

# Initial Environmental Examination

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Project Number: 41924-014  
18 November 2015

## Nam Ngiep 1 Hydropower Project (Lao People's Democratic Republic)

### Initial Environmental Examination for the Houay Soup Resettlement Area

Prepared by Earth System on behalf of Nam Ngiep 1 Power Company Limited for the Asian Development Bank

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# INITIAL ENVIRONMENTAL EXAMINATION

## FOR THE HOUAY SOUP RESETTLEMENT AREA



November 2015

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## FOR THE HOUAY SOUP RESETTLEMENT AREA

**FINAL**

Prepared for



By



November 2015



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**Appendix A: Integrated Natural Resource Management Plan**

**Appendix B: Public Consultation, Participation and Information Dissemination Plan for HSRA development**

**Appendix C: Infrastructure Schedule**

**Appendix D: Terrestrial Flora, NTFP and TFP**

**Appendix E: Terrestrial Fauna**

**Appendix F: Fish and Aquatic Resources**

**Appendix G: Soils Analysis**

**Appendix H: ESMMP-CP Sub-Plans (ERM, 2014)**

**Appendix I: Applicable Project Standards (ERM, 2014)**

**Appendix J: Requests and Approvals for PFA Land Category Transformation for PFA to HSRA Settlement Area**

## ACRONYMS

ADB	Asian Development Bank
ARI	Average Recurrence Interval
BMPs	Best Management Practices
COD	Carbonaceous Oxygen Demand
COD	Commercial Operation of Dam
CA	Concession Agreement
CEC	Cation Exchange Capacity
DAFO	District Agriculture and Forestry Office
dBa	'A' weighted decibels
DBH	Diameter at Breast Height
DEM	Digital Elevation Model
DIP	Ductile Iron Pipe
DO	Dissolved Oxygen
EC	Electrical Conductivity
EMO	Environmental Management Office
EIA	Environmental Impact Assessment
EM	Effective Microorganisms
EMP	Environmental Management Plan
ESD	Environmental and Social Division
ESIA	Environmental and Social Impact Assessment
ESMMP- CP	Environmental and Social Monitoring and Management Plan for the Construction Phase.
ESMMP-OP	Environmental and Social Monitoring and Management Plan for the Operations Phase
FAO	Food and Agriculture Organization
GHG	Greenhouse gas
GOL	Government of Lao PDR
GPS	Global Positioning System
Ha	Hectares
HDPE	High Density Polyethylene
HSRA	Houay Soup Resettlement Area
IAP	Independent Advisory Panel
IEE	Initial Environmental Examination
IFC	International Finance Corporation
IFI	International Financial Institution

IHA	International Hydropower Association
INRMP	Integrated Natural Resource Management Plan
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for Conservation of Nature
kV	Kilovolt
kW	Kilowatt
LFAP	Land and Forest Allocation Program
LKS	Local Knowledge Sharing
MAF	Ministry of Agriculture and Forestry
Masl	Metres above sea level
MONRE	Ministry of Natural Resources and environment
MSDS	Material Safety Data Sheet
MW	Megawatt
NAFRI	National Agriculture and Forestry Research Institute
NLMA	National Land Management Authority
NNP1	Nam Ngiep 1 Power Company
NN1HP	Nam Ngiep 1 Hydropower Project
NS	Lao PDR National UXO/MINE Action Standards
NTFP	Non-Timber Forest Products
NTU	Nephelometric Turbidity Unit
ORP	Oxidation Reduction Potential
PAFO	Provincial Agriculture and Forestry Office
PAPs	Project Affected Peoples
PCD	Public Consultation, Participation and Disclosure
PCDP	Public Consultation, Participation and Disclosure Plan
PFA	Protected Forest Area
pH	Potential Hydrogen
PLUP	Participatory Land Use Planning
PONRE	Provincial office of Natural Resources and Environment
PPE	Personal Protective Equipment
QC	Quality Control
RAP	Resettlement Action Plan
RDS	Resettlement Development Site
REDP	Resettlement and Ethnic Minority Development Plans
SDP	Social Development Plan
SIA	Social Impact Assessments
SMO	Social Management Office

