveys in 2013 apparently recognised the species, reporting it is less common in upper and lower Nam Xan however did not recognise its presence in Nam Ngiep and Huay Ngua visited areas.</p> <p>Stakeholder village surveys in 2013 recognised the species as very common in Ban Pou and Ban Xomxuen of the Nam Ngiep River though common in Ban Pakyong. In Nam Xan River villagers responded that the species is very common in Ban Kanyong, Ban Pakheuung and Ban Don.</p> <p>The Project EIA (2007) notes the species occurrence within and outside the Project area based on a secondary data source though no location is specified.</p> <p>Note: Verbal village information on pheasants in Lao PDR is difficult to assign to species despite the often overconfident presentation in interview reports. These reports are thus no more than weakly indicative of Siamese fireback presence in the Project area. However, the area contains suitable habitat in its lower-lying parts, and the species is extremely resilient to hunting and forest degradation (it may even benefit from some level of the latter). Thus, it is highly likely that Siamese fireback inhabits the area.</p>
<b>Distribution</b>	The species occurs in Thailand, Lao PDR, Cambodia and Vietnam. 1990s surveys recorded the species widely across lower-lying parts of Lao PDR.
<b>Population</b>	The species is locally common in much of its range. The total population is suspected to number 20,000-49,999 individuals based on a conservative estimate of c.2,000 individuals in Cambodia and an estimate of c.5,000 individuals in Thailand; the Lao PDR population is likely to dwarf both of these.
<b>Habitat</b>	The species occurs in evergreen, semi-evergreen and bamboo forest, secondary growth and scrub, often near roads and tracks through the forest, chiefly in the plains and foothills to 500 m, but occasionally much higher.
<b>Threats</b>	This species is declining in Lao PDR in proportion to wholesale conversion of lowland and lower-hill forest to plantations and other uses. However, very large areas of suitable habitat persist, and there are a sufficient number of records in the last decade to be sure that the species is not threatened in Lao PDR. Despite earlier concerns, it is now clear the species is highly resilient to hunting, perhaps including large-scale snaring, although this largely takes place in forests above its main altitudinal range.
<b>Summary</b>	Siamese fireback is very likely to occur, perhaps widely, in the Project area. Nonetheless, the <b>Project area constitutes an insignificant proportion of suitable habitat across Lao PDR, so does not constitute critical habitat.</b>
<b>References</b>	<p>BirdLife International. 2013. <i>Lophura diardi</i>. In: IUCN 2013. IUCN Red List of Threatened Species. Version 2013.1. &lt;www.iucnredlist.org&gt;. Downloaded on 04 September 2013.</p> <p>Duckworth, J.W., Salter, R.E. and Khounboline, K. 1999. Wildlife in Lao PDR 1999 Status Report. Vientiane: IUCN-The World Conservation Union/Wildlife Conservation Society/Centre for Protected Areas and Watershed Management.</p>



Species	<i>Pavo muticus</i> , Green peafowl
<b>Candidate Criteria</b>	Criterion 1 – The species is listed as Endangered on the IUCN Red List
<b>Record</b>	<p><i>Direct</i></p> <p>TISTR 2013 biodiversity survey did not record the species.</p> <hr/> <p><i>Indirect</i></p> <p>The Huay Ngua MP (2010) notes presence of the species within the provincial preserved area.</p> <p>Note: Verbal village information on pheasants in Lao PDR is difficult to assign to species despite the often overconfident presentation in interview reports. This is so even for the morphologically distinctive Green peafowl, which is often confused/amalgamated with Crested argus (<i>Rheinardia ocellata</i>) but also often is ‘reported’ from outside the plausible present-day range of either. In the context of huge range contraction of Green peafowl in Lao PDR in the last 60 years and the great rarity of surviving remnant populations outside of Savannakhet, these interview reports are most sensible taken as in error.</p>
<b>Distribution</b>	The IUCN mapped distribution across the Project area is mapped as ‘possibly extinct’. Birdlife International recognises almost 2,500 ha on the south-western periphery of PKK as an Important Bird Area (IBA) where individuals have been heard at a roosting site in 1994, 1995 and 2002, and were credibly reported as still present in 2009. All other remnant populations of Green peafowl confirmed in Lao PDR since 1990 are al far to the south of the Project area.
<b>Population</b>	The estimates of global population size are 15,000-30,000 individuals. Birdlife International (2003) notes while the population is of moderate to high national significance, it is of low global significance given the larger populations in parts of Cambodia. Duckworth et al 1999 report five areas that are likely to retain populations large enough to be viable in Lao PDR, including PKK.
<b>Habitat</b>	The species has been reported to occupy a variety of habitats including primary and secondary, tropical and subtropical, evergreen and deciduous forest types, mixed coniferous forest, swamp forest, open woodland, forest edge, bamboo, grasslands, savannah, scrub and farmland edge.
<b>Threats</b>	The main threat to the species in Lao PDR is hunting, including egg collection. Habitat modification and fragmentation may locally compound the problem. These threats have led to widespread extirpation across Lao PDR and adjacent countries.
<b>Summary</b>	Assuming that the interview reports are in error, there is <b>no reason to consider that the Project area constitutes critical habitat</b> . However, the rather anomalous survival of the small population around Ban Nakhaty, PKK, emphasises the possibility that other remnants may also survive, and it cannot be excluded that the Project area might support one. Such a population could be significant at the national level.
<b>References</b>	<p>BirdLife International. 2012. <i>Pavo muticus</i>. In: IUCN 2013. IUCN Red List of Threatened Species. Version 2013.1. &lt;www.iucnredlist.org&gt;. Downloaded on 12 September 2013</p> <p>Duckworth, J.W., Salter, R.E. and Khounbolin, K. 1999. Wildlife in Lao PDR 1999 Status Report. Vientiane: IUCN-The World Conservation Union/Wildlife Conservation Society/Centre for Protected Areas and Watershed Management.</p>

Species	<i>Polyplectron bicalcaratum</i> , Grey peacock-pheasant
<b>Candidate Criteria</b>	Criterion 1 - The species has an elevated protection status nationally and is listed as Restricted in the Regulation of the Ministry of Agriculture and Forestry No. 0360/MAF.
<b>Record</b>	<i>Direct</i> TISTR 2013 biodiversity survey did not record the species.
	<i>Indirect</i> The Huay Ngua MP (2010) notes presence of the species within the provincial preserved area. Biodiversity village surveys in 2013 apparently recognised the species, reporting it is less common in upper and lower Nam Xan however did not recognise its presence in Nam Ngiep and Huay Ngua visited areas. Note: Verbal village information on pheasants in Lao PDR is difficult to assign to species despite the often overconfident presentation in interview reports. These reports are thus no more than weakly indicative of Grey peacock-pheasant presence in the Project area. However, the area contains extensive suitable habitat, and the species is extremely resilient to hunting and forest degradation. Thus, it is highly likely that Grey peacock-pheasant inhabits the area, and it is quite probably common.
<b>Distribution</b>	The species is native to Bangladesh, Bhutan, Cambodia, China, India, Lao PDR, Myanmar, Thailand and Viet Nam.
<b>Population</b>	The population size has not been quantified however it is not believed to be <10,000 mature individuals. The species is reported to be locally common to fairly common and rare. The population is suspected to be declining owing to habitat loss and degradation and, locally, overexploitation. It remains widespread and common almost across the Lao PDR.
<b>Habitat</b>	Occurs in evergreen forest from lowlands to 1850 m. The species is reported to be tolerant to degradation of forest.
<b>Threats</b>	As with other evergreen forest pheasants in Lao PDR, although hunting is very high within this species's habitats, it seems highly resilient to offtake. There are thus no serious threats to the species in Lao PDR presently, although its population is presumably declining in proportion to the conversion of forest to plantations and other non-forest habitats.
<b>Summary</b>	Grey Peacock Pheasant is very likely to occur, perhaps widely and commonly, in the Project area. Nonetheless, the Project area constitutes an insignificant proportion of suitable habitat across Lao PDR, so <b>does not constitute critical habitat</b> .
<b>References</b>	BirdLife International. 2012. <i>Polyplectron bicalcaratum</i> . In: IUCN 2013. IUCN Red List of Threatened Species. Version 2013.1. < <a href="http://www.iucnredlist.org">www.iucnredlist.org</a> >. Downloaded on 04 September 2013. Duckworth, J.W., Salter, R.E. and Khounboline, K. 1999. Wildlife in Lao PDR 1999 Status Report. Vientiane: IUCN-The World Conservation Union/Wildlife Conservation Society/Centre for Protected Areas and Watershed Management.

Species	<i>Psittacula alexandri</i> , Red-breasted parakeet
<b>Candidate Criteria</b>	Criterion 1 - The species has an elevated protection status nationally and is listed as Restricted in the Regulation of the Ministry of Agriculture and Forestry No. 0360/MAF.
<b>Record</b>	<p><i>Direct</i></p> <p>TISTR 2013 biodiversity survey recorded the species in Huay Ngua PPA. The survey did not detect the species the Nam Ngiep, Nam Xan or resettlement site areas.</p> <hr/> <p><i>Indirect</i></p> <p>The Huay Ngua MP (2010) notes presence of the species within the protected area.</p> <p>Biodiversity village surveys in 2013 apparently recognised the species, reporting it is common in Huay Ngua.</p> <p>The Project EIA (2007) notes the species occurrence within and outside the Project area based on a secondary data source though no location is specified.</p> <p>Note: Verbal village information on parakeets in Lao PDR is difficult to assign to species despite the often overconfident presentation in interview reports. These reports are thus no more than weakly indicative of Red-breasted parakeet presence in the Project area. However, the area contains some suitable habitat and there are recent records from relatively nearby (lower Nam Kading plain; Pakxan wetlands) so it is quite plausible that Red-breasted parakeet inhabits the area, although, given general recent trends in its population in Lao PDR, it is unlikely to be common.</p>
<b>Distribution</b>	The species has a broad distribution and is native to Bangladesh; Bhutan; Cambodia; China; India; Indonesia; Lao PDR; Myanmar; Nepal; Thailand; and Viet Nam.
<b>Population</b>	The global population size has not been quantified; however the species is reported to be generally common. The species has been heavily traded, and 125,695 wild-caught individuals have been recorded in international trade since 1981. In Lao, Duckworth et al 1999 report flocks exceeding 1000 to occur (recorded in southern Lao PDR) but in most areas rarely number more than 20-30. The species has particularly declined in the northern half of the country, and has been widely extirpated.
<b>Habitat</b>	In Lao the species occurs in deciduous forests and adjacent secondary growth, mostly below 400m.
<b>Threats</b>	Four species of parakeets occur in Lao PDR the populations of all of them have probably declined hugely although this is based on status documented in neighbouring countries (where flocks are typically much larger than in Lao PDR, especially in Cambodia, China and, locally, in Vietnam) rather than on direct evidence of decline: historical Lao information is insufficiently precise. Declines have been particularly severe in the northern half of the country, where suitable habitat is naturally more fragmented and in smaller patches. The decline is assumed to have been driven by the cagebird trade, because there is no evidence of other trade in significant volumes, and ample suitable habitat remains widespread but supporting only very small numbers.
<b>Summary</b>	Accepting the likelihood of this species's occurrence in the Project area, it is however <b>unlikely, that in the context of the much larger numbers remaining in parts of Central and South Lao PDR, that the Project area could comprise critical habitat.</b>
<b>References</b>	<p>BirdLife International. 2012. <i>Psittacula alexandri</i>. In: IUCN 2013. IUCN Red List of Threatened Species. Version 2013.1. &lt;www.iucnredlist.org&gt;. Downloaded on 04 September 2013.</p> <p>Duckworth, J.W., Salter, R.E. and Khounboline, K. 1999. Wildlife in Lao PDR 1999 Status Report. Vientiane: IUCN-The World Conservation Union/Wildlife Conservation Society/Centre for Protected Areas and Watershed Management.</p>