SP	Sub-Plan
SS-ESMMP	Site Specific Environmental and Social Management and Monitoring Plan
TD	Technical Department
TFP	Timber Forest Products
TL	Transmission Line
TDS	Total Dissolved Solids
TSS	Total Suspended Solids
UMD	Upper Mixed Deciduous
UXO	Unexploded Ordnance
VFG	Village Forest Group
VLFA	Village Land and Forest Management Agreements
WMP	Watershed Management Plan
WQ	Water Quality



# EXECUTIVE SUMMARY

## ***Introduction***

This Initial Environmental Examination (IEE) has been prepared by Earth Systems on behalf of the Nam Ngiep 1 Power Company (NNP1) to identify and assess the potential environmental and social impacts of the proposed development of the Houay Soup Resettlement Area (HSRA).

This assessment covers the 6,108 ha HSRA including the development of a 2,393 ha resettlement development site (RDS) and the sustainable management of the 3,715 ha of Nam Ngiep Nam Mang Protected Forest Area (PFA) that overlaps the HSRA boundary.

## ***Context***

Nam Ngiep 1 Power Company has received a Concession Agreement (CA) (NNP1 2013a) from the Government of Lao PDR (GOL) to build and operate the Nam Ngiep 1 Hydropower Project (NN1HP) in Central Lao PDR. The NN1HP will generate power from a Main Dam (272 MW) and a Re-regulation Dam (18 MW) on the Nam Ngiep River in Bolikhan District, Bolikhamsay Province.

As many as 3,300 project affected people (PAPs) from 417 households in five (5) communities are expected to require relocation. Due to options to split households, up to 750 Resettlement houses may be required. Resettlement communities include:

- Ban Hatsaykham (a Hamlet of Ban Hat Gniun) located in the construction area (referred to as Zone 3); and
- Ban Houaypamom, Ban Sopphuane, Ban Sopyouak and Ban Namyouak located in the lower reservoir area (referred to as Zone 2LR).

The HSRA has been selected as the Project's designated resettlement site. This site was selected in consultation with PAPs after extensive analysis of a number of resettlement site options. The site's positive characteristics include its size, agricultural development potential, and access to forest resources, access to markets, and suitability for infrastructure (i.e. domestic and irrigation water supply) which will be provided. In addition, all of the greater majority of infrastructure development will occur on highly degraded habitat, with access to less disturbed areas for community resource requirements. Concerns have been raised regarding the suitability of the soil for agriculture in the area - with some PAPs not yet convinced by the viability of the soil improvement plan.

Part of the proposed HSRA is being used by a number of 'host communities' located downstream of the main Project (referred to as Zone 5). The NNP1 Concession Agreement identifies these communities as Ban Hat Gniun and Ban Thaheua. A Confirmation Survey conducted by NNP1 (2014) identified that villagers from Ban Hat Gniun, Ban Hatsaykham and Ban Somseun currently use land within the HSRA and villagers from Ban Thaheua do not.

The HSRA has previously been assessed in the Project's Environmental Impact Assessment (EIA) Social Impact Assessment (SIA) and Resettlement Action Plan (RAP) (KANSAI et al 2012a,b,c). These documents were approved by the Ministry of Environmental and Natural Resources (MONRE). The documents were then revised by NNP1 in 2014 to ensure compliance with ADB Safeguard Policies (ADB 2009). The revised EIA (ERM 2014), SIA (NNP1 2014a) and Resettlement and Ethnic Development Plan (REDP) (NNP1 2014b) provided further assessment and management measures for the development and operations of the HSRA.

A number of significant developments have occurred following the approval of these documents:

- The HSRA was found to be overlapping the Nam Ngiep Nam Mang Protected Forest Area (officially designated in 2012);
- The design of the HSRA has been revised to potentially accommodate the relocation of up to 750 households from the five (5) resettlement communities (up from 417 households); and
- Approximately 30 households from Ban Somseun have been identified as project affected people (NNP1 2014).

Consequently, the ADB and NNP1's Independent Advisory Panel requested a more comprehensive assessment for the revised design of the HSRA, with greater attention given to how resources in the PFA land will be managed.

### ***Brief Project Description***

NNP1 will develop the HSRA for inclusion of up to 750 individual households, community assets (road/bridge, schools, health centre, market, bus stop, and community hall / village offices) and utilities (domestic water supply, irrigation water supply / irrigation pumps, solid waste disposal facility and electricity).

Construction and resettlement will occur in phases; (a) preliminary construction works (temporary roads, barges, workforce accommodation, etc.); (b) permanent road infrastructure, and residential / community infrastructure and agricultural lands implemented for some 40 households that will be relocated from Ban Hatsaykham in April, 2016; (c) the remainder of the primary infrastructure completed over the following 1 – 2 years; and (d) additional agricultural plots / plantation completed post – construction. Further detail on this infrastructure is outlined in the following sections.

As part of the construction / post-construction for the HSRA, NNP1 will work with residents of the HSRA to implement approximately 369 ha of rice paddy fields, 427 ha of upland agricultural area, and 262 ha of plantation area, including the development and implementation of a soil improvement program to ensure yields meet expectations and requirements for livelihoods and sustenance. NNP1 will develop an aquaculture pond in the Irrigation Reservoir which will support HSRA residents in its sustainable supply of fish for consumption.

The HSRA has adequate resources to provide timber forest products (TFP), non-timber forest products (NTFP), agricultural areas, and culturally significant sites (e.g. cemeteries and spirit forests), some of which will occur within the Nam Ngiep Nam Mang Protected Forest Area (PFA). An *Integrated Natural Resource Management Plan* (INRMP – Appendix A) has therefore been developed to ensure resources are sustainably managed and applicable GOL laws for PFA are adhered to within the PFA.