Species	<i>Broghammerus reticulatus</i> , Reticulated python
<b>Candidate Criteria</b>	Criterion 1 - The species has an elevated protection status nationally and is listed as Restricted in the Regulation of the Ministry of Agriculture and Forestry No. 0360/MAF.
<b>Record</b>	<p><i>Direct</i></p> <p>TISTR 2013 biodiversity survey did not record the species.</p> <hr/> <p><i>Indirect</i></p> <p>The Huay Ngua MP (2010) notes presence of the species within the protected area.</p> <p>Biodiversity village surveys in 2013 apparently recognised the species, reporting it is less common in upper and lower Nam Ngiep, resettlement site and upper and lower Nam Xan however did not recognise its presence in Huay Ngua.</p> <p>Stakeholder village surveys in 2013 recognised the species as very common in Ban Pou, Ban Xomxuen and Ban Pakyong of the Nam Ngiep River as well as Ban Pakheuung and Ban Don of the Nam Xan River. Ban Kanyong of the Nam Xan River noted the species as common.</p>
<b>Distribution</b>	The species occurs in Indonesia, Timor-Leste, Bangladesh, Brunei Darussalam, Cambodia, India, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand and Vietnam.
<b>Population</b>	The species is considered to be widespread in Lao PDR, and populations are considered to be of low global significance.
<b>Habitat</b>	Duckworth et al (1999) noted the species is expected to occur in most forest types though it is also documented to inhabit humid forests and is typically found in riparian areas (Raffles Museum of Biodiversity Research 2013). It also occurs in agricultural areas, scrubland, mangroves and urban areas (Raffles Museum of Biodiversity Research 2013).
<b>Threats</b>	It is threatened by commercial exploitations for the skin trade.
<b>Summary</b>	Given that the Lao PDR population is not considered to be of global significance and that it is widespread it is <b>unlikely that the Project area sustains greater than 10 per cent of the global population or is one of 10 discrete management sites globally for the species (C1 Tier 1)</b> . The baseline information <b>does not provide an indication that the habitat is of significant importance, or that records are part of an important concentration (C1 Tier 2)</b> .
<b>References</b>	<p>Duckworth, J.W., Salter, R.E. and Khounboline, K. 1999. Wildlife in Lao PDR 1999 Status Report. Vientiane: IUCN-The World Conservation Union/Wildlife Conservation Society/Centre for Protected Areas and Watershed Management.</p> <p>Raffles Museum of Biodiversity Research. 2013. <i>Broghammerus reticulatus</i> (Schneider, 1801). In: The DNA of Singapore. &lt; <a href="http://rmbr.nus.edu.sg/dna/">http://rmbr.nus.edu.sg/dna/</a>&gt; Downloaded on 08 November 2013.</p> <p>Uetz, P &amp; Hallerman, J. 2013. <i>Broghammerus reticulatus</i> (Schneider, 1801). In: The Reptile Database. Zoological Museum Hamburg. &lt; <a href="http://reptile-database.reptarium.cz/">http://reptile-database.reptarium.cz/</a>&gt;. Downloaded on 08 November 2013.</p>

Species	<i>Platysternon megacephalum</i> , Big-headed turtle
<b>Candidate Criteria</b>	Criterion 1 – The species is listed as Endangered on the IUCN Red List
<b>Record</b>	<p><i>Direct</i></p> <p>TISTR 2013 biodiversity survey did not record the species.</p> <hr/> <p><i>Indirect</i></p> <p>The Huay Ngua MP (2010) notes presence of the species within the provincial preserved area.</p> <p>Biodiversity village surveys in 2013 apparently recognised the species, reporting it is less common in upper Nam Ngiep and upper Nam Xan however did not recognise its presence in Huay Ngua.</p>
<b>Distribution</b>	The species is native to China, Lao PDR, Myanmar, Thailand and Viet Nam. The species has been reported to occur in PKK to the west of the Project area as well as other records in Annamite mountains and southern Lao PDR in 1999 (Duckworth et al 1999).
<b>Population</b>	There is limited information regarding the size of the population of the species. In 1999 Duckworth et al. reported that Lao PDR populations are considered to be of moderate global significance with the species being widespread. In 2006 IEWMP reported the species probably occurs widely in the Bolikhamxay Province with known records from the Ban Nape area, Nam Nouang and NNT.
<b>Habitat</b>	The species inhabits fast flowing, cool, rocky mountain brooks and streams, usually narrower than 1 m and less than 10 cm deep. There are a number of low order streams that the Project area intersects. The species is thought to be nocturnal when it forages along the stream bottom and stream edge. It is a carnivorous species.
<b>Threats</b>	Main threats to the species include destruction and degradation of riverine habitats, including the loss of riparian forest corridors.
<b>Summary</b>	The Project area contains small perennial streams and a number of larger watercourse crossings however due to the design of the crossing infrastructure to maintain flows and manage stability of the sediment the Project area of influence is of limited size. As such <b>the Project area is considered unlikely to be critical habitat for the species.</b>
<b>References</b>	<p>Asian Turtle Trade Working Group. 2000. <i>Platysternon megacephalum</i>. In: IUCN 2012. IUCN Red List of Threatened Species. Version 2012.2. &lt;www.iucnredlist.org&gt;. Downloaded on 12 June 2013.</p> <p>Kirkpatrick, D.T. 1995. The Big-headed Turtle, <i>Platysternon megacephalum</i>. Originally published in Reptile and Amphibian Magazine, November/December 1995, pages 40-47.</p> <p>Duckworth, J.W., Salter, R.E. and Khounboline, K. 1999. Wildlife in Lao PDR 1999 Status Report. Vientiane: IUCN-The World Conservation Union/Wildlife Conservation Society/Centre for Protected Areas and Watershed Management.</p>



Species	<i>Catlocarpio siamensis</i> , Giant barb
<b>Candidate</b>	Criterion 1 - The species is listed as Endangered on the IUCN Red List
<b>Criteria</b>	Criterion 3 - The species is migratory
<b>Record</b>	<p><i>Direct</i></p> <p>TISTR 2013 biodiversity survey did not record the species.</p> <hr/> <p><i>Indirect</i></p> <p>The Huay Ngua MP (2010) notes presence of the species within the provincial preserved area.</p>
<b>Distribution</b>	The species is native to Cambodia, Lao PDR, Thailand and Viet Nam.
<b>Population</b>	The size of the population is reported to have declined rapidly since 1990. The species is very rare in Thai and Lao Mekong and associated tributaries.
<b>Habitat</b>	<p>The species inhabits floodplain and main river habitats feeding on algae, phytoplankton, vegetation and small fish. Spawning areas are unknown and little is known about spawning behaviour. The Mekong River Commission notes juveniles are mainly seen in floodplain habitats and small tributaries, and that mature fish are only found in large streams. Large mature fish have not been observed in floodplain habitats and it is more likely the species spawns in certain habitats within the main river channel where juveniles can reach rearing habitats on the floodplain.</p> <p>The species is reports to undertake short-distance migrations however further research is needed on the migratory patterns of the species.</p>
<b>Threats</b>	Main threats to the species include over-harvest and habitat fragmentation.
<b>Summary</b>	Specialist input identified that there is very little survey data from the Nam Ngiiep catchment (pers. comm. Dr Maurice Kottelat 7/11/2013). The species is threatened throughout its range and any area where the species reproduces would be considered critical habitat (pers. comm. Dr Maurice Kottelat 7/11/2013). Species profile information suggests that the species spawning occurs in main or larger river channels and identifies the importance of floodplain areas. It is not expected that the Project area contains these aquatic habitats or provides a migratory pathway with the exception of Nam Xao where a permanent bridge has been constructed (refer NNP1 IEE 2013). At the crossing location, the Nam Xao is not likely to sustain greater than 10 per cent of the global population (C1 Tier 1) or a regionally significant population (C1 Tier 2). Despite this, migration of juveniles may occasionally occur up-and downstream and as such crossing structure design has considered the requirement for adequate bridge length and allowance to maintain water flow.
<b>References</b>	<p>Hogan, Z. 2011. <i>Catlocarpio siamensis</i>. In: IUCN 2013. IUCN Red List of Threatened Species. Version 2013.1. &lt;<a href="http://www.iucnredlist.org">www.iucnredlist.org</a>&gt;. Downloaded on 12 September 2013.</p> <p>MRC. 2005a. Key Mekong fish species - migration paths. <i>Catlocarpio siamensis</i>. <a href="http://ns1.mrcmekong.org/programmes/fisheries/mig_catlocarpio.htm">http://ns1.mrcmekong.org/programmes/fisheries/mig_catlocarpio.htm</a>. Accessed 20 November 2013.</p>

<b>Species</b>	<b><i>Pangasianodon hypophthalmus</i>, Striped catfish</b>
<b>Candidate Criteria</b>	Criterion 1 – The species is listed as Endangered on the IUCN Red List Criterion 3 – The species is migratory
<b>Record</b>	<i>Direct</i> TISTR 2013 biodiversity survey did not record the species.
	<i>Indirect</i> The Huay Ngua MP (2010) notes presence of the species within the provincial preserved area.
<b>Distribution</b>	There is limited information regarding the size of the population of the species however the species remains common and popular aquaculture species. It is used in aquaculture.
<b>Population</b>	The species is native to Cambodia, Lao PDR, Thailand and Viet Nam.
<b>Habitat</b>	It inhabits main channels and floodplains, moving off-channel for feeding and nursing. The species feeds mainly on algae, plants, zooplankton, insects, fruits, crustaceans and fish. The species is reported to move seasonally from main channels floodplains of large rivers to floodplains and marshland for feeding and nursing. The species is capable of migration in excess of 300 km.
<b>Threats</b>	Major threats to the species globally include overexploitation, habitat degradation, and changes in water quality and flow. Plans to dam the Mekong may disrupt the species life cycle as the migratory requirements appear to rely on flow or water quality to facilitate migration, cue spawning, and aid dispersal of young.
<b>Summary</b>	Species profile information suggests that the species utilises main or larger river channels and floodplain areas. It is not expected that the Project area contains these aquatic habitats or provides a migratory pathway with the exception of Nam Xao where a permanent bridge has been constructed (refer NNP1 IEE 2013). At the crossing location, the Nam Xao is not likely to sustain greater than 10 per cent of the global population (C1 Tier 1) or a regionally significant population (C1 Tier 2), however up-and downstream areas it may play a role in migration of juveniles and as such crossing structure design has considered the requirement for adequate bridge length and allowance to maintain water flow.
<b>References</b>	Vidthayanon, C. and Hogan, Z. 2011. <i>Pangasianodon hypophthalmus</i> . In IUCN 2012. IUCN Red List of Threatened Species. Version 2013.1. <a href="http://www.iucnredlist.org">www.iucnredlist.org</a> Downloaded on 12 September 2013.

Species	<i>Probarbus labeamajor</i> , Thick lipped barb
<b>Candidate Criteria</b>	Criterion 1 - The species is listed as Endangered on the IUCN Red List Criterion 2 - The species is endemic to the Mekong Criterion 3 - The species is migratory
<b>Record</b>	<i>Direct</i> TISTR 2013 biodiversity survey did not record the species.
	<i>Indirect</i> The Huay Ngua MP (2010) notes presence of the species within the provincial preserved area.
<b>Distribution</b>	The species is endemic to the Mekong and reported only from the Mekong mainstream from Nakorn Phanom Province (Thailand) and Sambor District, Kratie District (Cambodia). It has also been found in Sesan, Sekong and Srepok tributaries of the Mekong.
<b>Population</b>	Population size is not well understood though it is noted to be decreasing and a population decline of at least 50% is inferred across the global population.
<b>Habitat</b>	The species inhabits the deep, slow reaches of the main channel of large rivers with a sand or gravel substrate and abundant mollusc population. It is known to undertake short distance migrations for spawning in November and January. The species feeds on aquatic plants, insects and shelled molluscs. The species is reported to undertake short distance migrations for spawning in November and January.
<b>Threats</b>	Threats to the species include overfishing, habitat destruction and large dams.
<b>Summary</b>	Specialist input (Dr Maurice Kottelat pers comm 11/11/2013) indicated that the species is not known to occur in the Project area part of the catchment and the record would require verification. The species is very distinctive and identification is generally unproblematic, as such the record is likely valid. Species profile information suggests that the species utilises main or larger river channels. It is not expected that the Project area contains these aquatic habitats with the exception of Nam Xao where a permanent bridge has been constructed (refer NNP1 IEE 2013). Should the record be correct, the habitat in the lower reaches of the Nam Ngiep River may be provide critical habitat however not within the Access Road Project area. <b>The Project area is not considered to be critical habitat for the species.</b>
<b>References</b>	Baird, I. 2011a. <i>Probarbus labeamajor</i> . In IUCN 2013. IUCN Red List of Threatened Species. Version 2013.1. www.iucnredlist.org Downloaded on 12 September 2013.