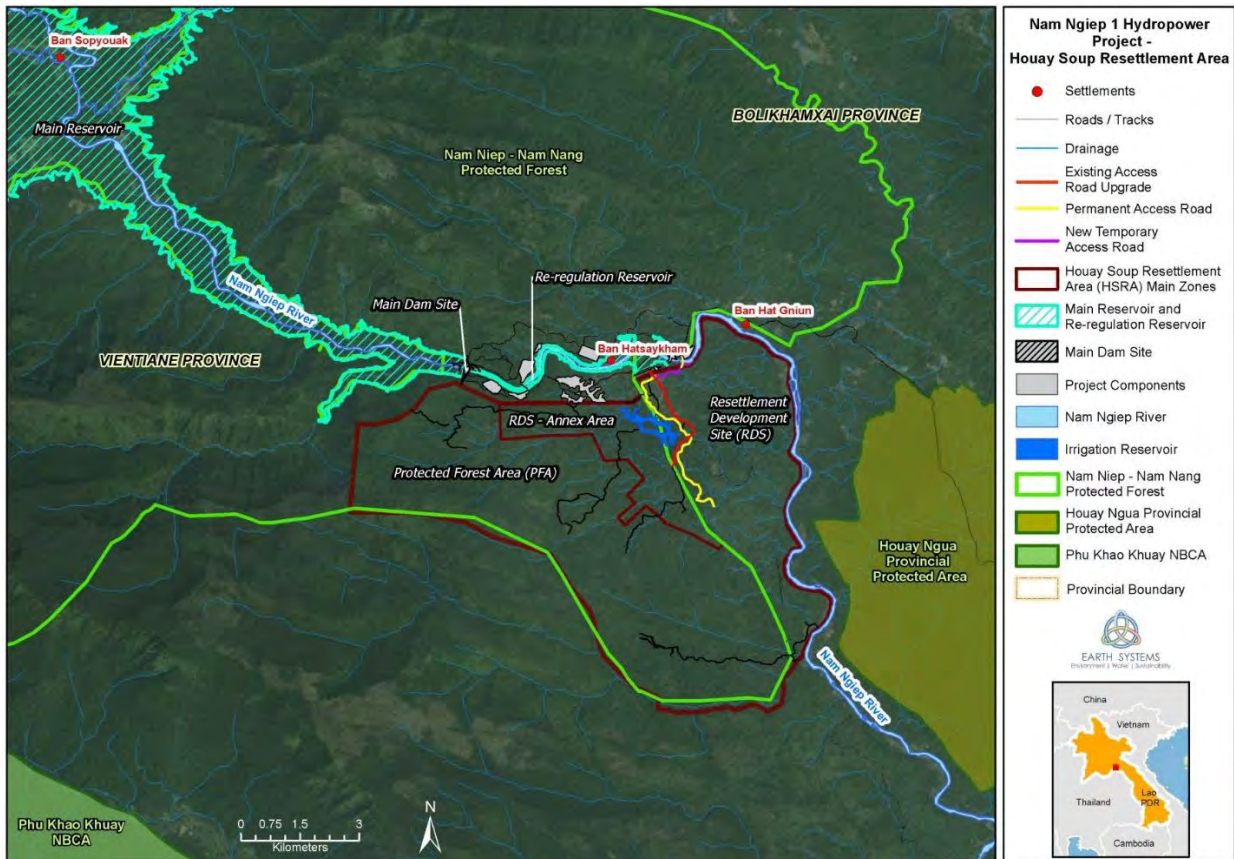


Figure 0-0-1 Location of the HSRA

## Objectives

The objectives of this IEE are to:

- Characterise the physical, social and biological baseline conditions of the HSRA;
- Identify and assess the potential environmental and social impacts of the HSRA development to host communities and resettled communities during construction and post construction phases;
- Identify management and mitigation measures to avoid, minimise or mitigate potential impacts during construction and post construction phases;
- Describe maintenance requirements for the HSRA infrastructure and identify suitable mechanisms for handover of responsibility from NNP1 to the village and GOL;
- Assess the capability of natural resources within the HSRA to support the livelihoods of resettled communities and outline management measures, in the form of an Integrated Natural Resource Management Plan (INRMP), to protect and enhance the integrity and sustainability of these resources;
- Ensure the conduct of public consultation and dissemination activities in compliance with the EIA / SIA (ERM 2014; NNP1 2014a) and the ADB Safeguards Policy (ADB 2009) through the development and implementation of a standalone public consultation and dissemination plan for the HSRA development; and
- Identify any additional environmental and social impacts that may result from the HSRA development.

## Methodology

This IEE has been conducted in compliance with both Lao Standards and the ADB's Safeguard Policy Statement (ADB 2009) and has included:

- A literature review of available background information, including preliminary and final technical design specifications for HSRA Project components;
- Detailed desk-based analysis of the proposed HSRA footprint utilising high-resolution satellite imagery;
- Conduct of a series of site investigations including village consultations, soil sampling, hydrological observations, water quality sampling and terrestrial biodiversity assessments;
- Mapping and analysis of current land uses, water resources, and habitat values in the HSRA;
- Assessment of the environmental and social risks and potential impacts for host communities and resettlement communities;
- Consultations with Project stakeholders (GOL, host communities and resettlement communities) on the preliminary results of the assessment; and
- The preparation of the IEE Report including standalone INRMP and PCDP.

### ***Key Findings: Risks and Potential Benefits and Impacts***

Key risks concerning the establishment and development of the HSRA identified and considered in this assessment include:

- Potential social and cultural impacts for host communities resulting from the loss of land and access to natural resources;
- Potential impacts on the natural environment including land, water, forests, aquatic and terrestrial biodiversity;
- Potential social and cultural impacts for resettlement communities resulting from their relocation to the area; and
- Potential inadequacy of proposed management and mitigation measures outlined in the ESMMP-CP (NNP1 2014c) and REDP (NNP1 2014b).

The sections below provide a summary of key risks and potential benefits and impacts of the proposed HSRA and existing management and mitigation measures.

#### ***Benefits for Resettlers and Host Communities***

Residents of the resettlement communities which choose to relocate to the HSRA are expected to benefit from the establishment and development of the area (in addition to compensation and livelihood restoration measures). Direct benefits are likely to include: security of tenure through the provision of land titles; access to the Project community development program; raising of income and housing to national standards; improved in-village services and infrastructure (i.e. education, health, bridge/roads, electricity); and support for the management of natural resources through the INRMP. Indirect benefits are likely to include better access to district and provincial services; reduced UXO risk; and increased monitoring / oversight (from GOL and Project financiers) regarding the successful development of the area.