<b>Species</b>	<b><i>Yasuhikotakia splendida</i>, Jaguar loach</b>
<b>Candidate Criteria</b>	Criterion 2 - The species may be endemic to Lao PDR
<b>Record</b>	<p><i>Direct</i></p> <p>TISTR 2013 biodiversity survey recorded the species at Huay Ngua (4 individuals) and lower Nam Ngiep (1 individuals). No individuals were recorded from Nam Xan or upper Nam Ngiep.</p> <hr/> <p><i>Indirect</i></p> <p>-</p>
<b>Distribution</b>	
<b>Population</b>	
<b>Habitat</b>	Species habitat is listed as rocky rapids in large streams and rivers. The distribution of the species is reported from the Sekong River, Mekong (as Savannakhet) and the Mun River, Thailand.
<b>Threats</b>	
<b>Summary</b>	Specialist input (Dr Maurice Kottelat pers comm 11/11/2013) indicated, consistent with other sources, the species is only known from the Xekong drainage in southern Lao and may be a mis-identification. If an accurate species identification the Nam Ngiep should be considered critical habitat and as such verification of the record would be required. At the crossing location, the Nam Xao is not likely to sustain greater than 10 per cent of the global population (C1 Tier 1) or a regionally significant population (C1 Tier 2) if the record was determined reliable.
<b>References</b>	Baird, I. 2011b. <i>Yasuhikotakia splendida</i> . In: IUCN 2013. IUCN Red List of Threatened Species. Version 2013.1. www.iucnredlist.org. Downloaded on 20 November 2013.

Species	<i>Wallago leeri</i>
<b>Candidate Criteria</b>	<p>Criterion 1 - The species has an elevated protection status nationally and is listed as Restricted in the Regulation of the Ministry of Agriculture and Forestry No. 0360/MAF.</p> <p>Criterion 3 - The species is migratory.</p>
<b>Record</b>	<p><i>Direct</i></p> <p>TISTR 2013 biodiversity survey did not record the species.</p> <hr/> <p><i>Indirect</i></p> <p>The Huay Ngua MP (2010) notes presence of the species within the provincial preserved area.</p>
<b>Distribution</b>	<p>The distribution of the species reaches from the Mekong delta to northern Lao PDR and Thailand (Poulsen and Valbo-Jorgensen 2000). Other sources note that reports of the species from the Mekong River basin are mis-identifications of <i>Wallago micropogon</i>. <i>W. leeri</i> is restricted to western Indonesia and Malay Peninsula where in the Mekong River <i>W. micropogon</i> occurs.</p>
<b>Population</b>	
<b>Habitat</b>	<p>The species is noted to occur in large streams and rivers with juveniles found in the mouth of small streams connected to larger rivers. MRC noted in 2005 that interviews with fisherman in Lao PDR and Thailand indicated that the species migrated to smaller stream habitats for spawning.</p>
<b>Threats</b>	
<b>Summary</b>	<p>Species profile information suggests that the species would utilise main or larger river areas and smaller streams for juveniles. It is not expected that the Project area contains these aquatic habitats with the exception of the watercourse crossing areas.</p> <p>The crossing locations specifically area unlikely to sustain greater than 10 per cent of the global population (C1 Tier 1) or a regionally significant population (C1 Tier 2), however up-and downstream areas it may play a role in migration of juveniles and as such crossing structure design has considered the requirement for adequate bridge length and allowance to maintain water flow.</p>
<b>References</b>	<p>MRC. 2005a. Key Mekong fish species - migration paths. <i>Catlocarpio siamensis</i>. <a href="http://ns1.mrcmekong.org/programmes/fisheries/mig_catlocarpio.htm">http://ns1.mrcmekong.org/programmes/fisheries/mig_catlocarpio.htm</a>. Accessed 20 November 2013.</p>



Species	Migratory Fish Species
<b>Candidate Criteria Record</b>	Criterion 3 – These species are migratory
<b>General</b>	<ul style="list-style-type: none"> <li>• <i>Acantopsis choirorhynchos</i> (Horseface loach) – potamodromous, occurs in swift, clear streams with sand or gravelly substrate, also large rivers. IUCN distribution does not include Lao PDR (Ng 2012a).</li> <li>• <i>Barbonymus gonionotus</i> (Java barb) – potamodromous, occurs in rivers, streams, floodplains and occasionally reservoirs. Prefers standing water habitats. Local migrant from the Mekong to small streams and flooded areas (Thin et al 2012). The species is widely distributed and cultivated.</li> <li>• <i>Henicorhynchus lineatus</i> – occurs mainly in medium to large-sized rivers and enters flooded fields (Allen 2011).</li> <li>• <i>Henicorhynchus ornatipinnis</i></li> <li>• <i>Hypsibarbus venayi</i></li> <li>• <i>Luciosoma bleekeri</i> (Shark minnow) – occurs in rivers and tributaries, moving to floodplains in the rainy season (Vidthayanon 2012a).</li> <li>• <i>Mystacoleucus atridorsalis</i> – occurs in lowland rivers and submontane streams and tributaries (Vidthayanon 2012c).</li> <li>• <i>Oxyeleotris marmorata</i> (Marbled goby) – occurs in wetlands, rivers, ponds, reservoirs, canals, swamps and flooded forest. Prefers little to no water movement (Allen 2011b). Conflicting evidence regarding the migratory nature of this species.</li> <li>• <i>Scaphognathops bandanensis</i></li> <li>• <i>Sikukia gudgeri</i> (Sikuk barb) – common throughout its range, potamodromous, migrates from Cambodia to southern Lao PDR and north-eastern Cambodia between November and February (Baird 2012).</li> </ul>
<b>Summary</b>	<p>For species where the aquatic habitats up and downstream of the access road crossings may play a role in migration pathways, the area may be considered critical habitat. Further investigation into the migratory species relevant to the Project area is scheduled.</p> <p>Environmental flows release from the proposed dam will be required to consider the requirements of migratory species.</p>
<b>References</b>	<p>Ng, H.H. 2012a. <i>Acantopsis choirorhynchos</i>. In IUCN 2013. IUCN Red List of Threatened Species. Version 2013.2. www.iucnredlist.org. Downloaded on 26 November 2013.</p> <p>Thin, D.V., Van, N.S. and Nguyen, T.H.T. 2012. <i>Barbonymus gonionotus</i>. In IUCN 2013. IUCN Red List of Threatened Species. Version 2013.2. www.iucnredlist.org. Downloaded on 26 November 2013.</p> <p>Allen, D. 2011a. <i>Clarias batrachus</i>. In IUCN 2013. IUCN Red List of Threatened Species. Version 2013.2. www.iucnredlist.org. Downloaded on 26 November 2013.</p> <p>Allen, D. 2011. <i>Gymnostomus lineatus</i>. In IUCN 2013. IUCN Red List of Threatened Species. Version 2013.2. www.iucnredlist.org. Downloaded on 16 January 2014.</p> <p>Vidthayanon, C. 2012. <i>Luciosoma bleekeri</i>. In IUCN 2013. IUCN Red List of Threatened Species. Version 2013.2. www.iucnredlist.org. Downloaded on 26 November 2013.</p> <p>Rayamajhi, A., Jha, B.R. and Sharma, C. 2010. <i>Mastacembelus armatus</i>. In IUCN 2013. IUCN Red List of Threatened Species. Version 2013.2. www.iucnredlist.org. Downloaded on 26 November 2013.</p>

Species	Migratory Fish Species
	Vidthayanon, C. 2012b. <i>Mastacembelus favus</i> . In IUCN 2013. IUCN Red List of Threatened Species. Version 2013.2. <a href="http://www.iucnredlist.org">www.iucnredlist.org</a> . Downloaded on 26 November 2013.
	Vidthayanon, C. 2012c. <i>Mystacoleucus atridorsalis</i> . In IUCN 2013. IUCN Red List of Threatened Species. Version 2013.2. <a href="http://www.iucnredlist.org">www.iucnredlist.org</a> . Downloaded on 26 November 2013.
	Ng, H.H. 2012b. <i>Mystus singaringan</i> . In IUCN 2013. IUCN Red List of Threatened Species. Version 2013.2. <a href="http://www.iucnredlist.org">www.iucnredlist.org</a> . Downloaded on 26 November 2013.
	Allen, D. 2011b. <i>Oxyeleotris marmorata</i> . In IUCN 2013. IUCN Red List of Threatened Species. Version 2013.2. <a href="http://www.iucnredlist.org">www.iucnredlist.org</a> . Downloaded on 26 November 2013.
	Ng, H.H. 2012c. <i>Pseudomystus siamensis</i> . In IUCN 2013. IUCN Red List of Threatened Species. Version 2013.2. <a href="http://www.iucnredlist.org">www.iucnredlist.org</a> . Downloaded on 26 November 2013.
	Baird, I. 2012. <i>Sikukia gudgeri</i> . In IUCN 2013. IUCN Red List of Threatened Species. Version 2013.2. <a href="http://www.iucnredlist.org">www.iucnredlist.org</a> . Downloaded on 26 November 2013.
	Dey, S.C. 2010. <i>Xenentodon cancila</i> . In IUCN 2013. IUCN Red List of Threatened Species. Version 2013.2. <a href="http://www.iucnredlist.org">www.iucnredlist.org</a> . Downloaded on 26 November 2013.

Annex F

## Consultation Documentation

## ESMMP-CP for Access Road Construction\_NamNgiep Hydropower Project

### Minutes Of 9April 2013 Consultation Meeting with Affected People by the Road Construction from Nonsomboun village to the Dam Site

<b>PREPARED BY:</b> Minavanh Pholsena, Lao Consulting Group	<b>REVIEWED AND APPROVED BY:</b>	<b>REFERENCE NO:</b>
<b>DATE OF MEETING:</b> 09 April 2013	<b>VENUE AND TIME:</b> Hat Gniun from 09:00 am to 11:30 am Nonsomboun from 0 2:00 pm to 4:30 pm	
<b>PARTICIPANTS :</b> BORIKHAN DISTRICT AUTHORITIES:05 (female 0) VILLAGE AUHOROTIES:05 (female 0) AFFECTED HOUSEHOLDS:79 (female34) KANSAI STAFF: 6 (female 2) CONSULTANTS: 3 (female 3)  (See Annex 1 for details)		
<b>BACKGROUND AND OBJECTIVES OF THE MEETING:</b> <ul style="list-style-type: none"> <li>◆ To introduce the background of the Nam Ngiep Hydropower project</li> <li>◆ To provide information on the construction of the access road from Nonsomboun village to the dam site</li> <li>◆ To provide information on the compensation plan for the affected households by the access road</li> <li>◆ To get the feedback from the affected households on the impacts and compensation plan of the access road</li> </ul>		
<b>METHODOLOGY:</b> <ul style="list-style-type: none"> <li>• Distribution of booklet on and presentation of technical aspect of the construction of the access road, compensation plan and grievance procedures</li> <li>• Focus group discussions with men and women separately on the impacts of the road construction and proposed mitigation measures of the negative impacts</li> <li>• Panel discussions on issues discussed in the groups and</li> <li>• Clarification by the developer on the issues raised from the group discussions.</li> </ul>		

#### DISCUSSION HIGHLIGHTS AND AGREEMENTS REACHED:

- **Positive impact of the access road :**
  - **Hat Guin:**
    - **During the construction** the villagers will be able to get the job with the contractors and thus improve their family income.
    - **After the construction** there will be an improved access all year round to the government administrative and health care services, and to the markets. Particularly the women were very happy and were expected to see this improved access road materialized. Some of them expressed their willingness to contribute their affected land to the project.