Residents of Ban Hatsaykham will be relocated to the HSRA and will benefit from the establishment and development of the HSRA. PAPs from Ban Hat Gniun and Ban Somseun will receive compensation and livelihood restoration support. Ban Hat Gniun is also expected to directly benefit from the development of infrastructure within the village and the HSRA. Residents from Ban Hat Gniun, and to a lesser extent Ban Somseun, may receive indirect benefits from further development of the surrounding area including improved infrastructure and services and development of the local economy.

#### ***Land, Assets, and Agricultural Livelihoods***



The allocation of lands for the HSRA will allow for the development of a settlement and productive lands that will facilitate compensation and livelihood restoration (NNP1, 2014b) for households directly affected by the inundation of the NN1HP reservoirs.

The establishment and development of the HSRA will result in the loss of land currently being used by villagers from Ban Hatsaykham, Ban Hat Gniun and Ban Somseun.

A substantial percentage of the total village lands of Ban Hatsaykham (63%) and Ban Hat Gniun (69%) will be lost to the HSRA development. The affected land area includes agricultural and cattle grazing zones for these communities. Households from Hatsaykham will be compensated through resettlement to the HSRA. Households from Hat Gniun and Ban Somseun who will not be resettled, will be compensated. Effective implementation of the REDP and additional management and mitigation measures outlined above are expected to result in fair and adequate compensation for all PAPs from these communities.

### ***Forest Resources***

The key potential impact is the loss of access to agricultural landscapes and forests currently utilised by host communities for forest resource livelihoods. Villagers in Hatsaykham will be relocated and will benefit from the establishment of the HSRA. The forest resource based livelihoods of villagers from Ban Hat Gniun and Ban Somseun are expected to be restored or supplemented through effective implementation of livelihood restoration programs and the provision of community use rights to other areas within the PFA and support for the management of these areas.

### ***Archaeology and Cultural Heritage***

Local Knowledge Surveys conducted in Ban Hat Gniun, Ban Hatsaykham, and Ban Somseun indicated there are no archaeological and culturally significant sites of national and regional importance within the HSRA and none of major significance.

One local culturally significant site was identified within the HSRA: a sacred rock near Houay Thamdin (at the confluence with the Nam Ngiep River). The site is respected by local villagers as it was believed a hermit monk meditated in a small cave called Thamdin (Din cave). The cave has collapsed long ago and only sacred rocks remain. No grave sites or cemeteries were identified in the HSRA during the surveys.

The protection of cultural heritage values within the HSRA will be achieved through avoidance of known sites, a duty of care under the Law on National Heritage (2013), and application of procedures for chance finds.

### ***Noise, Vibration and Air Quality***

Due to the distance from local settlements, preliminary and early phase HSRA construction activities will not impact sensitive receptors. As Ban Hatsaykham will be relocated in approximately April 2016, while HSRA infrastructure development continues, relocated villagers may be exposed to nuisance level noise, vibration and dust stemming from earthworks and vehicular traffic on unsealed roads. Management and mitigation measures provided in the Project's ESMMP-CP and this IEE will minimise these impacts. However, nuisance level air quality impacts (dust) and noise during daylight hours is anticipated.

### ***Flora***

The severity of impacts to terrestrial fauna will be limited as development of the HSRA in the Resettlement Development Site will primarily impact fallow habitat or agricultural plots. Approximately 88% (2,106 ha) of the 2,394 ha of land that will be disturbed during implementation of the residential area, water resource infrastructure, paddy fields, upland agricultural / plantation plots, and livestock grazing areas is comprised of Fallow forest, cleared land, or current agricultural areas. Approximately 8% of the HSRA footprint (200 ha) is comprised of moderately to highly disturbed and fragmented modified habitat types (Upper Mixed Deciduous Forest/ Mixed Deciduous / Bamboo mosaic, Bamboo Forest, and Riparian Forest). The impact of clearing this forest is tempered by the fact that the quality and ecological function of the forested areas in the PFA is considerably higher. During June 2015 surveys, no threatened flora species were identified within the RDS.

The flora of the PFA (within the HSRA) ranges from pristine to moderately disturbed. The introduction of up to 750 households to the HSRA is likely to increase timber and non-timber forest product resource extraction from the PFA. The PFA will be managed according to the *Integrated Natural Resource Management Plan* (Appendix A), which provides a sustainable approach to forest resource management and requires adherence to GOL law with respect to resource extraction in a PFA (e.g. Total Protection Zones, Conservation Zones, Utilisation Zones). Implementation of this plan is expected to minimise impacts, and should serve to protect the handful of threatened flora species identified during surveys of the PFA.