- **Nonsomboun:**
  - Higher value of land resulting in improved access to the area.
- **Negative impacts:**
  - **Hat Guin:**
    - **During the construction:**
      - **Hat Guin:**
        - houses, trees (teak), garden and residential land will be affected and the affected people would like to





know the exact area that is going to be affected. They don't know the price of their land and they expect to get fair compensation. The price of the teak is 500 Bath per tree with the diameter of 25 centimeters.

- Dust. The villagers are disturbed with dust and they would like the company to make sure that the road is watered every day.
- Accidents particularly with school children, women and elderly. The villagers experienced high speed of vehicle movement in the area and they asked the company to develop the measure for control of high speed .
  - Traffic signs are put close to the construction sites and the villagers have asked the company to put it up farther from the construction site so people are aware before they reach the sites.
  - Social disorder due to mobility of construction workers in the area. For instance drug abuse, thieves, commercial sex service and associated STI diseases.
- **Nonsomboun:**
  - houses, fences, trees, part of paddy, garden and residential land will be affected and the affected people would like to know the exact area that is going to be affected so they could plan their land use for the next rainy season. They mentioned that the price of the agricultural land is between 150000 to 200,000 Thai Bath per ha and they would like to get fair compensation. For the price of the tree they know the cost of rubber seedling which is between 2000 to 5000 Kip per seedling.
  - For the removal of fences along the road in Nonsomboun section, the villagers have asked the project developer to help with it and put it back after the road is completed

- The high trucks may destroy the electricity wires across the road in



Nonsomboun  
village

- Culvert installation must be completed before the rainy season in order to prevent the flooding
  - Dust disturbance.
  - The junction between the main road and the access road must be widened to avoid accident
  - Spoil from the construction activities must be removed from the field of the villagers after the construction.
  - Vehicle speed must be control to prevent small children from the accident.
  - Traffic sign must be put up along the road
- **After the construction:** Villagers in both Hat Guin and Nonsomboun mentioned about the risks of accident and social disorder due to improved access.
- At the end of the consultation meetings in both venues the participants have asked about the starting date of the road construction. They have attended many meetings about this project and they want to see the actual road construction started as soon as possible. They agreed to get the compensation after the completion of the road with the rate determined through PMLCRC.
- **Clarification by the company:**
  - Following the consultation meeting held on 08/01, the company has the list of all potential affected households and it will be finalized after detailed design and the affected households will be compensated based on the actual loss taken by the road. The Resettlement Management Unit (RMU) has been set up and approved a week before this consultation meeting and this RMU will make sure that the entitlements of all affected household are strictly followed by the company. The RMU will make the decision on the cost norm of all

affected assets.



- The company will minimize the impact on building structures as much as possible.
- The company will make sure that along the road sections that pass through the villages are watered at least once a day to minimize dust.
- With regard to damage of electricity wire, the company will avoid any damage through the discussion with contractor.
- The company will ensure that the contractors will follow rules and regulations concerning speed limit and the construction signs are put in the right places. The company has asked whether the pamphlet on road safety were relevant easy to understand by the children? The villagers replied that they understand the message. Thus the company will provide more pamphlets on road safety to the schools in the area.

## Explanation of access road rehabilitation works

### 1. Meeting with Ban Hat Gniun and Ban Thahua

1-1. Time; 8<sup>th</sup> February 9:45-10:50

1-2. Attendees;

- ① Bolikhan district; Mr. Bounphanh (President of Lao Front for National Construction, Bolikhan District), Mr. Vongsavanh (Official staff, secretary of Bolikhan District Governor)
- ② PAPs; 60 peoples (Ban Hat Gniun, Ban Thahua and Ban Hatsaykham) including village head, lao women union, lao front national construction and representative of youth
- ③ NNP1; Tanaka, Keo, Vilanhpan, Vylar, Tomioka
- ④ Contractor of road rehabilitation works; Mr. Kheungkham (Road No.8)
- ⑤ Consultant of compensation; Mr. Bounma (SSAFE)

1-3. Minutes of meeting;

NNP1 explained as follows;

- This explanation is not for the whole construction works but for just road rehabilitation works. The purpose of this meeting is to explain the plan of access road rehabilitation works, environmental mitigation plan, compensation and grievance redress mechanism to PAPs.
- The purpose of this works is to secure accessibility to go to site for geological survey even in the coming rainy season. We will install 3 bridges at Nam Xao, Nam Tak and Nam Miang River. Villagers along the existing road can get benefits from this works due to the improvement of accessibility.

a) Village head (Hat Gniun);

We agree the plan of access road rehabilitation works and compensation scheme. The village head requests villagers to cooperate with the works. Also, the village head agrees that the existing fence, which demarcates the public land from the private land, along the access road can be removed to be convenient for the works. Regarding the location of borrow pits of the works, the village head also requests villagers to cooperate with contractor and consultant on the decision of location.

b) Villagers (Hat Gniun);

We have been explained such plan of construction works from developer many times. My concern is whether this works are to be certainly realized.

NNP1; We have already contracted with contractor to start rehabilitation works.

c) Villagers (Ban Thahua);

We have been waiting for start of this project. We worry that the whole construction works of NNP1 are not to be implemented.

NNP1; We will start the whole construction works in the near future.

d) Bolikhan District;

The villagers have waited for this project for a long time. Bolikhan District would like to ask the both villages to cooperate with NNP1. Regarding the compensation rate, Resettlement Committee will discuss to decide the rate later. If villagers have any uncertain points, please don't hesitate to construct with NNP1.

## 2. Meeting with Ban Hat Nonsomboun and Ban Sisavath

2-1. Time; 8<sup>th</sup> February 14:00-15:00

2-2. Attendees;

- ① Bolikhan district; Mr. Bounphanh (President of Lao Front for National Construction, Bolikhan District), Mr. Vongsavanh (Official staff, secretary of Bolikhan District Governor)
- ② PAPs; 60 peoples (Ban Hat Nonsomboun and Ban Sisavath) including village head, lao women union, lao front national construction and representative of youth
- ③ NNP1; Tanaka, Keo, Vilanhpan, Vylar, Tomioka
- ④ Contractor of road rehabilitation works; Mr. Kheungkham (Road No.8)
- ⑤ Consultant of compensation; Mr. Bounma (SSAFE)

2-3. Minutes of meeting;

As same as the meeting in the morning, NNP1 explained the purpose of the explanation.

a) Villagers (Ban Nonsomboun);

My paddy field is located in lower area along the small valley. In the last rainy season, my paddy field was flooded because the backfill, which locates at access road near my paddy field, blocked water flow. That's why, please install pipe culverts at my paddy field to pass through water flow.

NNP1; According to our layout plan of pipe culverts, your paddy field is located at the No. 2 and No. 3 of pipe culvert. We will install pipe culverts near your paddy field.

b) Villagers (Ban Nonsomboun);

If your work schedule is delayed, there is a possibility not to be completed due to rainy season.

NNP1; Thank you for your advice. We consider the impact from rainy season carefully.

c) Village head (Ban Nonsomboun);



We hope that almost of work items are to be completed before the rainy season.

We should recognize that this works contribute to improvement of living standards of each village.

The village head requests villagers to cooperate for the works and owners of each affected asset to wait RC decision on the compensation rate for negotiation of compensation. However, each record on loss of assets is required in advance.

d) Bolikhan District;

The villagers have waited for this project for a long time. Bolikhan District would like to ask the both villages to cooperate with NNP1. Regarding the compensation rate, Resettlement Committee will discuss to decide the rate later. If villagers have any uncertain points, please don't hesitate to construct with NNP1.

(Attachment)

Attachment-1; Presentation document

Attachment-2; Participants list

Attachment-3; Photos

## ບົດອະທິບາຍກ່ຽວກັບການປັບປຸງພື້ນຟູເສັ້ນທາງ.

### 1. ກອງປະຊຸມກັບບ້ານຫາດຍືນ ແລະ ບ້ານທ່າເຮືອ

1.1 ເວລາ: ວັນທີ 8 ກຸມພາ 2013, 9:45 - 10:50

#### 1.2 ຜູ້ເຂົ້າຮ່ວມ

- ເມືອງ ບໍລິຄັນ: ທ່ານ ບຸນພັນ ( ປະທານແນວລາວສ້າງຊາດ ປະຈຳເມືອງ ບໍລິຄັນ), ທ່ານ ວົງສະຫວັນ ( ພະນັກງານ, ເລຂາພັກເມືອງ ບໍລິຄັນ)
- ຊາວບ້ານທີ່ໄດ້ຮັບຜົນກະທົບ ຈຳນວນ 60 ຄົນ( ບ້ານ ຫາດຍືນ, ບ້ານ ທ່າເຮືອ ແລະ ບ້ານ ຫາດຊາຍຄຳ) ເຊິ່ງໃນນັ້ນມີ: ນາຍບ້ານ, ສະຫະພັນແມ່ຍິງ, ແນວລາວສ້າງຊາດ ແລະ ຕົວແທນຊາວໜຸ່ມ.
- ໂຄງການເຂື່ອນໄຟຟ້ານ້ຳງຽບ1: ທານາກະ, ຂັນແກ້ວ, ວິລະພັນ, ວິນລະ, ໂຕມິໂອກະ.
- ຜູ້ຮັບເໝົາວຽກບ້ານປັບປຸງພື້ນຟູເສັ້ນທາງ: ທ່ານ ເຊິງຄຳ( ເສັ້ນທາງ ເລກ8)
- ທີ່ປຶກສາກ່ຽວກັບວຽກງານຊົດເຊີຍ: ທ່ານ ບຸນມາ( SSAFE)

#### 1.3 ບົດບັນທຶກກອງປະຊຸມ

ໂຄງການເຂື່ອນນ້ຳງຽບ 1 ໄດ້ສະເໜີດັ່ງລຸ່ມນີ້:

- ການສະເໜີຄັ້ງນີ້ ແມ່ນບໍ່ໄດ້ໝາຍເຖິງທັງໝົດຂອງວຽກງານການກໍ່ສ້າງ, ມີພຽງແຕ່ວຽກປັບປຸງພື້ນຟູເສັ້ນທາງເທົ່ານັ້ນ. ຈຸດປະສົງຂອງການປະຊຸມດັ່ງກ່າວ ແມ່ນເພື່ອອະທິບາຍແຜນວຽກຂອງການປັບປຸງພື້ນຟູເສັ້ນທາງ, ແຜນການຫຼຸດຜ່ອນຜົນກະທົບທາງດ້ານສິ່ງແວດລ້ອມ, ກົນໄກການຊົດເຊີຍ ແລະ ຫຼຸດຜ່ອນຄ່າເສຍຫາຍໃຫ້ແກ່ປະຊາຊົນຜູ້ທີ່ໄດ້ຮັບຜົນກະທົບ.
- ຈຸດປະສົງທີສອງ ແມ່ນເພື່ອເປັນການຮັບປະກັນເຖິງຄວາມປອດໄພໃນການເຂົ້າສຳຫຼວດທາງດ້ານທໍລະນີສາດ ໃນຊ່ວງລະດູຝົນທີ່ຈະມາເຖິງນີ້. ພວກເຮົາຈະສ້າງຂົວ 3 ແຫ່ງຄື: ນ້ຳຊາວ, ນ້ຳຕາກ ແລະ ນ້ຳໝັງ. ປະຊາຊົນຜູ້ທີ່ໄດ້ຍັງອາໄສຢູ່ຕາມເສັ້ນທາງດັ່ງກ່າວນັ້ນ ກໍຈະໄດ້ຮັບຜົນປະໂຫຍດໃນການນໍາໃຊ້ເສັ້ນທາງເຊັ່ນດຽວກັນ.

#### a) ນາຍບ້ານ( ບ້ານ ຫາດຍືນ)

ພວກເຮົາເຫັນດີຕໍ່ແຜນວຽກໃນການປັບປຸງພື້ນຟູເສັ້ນທາງ ແລະ ແຜນການຊົດເຊີຍ. ໃນນັ້ນນາຍບ້ານ ຍັງໄດ້ຮຽກຮ້ອງໃຫ້ປະຊາຊົນຈົ່ງໃຫ້ຄວາມຮ່ວມມືໃນການປະຕິບັດວຽກຕ່າງໆ. ນອກຈາກນັ້ນ, ນາຍບ້ານກໍໄດ້ຕົກລົງ ສາມາດໃຫ້ມີການຍົກຍ້າຍຮົ່ວຫັກເຂດແດນກັນລະຫ່ວາງດິນລັດແລະ ດິນສ່ວນບຸກຄົນ ເພື່ອເປັນການອໍານວຍຄວາມສະດວກໃຫ້ແກ່ໜ້າວຽກດັ່ງກ່າວ. ກ່ຽວກັບການຍົກຍ້າຍສາລັບບໍ່ດິນຂອງໂຄງການ, ນາຍບ້ານຍັງໄດ້ຮຽກຮ້ອງໃຫ້ຊາວບ້ານຈົ່ງໃຫ້ຄວາມຮ່ວມມືຕໍ່ຜູ້ຮັບເໝົາ ແລະ ທີ່ປຶກສາໃນການຕັດສິນໃຈຕໍ່ການກຳນົດທີ່ຕັ້ງ.

b) ປະຊາຊົນ( ບ້ານ ຫາດຍືນ)

ພວກເຮົາໄດ້ຍືນການນຳສະເໜີແຜນການກໍ່ສ້າງຫຼາຍໆຄັ້ງຈາກຜູ້ພັດທະນາໂຄງການ. ແຕ່ພວກເຮົາກໍຍັງກັງວົນວ່າໂຄງການດັ່ງກ່າວ ຈະເລີ່ມປະຕິບັດແທ້ບໍ່.

ໂຄງການເຂື່ອນໄຟຟ້ານ້ຳງຽບ1: ພວກເຮົາໄດ້ເຊັນສັນຍາກັບຜູ້ຮັບເໝົາເພື່ອເລີ່ມວຽກປັບປຸງພື້ນຟູເສັ້ນທາງເປັນທີ່ຮຽບຮ້ອຍແລ້ວ.

c) ປະຊາຊົນ( ບ້ານ ທ່າເຮືອ)

ພວກເຮົາໄດ້ລໍຖ້າການເລີ່ມໂຄງການ ແລະ ພວກເຮົາມີຄວາມກັງວົນວ່າວຽກກໍ່ສ້າງທັງໝົດຂອງໂຄງການເຂື່ອນໄຟຟ້ານ້ຳງຽບ1 ຈະບໍ່ໄດ້ຖືກຈັດຕັ້ງປະຕິບັດເທື່ອ.

ໂຄງການເຂື່ອນໄຟຟ້ານ້ຳງຽບ1: ພວກເຮົາຈະເລີ່ມວຽກກໍ່ສ້າງທັງໝົດໃນອະນາຄົດໃກ້ໆນີ້.

d) ເມືອງບໍລິຄັນ

ຊາວບ້ານໄດ້ລໍຖ້າໂຄງການນີ້ເປັນເວລາດົນນານ. ເມືອງ ບໍລິຄັນໄດ້ຮຽກຮ້ອງໃຫ້ທັງສອງບ້ານຈຶ່ງໃຫ້ຄວາມຮ່ວມມືກັບ ໂຄງການເຂື່ອນໄຟຟ້ານ້ຳງຽບ1. ກ່ຽວກັບອັດຕາຄ່າຊົດເຊີຍ, ຄະນະກຳມະການຍົກຍ້າຍຈັດສັນຈະປຶກສາຫາລື ເພື່ອກຳນົດອັດຕາຄ່າຊົດເຊີຍພາຍຫຼັງ. ກໍລະນີຖ້າຫາກຊາວບ້ານມີຂໍ້ຄ້າງຄາ ກໍສາມາດສອບຖາມກັບໂຄງການເຂື່ອນໄຟຟ້ານ້ຳງຽບ1.

2. ກອງປະຊຸມກັບບ້ານ ໂນນສົມບູນ ແລະ ບ້ານສີສະຫວາດ

2.1 ເວລາ: ວັນທີ 8 ກຸມພາ 2013, 14:00 - 15:00

2.2 ຜູ້ເຂົ້າຮ່ວມ

- ເມືອງ ບໍລິຄັນ: ທ່ານ ບຸນພັນ ( ປະທານແນວລາວສ້າງຊາດ ປະຈຳເມືອງ ບໍລິຄັນ), ທ່ານ ວົງສະຫວັນ ( ພະນັກງານ, ເລຂາພັກເມືອງ ບໍລິຄັນ)
- ຊາວບ້ານທີ່ໄດ້ຮັບຜົນກະທົບ ຈຳນວນ 60 ຄົນ( ບ້ານ ຫາດຍືນ, ບ້ານ ທ່າເຮືອ ແລະ ບ້ານ ຫາດຊາຍຄຳ) ເຊິ່ງໃນນັ້ນມີ: ນາຍບ້ານ,ສະຫະພັນແມ່ຍິງ,ແນວລາວສ້າງຊາດ ແລະ ຕົວແທນຊາວໜຸ່ມ.
- ໂຄງການເຂື່ອນໄຟຟ້ານ້ຳງຽບ1: ທານາກະ, ຂັນແກ້ວ, ວິລະພັນ, ວິນລະ, ໂຕມິໂອກະ.
- ຜູ້ຮັບເໝົາວຽກບ້ານປັບປຸງພື້ນຟູເສັ້ນທາງ: ທ່ານ ເຂົງຄຳ( ເສັ້ນທາງ ເລກ8)
- ທີ່ປຶກສາກ່ຽວກັບວຽກງານຊົດເຊີຍ: ທ່ານ ບຸນມາ( SSAFE)

2.3 ບົດບັນທຶກກອງປະຊຸມ

ຄືດັ່ງໃນກອງປະຊຸມໃນຊ່ວງຕອນເຊົ້າ, ໂຄງການເຂື່ອນໄຟຟ້ານ້ຳງຽບ1 ໄດ້ສະເໜີສົງຂອງຈຸດປະສົງຂອງການອະທິບາຍ.

a) ປະຊາຊົນ( ບ້ານ ໂນນສົມບູນ)

ດິນນາຂອງຂ້ອຍ ແມ່ນຕັ້ງຢູ່ເຂດພື້ນທີ່ຕຳຕາມແຄມທາງ. ໃນຊ່ວງລະດູຝົນປົກກາຍນີ້ໄດ້ຖືກນ້ຳຖ້ວມ ເພາະວ່າໄດ້ມີການປັບປຸງຖິ່ນດິນຢູ່ຕາມເສັ້ນທາງບໍລິເວນດິນນາດັ່ງກ່າວ ສະນັ້ນມັນ

ໄດ້ກົດຂວາງທາງນຳເຮັດໃຫ້ນຳບໍ່ໄຫຼ. ດ້ວຍເຫດນັ້ນຈຶ່ງຍາກໃຫ້ມີການວາງທໍ່ລະບາຍນ້ຳຂ້ວາມທາງຢູ່ພື້ນທີ່ດິນນາດັ່ງກ່າວເພື່ອບໍ່ໃຫ້ນຳຖ້ວມອີກ.

ໂຄງການເຂື່ອນໄຟຟ້ານ້ຳງຽບ1: ອີງຕາມແຜນງານໃນການຕິດຕັ້ງທໍ່ລະບາຍນ້ຳລອດທາງ, ພວກເຮົາມີແຜນຈະ ຕິດຕັ້ງທໍ່ຢູ່ບໍລິເວນພື້ນທີ່ດັ່ງກ່າວແລ້ວ ແລະ ຕັ້ງຢູ່ ຈຸດທີ2 ແລະ ຈຸດທີ3.

b) ຊາວບ້ານ( ບ້ານ ໂນນສົມບູນ)

ໃຫ້ເອົາໃຈໃສ່ຕໍ່ແຜນວຽກຂອງທ່ານເພາະວ່າຖ້າຫາກແຜນວຽກຊັກຊ້າ, ຈະມີຄວາມເປັນໄປໄດ້ທີ່ຈະບໍ່ສຳເລັດວຽກງານດັ່ງກ່າວໃນຊ່ວງລະດູຝົນ.

ໂຄງການເຂື່ອນໄຟຟ້ານ້ຳງຽບ1: ຂອບໃຈສຳລັບຄຳແນະນຳ. ພວກເຮົາຈະພິຈາລະນາເຖິງຜົນກະທົບຈາກລະດູຝົນຢ່າງລະອຽດ.

c) ນາຍບ້ານ ( ບ້ານ ໂນນສົມບູນ)

ພວກເຮົາຫ້ວງວ່າ ຫ້າວຽກທັງໝົດຈະສຳເລັດໃນລະດູຝົນ.

ພວກເຮົາຄວນຮັບຮູ້ວ່າ ຫ້າວຽກດັ່ງກ່າວຈະຊ່ວຍໃນການປັບປຸງຊີວິດການເປັນຢູ່ຂອງແຕ່ລະບ້ານນັ້ນ, ນາຍບ້ານຍັງຮຽກຮ້ອງໃຫ້ຊາວບ້ານຈຶ່ງໃຫ້ຄວາມຮ່ວມມືຕໍ່ກັບວຽກງານດັ່ງກ່າວ ແລະ ຜູ້ທີ່ເປັນເຈົ້າຂອງຊັບສິນທີ່ໄດ້ຮັບຜົນກະທົບໃຫ້ລໍຖ້າການສິນຂອງຄະນະກຳມະການຍົກຍ້າຍຈັດສັນກ່ຽວກັບອັດຕາການຊົດເຊີຍເພື່ອທີ່ຈະເຈລະຈາການຊົດເຊີຍ. ເຖິງຢ່າງໃດກໍຕາມພວກເຮົາຈະເກັບກຳແລະບັນທຶກລາຍການຊັບສິນທີ່ເສຍຫາຍໄວ້ລ່ວງໜ້າກ່ອນ.

d) ເມືອງ ບໍລິຄັນ.

ປະຊາຊົນ ແມ່ນໄດ້ລໍຖ້າໂຄງການດັ່ງກ່າວເປັນເວລາດົນນານແລ້ວ ແລະ ຮຽກຮ້ອງໃຫ້ທັງສອງບ້ານຈຶ່ງໃຫ້ຄວາມຮ່ວມມືກັບໂຄງການເຂື່ອນໄຟຟ້ານ້ຳງຽບ1. ອີງຕາມອັດຕາການຊົດເຊີຍ, ຄະນະກຳມະການຍົກຍ້າຍຈັດສັນຈະປຶກສາຫາລືໃນການຕັດສິນອັດຕາການຊົດເຊີຍພາຍຫຼັງ. ຖ້າຫາກວ່າຊາວບ້ານມີຂໍ້ສົງໄສອັນໃດກໍສາມາດປຶກສາຫາລືກັບ ໂຄງການເຂື່ອນໄຟຟ້ານ້ຳງຽບ1 ໄດ້.

(ເອກກະສານຕິດຄັດມານຳ)

ເອກກະສານຕິດຄັດ 01 ; ເອກກະສານນຳສະເໜີໂຄງການ

ເອກກະສານຕິດຄັດ 02 ; ລາຍຊື່ຜູ້ເຂົ້າຮ່ວມ

ເອກກະສານຕິດຄັດ 03 ; ຮູບຖ່າຍ

ESMMP-CP for Access Road Construction\_Nam Ngiep Hydropower Project

List of People Meet

Date..... 28 / 02 / 2013

Location:..... Ban Thaboua Matt Gnum.....