### **Terrestrial Fauna**

According to the results of Local Knowledge Surveys for this IEE, 14 threatened terrestrial fauna species have been observed by villagers in the PFA (ranging from Vulnerable to Endangered, according to IUCN Red List of Threatened Species, 2015), with none observed within the HSRA Resettlement Development Site. Construction, agricultural activity, and forest resource extraction will leave habitat for these species largely intact. However, the relocation of up to 750 households to the HSRA is likely to increase hunting activities, potentially impacting the fauna populations and species diversity.

### **Aquatic Biodiversity**

A host of resident and migratory fish, crustaceans, eel, frogs, snail, aquatic insects, and other aquatic biodiversity inhabit HSRA streams. According to the results of the Local Knowledge Surveys, a number of species of conservation significance may utilise the perennial streams. However, due to their similarity in appearance to other (non-threatened) species their occurrence cannot be confirmed without direct sampling from a qualified aquatic biologist.

Development of the HSRA will impact aquatic biology in one perennial stream (two tributaries), but is not expected to impact regional / global fish populations as many tributaries of similar morphology discharge to the Nam Ngiep River upstream and downstream of the NN1HP inundation area.

Potential impacts are expected to be minimised by: (i) inclusion of an environmental flow regime, with at least baseflow bypassing the Houay Soup Noi Dam and the Houay Soup Ngai domestic water intake to minimise impacts to aquatic habitat and fish migration; (ii) ensuring irrigation canal design provides for the ongoing existence of natural Houay Soup stream channels; (iii) prohibiting infrastructure development, diversion, or abstraction from Houay Khinguak and its tributaries; and (iv) potential inclusion of Houay Khinguak and its tributaries as a Conservation Zone (determined during Participatory Land Use Planning), prohibiting or limiting resource extraction. Given the application of these management and mitigation measures, it is anticipated that impacts to aquatic resources may be locally significant but are not expected to have regional significance for fish populations.

The development of the aquaculture pond in the Irrigation Reservoir is also expected to offset resource losses from increased fishing pressure of HSRA resulting from resettlement / increased population.

### **Hydrology**

Five (5) perennial streams flow through the HSRA. The hydrology of two (2) of these streams (Houay Soup Noi and Houay Soup Ngai) will be significantly altered and the hydrology of the remaining small perennial stream (Houay Dhakong) slightly altered. The impoundment of the primary Houay Soup Noi tributary for the paddy field Irrigation Reservoir / aquaculture pond will significantly reduce the flow in this stream, particularly during the dry season. Abstraction of Houay Soup Ngai surface water for domestic water supply will significantly reduce the downstream flow regime during the dry season. The implementation of a continuous environmental flow program (365 days / years, 24 hours / day) will minimise the severity of impacts to hydrology and aquatic biodiversity.

### **Flooding**

Preliminary flood modelling for this IEE indicates that flooding from peak storm events could impact HSRA infrastructure (e.g. a portion of the main access road / road network) and potentially a small portion of the

HSRA residential area. NNP1 should conduct more detailed flood modelling to ensure the impact from flooding on HSRA infrastructure / livelihoods will not be significant.

Construction of the settlement for the first phase of relocation (Ban Hatsaykham in April 2016) may easily avoid potential flood zones. Higher ground also exists within the RDS annex area to the north of the current residential alignment if further flood modelling indicates the need to realign any of the Project footprint. Road alignment will require careful consideration to avoid long-term impacts on the community from flooding.

### **Water Quality**

Water quality in HSRA steams is generally good, with the exception of total and faecal coliforms that are likely a result of fairly extensive utilisation of the area for livestock grazing. Implementation of roughing filters and chlorination for the domestic water supply and implementation of fencing to prohibit livestock from accessing water resource infrastructure and much of the catchment area will improve water quality for residents in the HSRA.