No.	ຊື່ ແລະ ນາມສະກຸນ Name and surname	ເພດ Gender	ຊົນເຜົ່າ Ethnic	ເບີໂທ Telephone	ລາຍເຊັນ Signature
1.	ທ. ສຸມສິງ ໄຊທະລາດ	ຊາຍ	ລາວ	55491810	
2.	ທ. ສຸມສິງ ໄຊທະລາດ	ຊາຍ	ລາວ	59774484	
3.	ທ. ທາງລີ ທາງລຸນສິມສິງ	ຊາຍ	ລາວ	55557179	
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Access Road Construction\_Nam Ngiep Hydropower Project

List of Participants in the Consultation Meeting

Date: 09/04/2013

Location: Ban Nonsombahn

No.	ຊື່ ແລະ ນາມສະກຸນ Name and surname	ເພດ Gender	ຊົນເຜົ່າ Ethnic	ເບີໂທ Telephone	Village	ລາຍເຊັນ Signature
1.	ນ. ຄຳວະ	ຍິງ	ລາວ	56024993	ໂພນສົມບູນ	
2.	ທ. ຫົວຄຳ	ຊາຍ	ລາວ	29991186	-	
3.	ທ. ຈິງ ເລີ້ອາ	ຊາຍ	ລາວ		-	
4.	ນ. ສິມພັນ	ຍິງ	ລາວ	50923819	-	
5.	ທ. ສາວ ສິ	ຊາຍ	ລາວ	2208946	ໂພນສົມບູນ	
6.	ທ. ສິນ	ຊາຍ	ລາວ	23107850	ໂພນສົມບູນ	
7.	ນ. ສາວ	ຍິງ	ລາວ		ໂພນສົມບູນ	
8.	ນ. ສິມພັນ	ຍິງ	ລາວ	228270	ໂພນສົມບູນ	
9.	ທ. ສິມພັນ	ຊາຍ	ລາວ	56034722	ໂພນສົມບູນ	
10.	ນ. ສິມພັນ	ຍິງ	ລາວ		-	
11.	ທ. ສິມພັນ	ຊາຍ	ລາວ	55281586	-	
12.	ທ. ສິມພັນ	ຊາຍ	ລາວ	29924099	-	
13.	ນ. ສິມພັນ	ຍິງ	ລາວ	58479124	-	
14.	ນ. ສິມພັນ	ຍິງ	ລາວ		-	
15.	ທ. ສິມພັນ	ຊາຍ	ລາວ	5579570	ໂພນສົມບູນ	
16.	ນ. ສິມພັນ	ຍິງ	ລາວ	56515903	ໂພນສົມບູນ	
17.	ນ. ສິມພັນ	ຍິງ	ລາວ	55989968	ໂພນສົມບູນ	
18.	ນ. ສິມພັນ	ຍິງ	ລາວ	99342422		
19.	ນ. ສິມພັນ	ຍິງ	ລາວ		ໂພນສົມບູນ	
20.	ນ. ສິມພັນ	ຍິງ	ລາວ	23094424		
21.	ທ. ສິມພັນ	ຊາຍ	ລາວ	99968329	ໂພນສົມບູນ	
22.	ນ. ສິມພັນ	ຍິງ	ລາວ	55964453	-	
23.	ທ. ສິມພັນ	ຊາຍ	ລາວ		ໂພນສົມບູນ	
24.	ນ. ສິມພັນ	ຍິງ	ລາວ		-	

Access Road Construction\_Nam Ngiep Hydropower Project

List of Participants in the Consultation Meeting

Date... 09/10/2013

Location: Ban Nonsamboun

No.	ຊື່ ແລະ ນາມສະກຸນ Name and surname	ເພດ Gender	ຊົນເຜົ່າ Ethnic	ເບີໂທ Telephone	Village	ລາຍເຊັນ Signature
1.	ນ ເຮງ	ຍິງ	ລາວ		ບ້ານ ສົມພອນ	ເຮງ
2.	ສິມພອນ	ຊ	ລາວ		ບ້ານ ສົມພອນ	ສິມພອນ
3.	ສິມພອນ	ຍິງ	ລາວ		ບ້ານ ສົມພອນ	ສິມພອນ
4.	ນ.ນ	ຍິງ	ລາວ		ບ້ານ ສົມພອນ	ນ
5.	ນ.ສົມພອນ	ຊາຍ	ລາວ		ບ້ານ ສົມພອນ	ສົມພອນ
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Access Road Construction\_Nam Ngiep Hydropower Project

List of Participants in the Consultation Meeting

Date: 09/04/2013

Location: Ban Hat Ghann

No.	ຊື່ ແລະ ນາມສະກຸນ Name and surname	ເພດ Gender	ຊົນເຜົ່າ Ethnic	ເບີໂທ Telephone	Village	ລາຍເຊັນ Signature
1.	1121 ພານພອນ	F	ລາວ	0305264242	ຫາດຊື່ນ	ພານພອນ
2.	ນ. ວິມັດ	ຍິງ	ລາວ	0305	-	
3.	ນ. ວິມັດ	ຸ	ຸ		-	
4.	ນ. ວິມັດ	ຸ	ຸ		-	
5.	ນ. ວິມັດ	ຍິງ	ລາວ		ຫາດຊື່ນ	
6.	ນ. ວິມັດ	ຍິງ		58547416		
7.	ທ. ວິມັດ	ຸ	ລາວ	58421043	ຫາດຊື່ນ	ທ. ວິມັດ
8.	ທ. ວິມັດ	ຸ	ລາວ		ຫາດຊື່ນ	ທ. ວິມັດ
9.	ທ. ວິມັດ	ຸ	ລາວ	97317046	ຫາດຊື່ນ	ທ. ວິມັດ
10.	ທ. ວິມັດ	ຸ	ລາວ		ຫາດຊື່ນ	ທ. ວິມັດ
11.	ທ. ວິມັດ	ຸ	ລາວ	5922574	ຫາດຊື່ນ	ທ. ວິມັດ
12.	ທ. ວິມັດ	ຸ	ລາວ	9612205	ຫາດຊື່ນ	ທ. ວິມັດ
13.	ທ. ວິມັດ	ຸ	ຸ			
14.	ທ. ວິມັດ	ຸ	ລາວ		ຫາດຊື່ນ	ທ. ວິມັດ
15.	ທ. ວິມັດ	ຸ	ລາວ		ຫາດຊື່ນ	ທ. ວິມັດ
16.	ທ. ວິມັດ	ຸ	ລາວ	55592403	ຫາດຊື່ນ	ທ. ວິມັດ
17.	ທ. ວິມັດ	ຸ	ລາວ	55491810	ຫາດຊື່ນ	ທ. ວິມັດ
18.	ທ. ວິມັດ	ຸ	ລາວ	59120777	ຫາດຊື່ນ	ທ. ວິມັດ
19.	ທ. ວິມັດ	ຸ	ລາວ		ຫາດຊື່ນ	ທ. ວິມັດ
20.	ທ. ວິມັດ	ຸ	ລາວ		ຫາດຊື່ນ	ທ. ວິມັດ
21.	ທ. ວິມັດ	ຸ	ລາວ	58422904	ຫາດຊື່ນ	ທ. ວິມັດ
22.	ທ. ວິມັດ	ຸ	ລາວ	98522594	ຫາດຊື່ນ	ທ. ວິມັດ
23.	ທ. ວິມັດ	ຸ	ລາວ	54745565	ຫາດຊື່ນ	ທ. ວິມັດ
24.	ທ. ວິມັດ	ຸ	ລາວ	55986157	ຫາດຊື່ນ	ທ. ວິມັດ
	ທ. ວິມັດ	ຸ	ລາວ	54241381	ຫາດຊື່ນ	ທ. ວິມັດ



Access Road Construction\_Nam Ngiep Hydropower Project

List of Participants in the Consultation Meeting

Dong,

59902929-

Date: 09/10/2013

Location: Ban Hat Gheun

No.	ຊື່ ແລະ ນາມສະກຸນ Name and surname	ເພດ Gender	ຊົນເຜົ່າ Ethnic	ເບີໂທ Telephone	Village	ລາຍເຊັນ Signature
1.	ແມ່ນຸນນອຍ	ຍິງ	ລາວ		ທາດຍິນ	ນຸນນອຍ
2.	ນວິມິດ	ຍິງ	ລາວ	0305244292	ທາດຍິນ	ນວິມິດ
3.	ນ. ງາດ	ຍິງ	ລາວ	54064816	ທາດຍິນ	ງາດ
4.	ແມ່ສິມພັນ	ຍິງ	ລາວ	9871685	ທາດຍິນ	ສິມພັນ
5.	ນາງ ແກ້ວ	ຍິງ	ລາວ	5830368	ທາດຍິນ	ແກ້ວ
6.	ນາງ ໂພດ	ຍິງ	ລາວ	59673156	ທາດຍິນ	ໂພດ
7.	ນ. ສັກສາອອນ	ຍິງ	ລາວ		-	
8.	ນ. ກຸ້ມ	ນ	ລາວ		ທາດຍິນ	
9.	ແມ່ທ່າ ສິງ	ນ	ຝ		-	
10.	ນ. ງາດ	ນ	ຝ	59443913	-	ນ. ງາດ
11.	ນ. ສອຍ	ນ	ຝ	64410340	-	ນ. ສອຍ
12.	ນ. ສິງ	ນ	ຝ		-	
13.	ນ. ສິງ	ນ	ຝ		-	
14.	ນ. ສິງ	ນ	ຝ		-	
15.	ນ. ສິງ	ນ	ຝ	5578087	-	ນ. ສິງ
16.	ນ. ສິງ	ນ	ຝ		-	
17.	ນ. ສິງ	ນ	ຝ		-	
18.	ນາງ ສິງ	ຍິງ	ລາວ		ທ່າເຮືອ	ນາງ ສິງ
19.	ນາງ ສິງ	ຍິງ	ລາວ		ທ່າເຮືອ	ນ. ສິງ
20.	ນາງ ສິງ	ຍິງ	ລາວ	5984723	ທ່າເຮືອ	ນ. ສິງ
21.	ນາງ ສິງ	ຍິງ	ລາວ	58993173	ທ່າເຮືອ	ນ. ສິງ
22.	ນາງ ສິງ	ຍິງ	ລາວ		ທ່າເຮືອ	ນ. ສິງ
23.	ນາງ ສິງ	ຍິງ	ລາວ		ທ່າເຮືອ	ນ. ສິງ
24.	ນາງ ສິງ	ຍິງ	ລາວ		ທ່າເຮືອ	ນ. ສິງ

ESMMP-CP for Access Road Construction\_Nam Ngiep Hydropower Project

List of People Meet

Date... 09...../04./2013

Location: Ban Hat Gneu - Ban Nansombon

No.	ຊື່ ແລະ ນາມສະກຸນ Name and surname	ເພດ Gender	ຊົນເຜົ່າ Ethnic	ເບີໂທ Telephone	ລາຍເຊັນ Signature
1.	ທ. ຂວັນ ພົມສິວສິວ	ຊາຍ	ລາວ ລຸ່ມ	22339447	
2.	ທ. ພົມ ພິຂາວັນ	ຊາຍ	ລາວ ລຸ່ມ	22815020	
3.	ທ. ສິນທິພັນ ທອງສິນ	ຊາຍ	ລາວ ລຸ່ມ	22435235	
4.	ທ. ລຳໄສ ສິວມະນາດ	ຊາຍ	ລາວ	22105031	
5.	ທ. ວຽງ ທວນ ສິມບຸນ	-	ລຽງ	22441179	
6.	ທ. ສິມບຸນ ສິມບຸນ	-	ໄທ	22808752	
7.	ທ. ສິມບຸນ ສິມບຸນ	ຊາຍ	ລາວ	55557179	
8.	ທ. ສິມບຸນ ສິມບຸນ				
9.	ທ. ສິມບຸນ ສິມບຸນ	ຊາຍ	ລາວ ລຸ່ມ	56149468	
10.	ທ. ສິມບຸນ ສິມບຸນ				
11.	ທ. ສິມບຸນ ສິມບຸນ	ຊາຍ	ລາວ ລຸ່ມ	09968328	
12.	ທ. ສິມບຸນ ສິມບຸນ	ສິມບຸນ	ລາວ ລຸ່ມ		
13.	ທ. ສິມບຸນ ສິມບຸນ	ຊາຍ	ລາວ ລຸ່ມ	09968328	
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Access Road Construction\_Nam Ngiep Hydropower Project

List of Participants in the Consultation Meeting

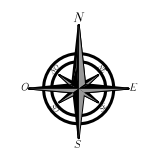
Date... 09 / 04 / 2013

Location: Ban Hat Gneu

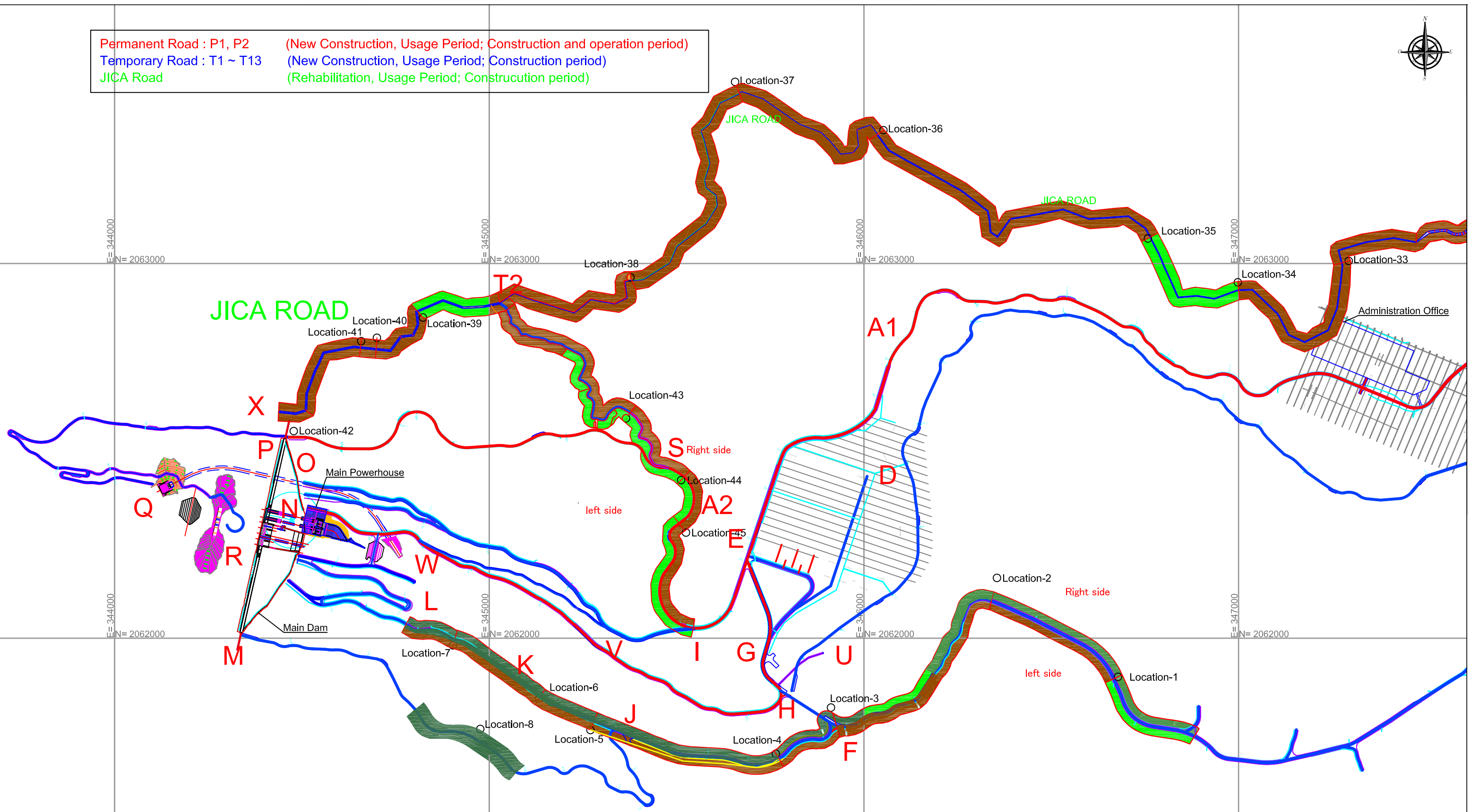
No.	ຊື່ ແລະ ນາມສະກຸນ Name and surname	ເພດ Gender	ຊົນເຜົ່າ Ethnic	ເບີໂທ Telephone	Village	ລາຍເຊັນ Signature
1.	ບ. ມິ່ນ ທອງ	ຊື່	ລາວລຸ່ມ	56531511	ບ້ານ 159	
2.	ບ. ບຸນທອງ	ຜູ້	ລາວ		ບ້ານ 159	
3.						
4.						
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Annex G

## Ground-truthed Natural and Modified Habitat Mapping



Permanent Road : P1, P2 (New Construction, Usage Period; Construction and operation period)  
 Temporary Road : T1 ~ T13 (New Construction, Usage Period; Construction period)  
 JICA Road (Rehabilitation, Usage Period; Construction period)



Road Name	Start point	Mid point	End point	Length
P1 (To Dam Top)	A	T1, B, A1, E, I, A2, S	P	9.32km
P2 (To Power house)	E	G, H, W	N	1.84km
T1, T2 (Haul road EL. 230 and 250m)	I	V	O	1.58km
T3 (RCC & CVC plant road)	G	-	D	0.55km
T4 (Upstream approach road)	P	-	Q, R	1.94km
T5 (Temporary access road)	B	-	H	3.88km

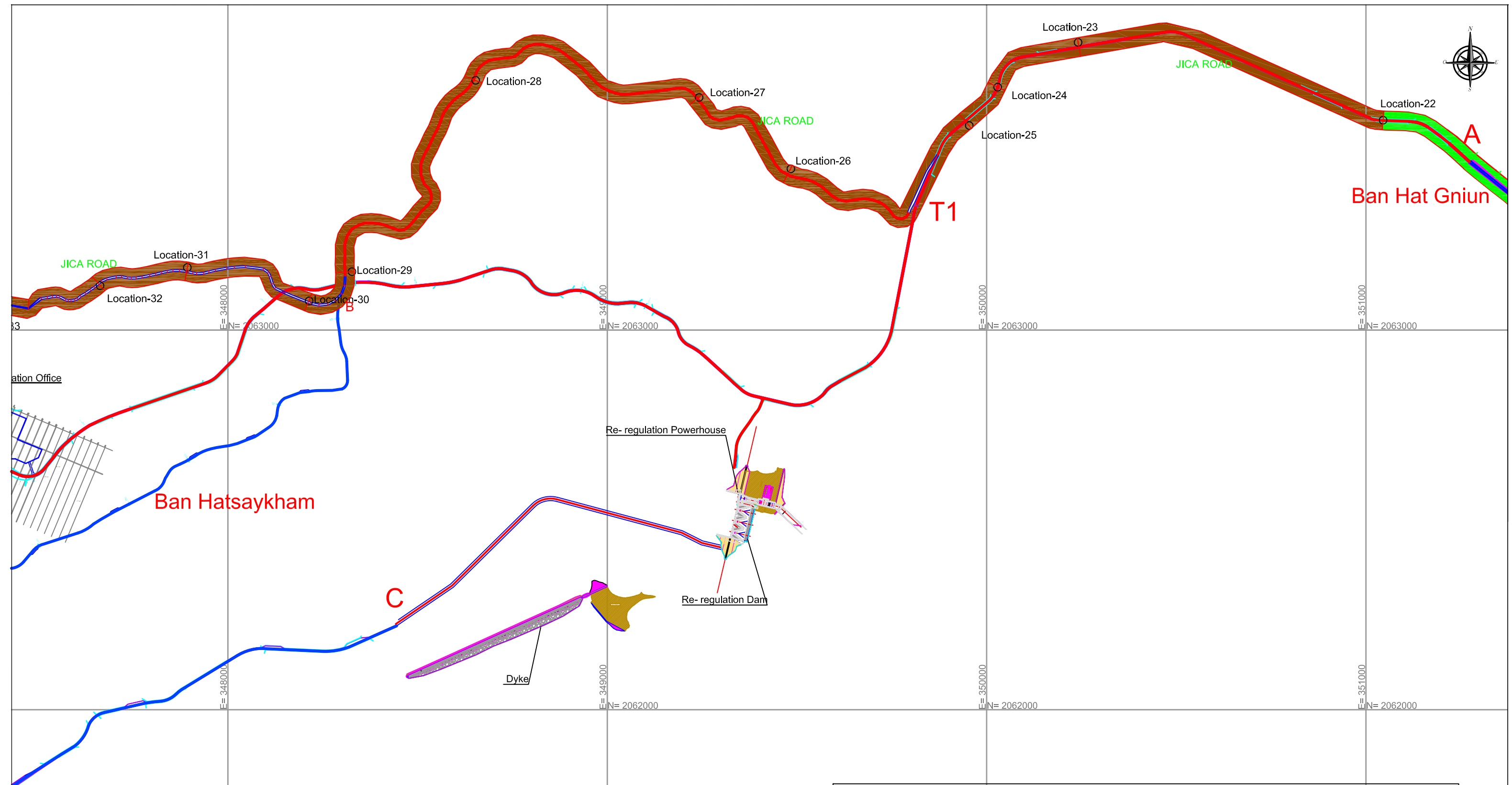
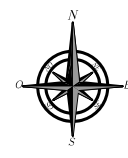
Road Name	Start point	Mid point	End point	Length
T6 (Jetty road)	H	-	U	0.20km
T7 (Haul road to dam top)	J	-	M	1.54km
T8 (Soil disposal road)	F	-	C	3.20km
T9 (Haul road to quarry)	F	-	K	1.00km
T10, T11 (Haul road EL. 200 and 230m)	K	-	L	1.68km
T12 (Temporary Road)	S	-	T2	0.72km
T13 (Temporary Road)	V	-	W	0.52km
JICA Road	A	T1, B, T2	X	9.25km

REV. NO.	JOB NO.	JOB DESCRIPTION	DRAWN	DESIGNED	VERIFIED	VALIDATED	RECOMMENDED	CONCURRED	APPROVED	DATE


  
 THE KANSAI ELECTRIC POWER CO., INC.  
 ELECTRICITY GENERATING AUTHORITY OF THAILAND

**NAM NGIEP 1 HYDROPOWER PROJECT**

DRAWN	VALIDATED	DRAWING NAME	
DESIGNED	RECOMMENDED	Layout of JICA Road, Permanent Road and Temporary Road	
VERIFIED	CONCURRED		
APPROVED	DATE : November, 2013	SCALE: 1/ 10,000	REPLACING DWG. NO. / JOB NO.
		DWG. NO.	REV.



Permanent Road : P1, P2 (New Construction, Usage Period; Construction and operation period)  
 Temporary Road : T1 ~ T13 (New Construction, Usage Period; Construction period)  
 JICA Road (Rehabilitation, Usage Period; Construction period)

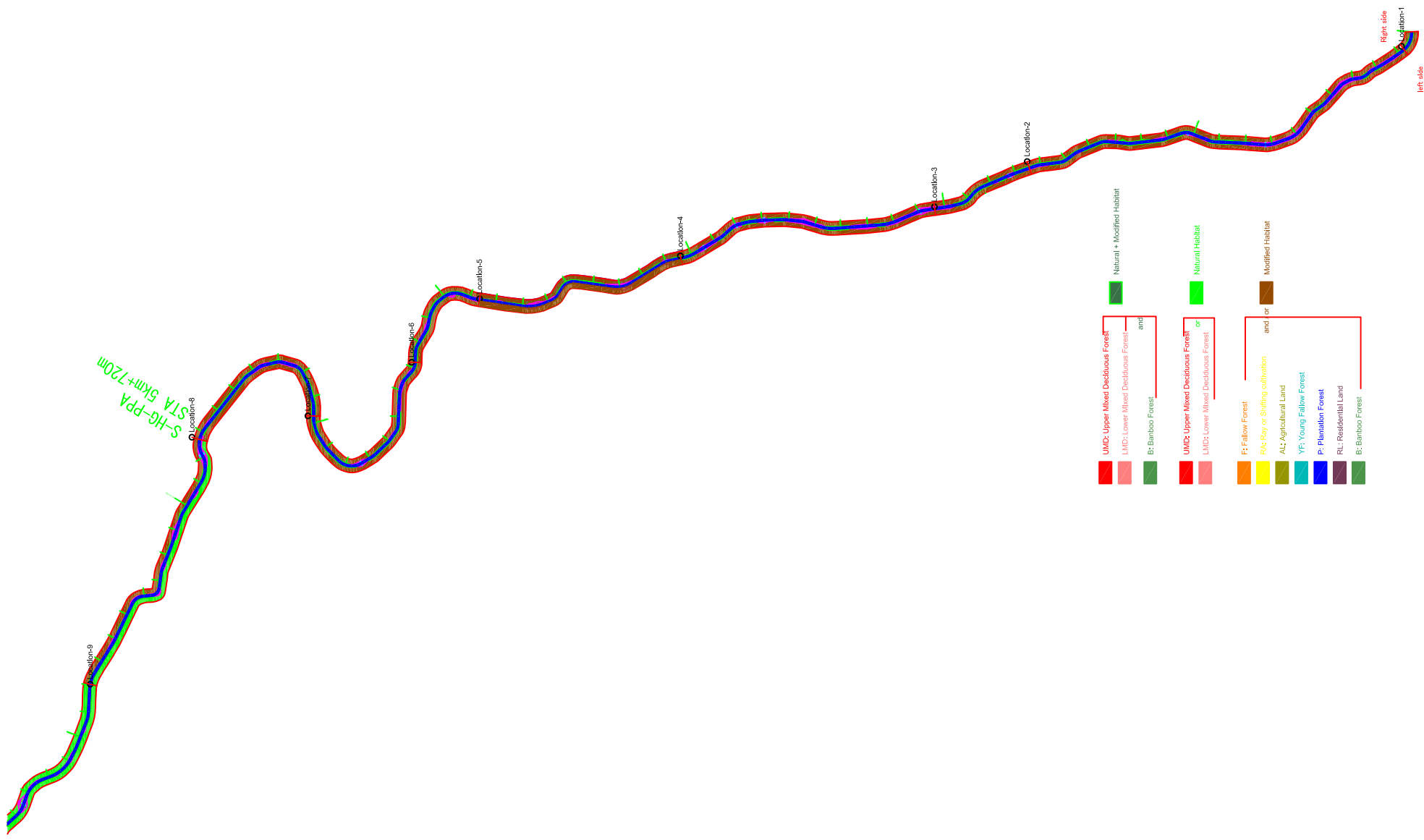
Road Name	Start point	Mid point	End point	Length
P1 (To Dam Top)	A	T1, B, A1, E, I, A2, S	P	9.32km
P2 (To Power house)	E	G, H, W	N	1.84km
T1, T2 (Haul road EL. 230 and 250m)	I	V	O	1.58km
T3 (RCC & CVC plant road)	G	-	D	0.55km
T4 (Upstream approach road)	P	-	Q, R	1.94km
T5 (Temporary access road)	B	-	H	3.88km

Road Name	Start point	Mid point	End point	Length
T6 (Jetty road)	H	-	U	0.20km
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JICA Road	A	T1, B, T2	X	9.25km

REV. NO.	JOB NO.	JOB DESCRIPTION	DRAWN	DESIGNED	VERIFIED	VALIDATED	RECOMMENDED	CONCURRED	APPROVED	DATE

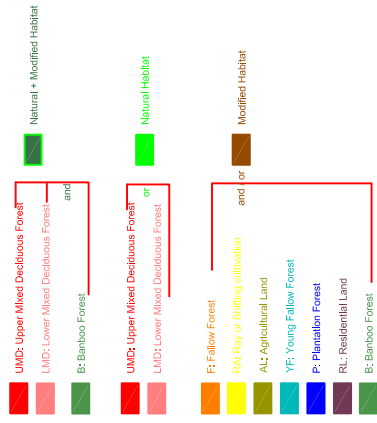


NAM NGIEP 1 HYDROPOWER PROJECT				
DRAWN	VALIDATED	DRAWING NAME		
DESIGNED	RECOMMENDED	Layout of JICA Road, Permanent Road and Temporary Road		
VERIFIED	CONCURRED	SCALE:	REPLACING DWG. NO.	DWG. NO.
APPROVED	DATE : November, 2013	1/ 10,000	JOB NO.	REV.



S-HG-PPA  
STA 5KM+120M

Right side  
Left side







- |                                   |        |                            |
|-----------------------------------|--------|----------------------------|
| UMD: Upper Mixed Deciduous Forest | and    | Natural + Modified Habitat |
| LMD: Lower Mixed Deciduous Forest |        |                            |
| B: Bamboo Forest                  |        |                            |
| UMD: Upper Mixed Deciduous Forest | or     | Natural Habitat            |
| LMD: Lower Mixed Deciduous Forest |        |                            |
| F: Fallow Forest                  | and/or | Modified Habitat           |
| RA: Ray or Shifting cultivation   |        |                            |
| AL: Agricultural Land             |        |                            |
| YF: Young Fallow Forest           |        |                            |
| P: Plantation Forest              |        |                            |
| RL: Residential Land              |        |                            |
| B: Bamboo Forest                  |        |                            |

S-HG-PPA  
STA 5km+720m

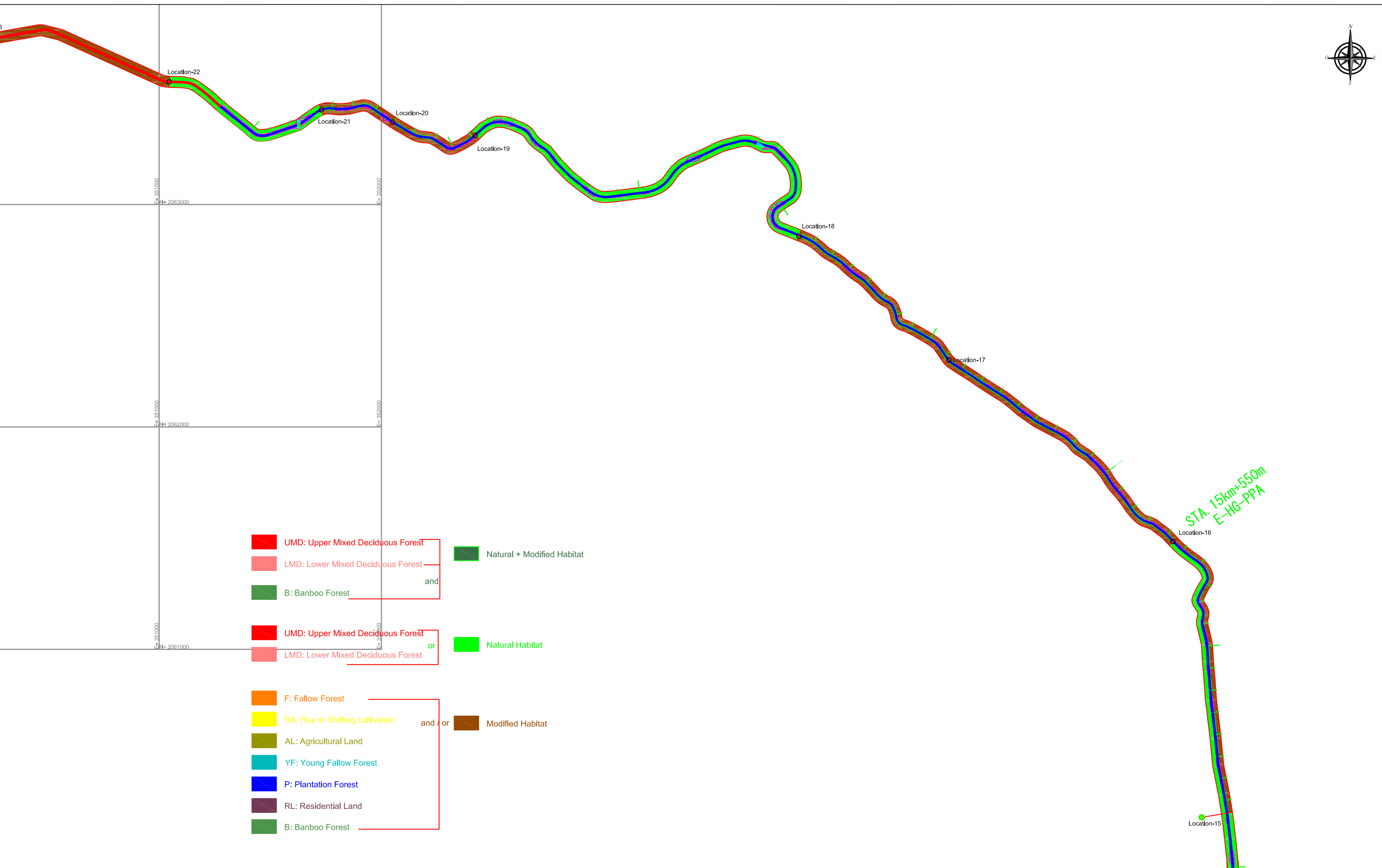
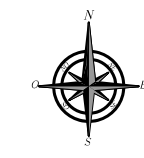
REV.NO.	JOB NO.	JOB DESCRIPTION	DRAWN	DESIGNED	VERIFIED	VALIDATED	RECOMMENDED	CONCURRED	APPROVED	DATE






**THE KANSAI ELECTRIC POWER CO., INC.**  
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NAM NGIEP 1 HYDROPOWER PROJECT				
DRAWN		VALIDATED		DRAWING NAME
DESIGNED		RECOMMENDED		Layout of JICA Road, Permanent Road and Temporary Road
VERIFIED		CONCURRED		
APPROVED			SCALE:	REPLACING DWG. NO.
				DWG. NO.
				REV.
			DATE : November, 2013	





REV.NO.	JOB NO.	JOB DESCRIPTION	DRAWN	DESIGNED	VERIFIED	VALIDATED	RECOMMENDED	CONCURRED	APPROVED	DATE

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APPROVED	DATE : November, 2013		JOB NO.	REV.

Annex H

## IUCN Reserve Classification

## *IUCN Reserve Classifications*

Category	Description	Assessment of HN PPA
<b>Category Ia</b>	Category Ia are strictly protected areas set aside to protect biodiversity and also possibly geological and geomorphological features, where human visitation, use and impacts are strictly controlled and limited to ensure protection of the conservation values. Such protected areas can serve as indispensable reference areas for scientific research and monitoring.	Does not meet the category as a “strictly protected area” as other non-conservation uses are permitted in the PPA (such as agriculture and NTFP collection)
<b>Category Ib</b>	Category Ib protected areas will generally be larger and less strictly protected from human visitation than category Ia: although not usually subject to mass tourism they may be open to limited numbers of people prepared for self-reliant travel such as on foot or by boat, which is not always the case in Ia.	Does not meet the category as a access is not restricted to human visitation and permits other non-conservation uses in the PPA (such as agriculture and NTFP collection)
<b>Category II</b>	Category II protected areas usually combine ecosystem protection with recreation, subject to zoning, on a scale not suitable for category I.	Does not meet the category as a access is not restricted to human visitation and recreation. The reserve permits other non-conservation uses in the PPA (such as agriculture and NTFP collection)
<b>Category III</b>	Category III protected areas are generally centred on a particular natural feature, so that the primary focus of management is on maintaining this feature, whereas objectives of Ia are generally aimed at a whole ecosystem and ecosystem processes.	Does not meet the criteria. The reserve is not featured on an area of a natural feature or ecosystem.
<b>Category IV</b>	Category IV protected areas protect fragments of ecosystems or habitats, which often require continual management intervention to maintain. Category Ia areas on the other hand should be largely self-sustaining and their objectives preclude such management activity or the rate of visitation common in category IV. Category IV protected areas are also often established to protect particular species or habitats rather than the specific ecological aims of category Ia.	Does not meet criteria. PPA has not been established to protect particular species or habitat. PPA does however require continual management (although this is not undertaken).
<b>Category V</b>	Category V protected areas are generally cultural landscapes or seascapes that have been altered by humans over hundreds or even thousands of years and that rely on continuing intervention to maintain their qualities including biodiversity. Many category V protected areas contain permanent human settlements. All the above are incompatible with category Ia.	Does not meet criteria. PPA is not a cultural landscapes or seascape.



Category	Description	Assessment of HN PPA
Category VI	Category VI protected areas contain natural areas where biodiversity conservation is linked with sustainable use of natural resources, which is incompatible with category Ia. However large category VI protected areas may contain category Ia areas within their boundaries as part of management zoning.	May meet criteria. PPA declaration requires the preservation and sustainable use of natural resources. However this is not enforced and hence the use of natural resources, including agriculture and forestry within the PPA, is not considered sustainable.

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