Downstream receiving waters may be impacted. In the absence of diligent application of erosion and sediment control measures, sediment loading in streams will be significant during construction and following regular site preparation for agricultural areas. Progressive rehabilitation and the rapid establishment of vegetation in the region will incrementally reduce potential impacts.

Fertiliser applications and feed application in the aquaculture pond may increase nutrient loading considerably. Careful evaluation of fertiliser application rates and aquaculture practices is required to minimise nutrient loading and potential indirect impacts (e.g. eutrophication).

### **Soil Quality**

Soils of the HSRA are moderately to highly acidic and low in available nutrients, organic matter, and cation exchange capacity. The soil improvement program will increase the quality of soils in the HSRA, with the capacity for higher crop yields and improved annual growth / productivity for plantations.

### **Hazardous and Non-Hazardous Waste**

A significant quantity of non-hazardous waste will be generated, stored and disposed of in the HSRA during construction and post-construction. A number of potentially hazardous materials and hazardous materials waste products will be stored and handled in the HSRA during construction and post-construction. Non-hazardous and hazardous wastes may impact soil, surface water, and groundwater quality if improperly managed or contained.

NNP1 has developed management and mitigation measures for non-hazardous and hazardous waste storage, handling, and disposal in its ESMMP-CP and measures are further elaborated in this report. Diligent application of these measures is expected to minimise potential impacts to negligible during construction.

Non-hazardous waste separation, storage, and disposal (recycling and landfill) have been preliminarily designed for HSRA operations. Hazardous waste storage facilities (e.g. for hydrocarbons, sewage, herbicides, etc.) will have to be properly designed and constructed to ensure that they cannot discharge to the environment. Applicable HSRA residents will have to be trained in handling procedures for hazardous and non-hazardous materials / waste and emergency preparedness and response planning to ensure sensitive receptors (people and the receiving environment) are not impacted during operations.

## **Conclusions**

The assessment of the IEE concludes that the establishment of the HSRA is important so as to enable the planned resettlement for the Nam Ngiep Hydropower Project.

The proposed HSRA is considered a viable site for the NNP1 resettlement program:

- The HSRA has ample forest resources and water resources. Communal land use rights will be required to take sustainably manage and provide adequate resources for the resettled communities;
- While HSRA soils have been confirmed to be poor for agriculture purposes across the HSRA, the physical and chemical deficiencies can be suitably ameliorated with the implementation of a robust soil improvement program;
- The siting of the RDS will primarily occur on highly disturbed land and habitat;
- Preliminary modelling indicates that road infrastructure and potentially a small part of the residential area may reside within the peak storm event flood inundation zone. With the annexure of the additional 648 ha, ample land exists for re-siting if required. Current road alignment and design should be considered in the context of the anticipated flood regime; and
- Implementation of an environmental flow is considered a key factor in sustaining aquatic habitat and aquatic fauna in the Ban Houay Soup and its tributaries.

Residents of Ban Hat Gniun and to a lesser extent Ban Somseun (~30 households) who are currently using land and natural resources inside the proposed HSRA have the potential to be significantly impacted by the establishment of the HSRA. These PAPs require compensation to be implemented in accordance with the REDP (NNP1 2014).

Monitoring and management of the HSRA during the construction and post construction phases will be required to ensure that Nam Ngiep environmental and social standards are implemented.

### **Key Recommendations**

It is recommended that NNP1:

- Consult with the GOL and ADB regarding HSRA host communities and the identification of approximately 30 households from Ban Somseun;
- Continue to work with the GOL and residents of Ban Hat Gniun and affected households in Ban Somseun to identify suitable compensation, livelihood restoration, and / or provision of additional village land to recompense for land / livelihood losses associated with HSRA development and decrease in agriculture / livestock land for these two communities;
- Support the implementation of *Integrated Natural Resource Management Plan* developed for the HSRA (RDS and PFA) including completion of participatory land use planning; conduct of environmental protection and improvement activities and monitoring and evaluation of the program;
- Conduct flood modelling (including survey channel bathymetry and Digital Elevation Models) to ensure HSRA infrastructure, including residential areas and road networks, are outside the flood zone for peak storm events;
- Engineer the Houay Soup Noi irrigation water supply dam and the Houay Soup Ngai domestic water intake facility to provide for ongoing (365 days per year) environmental flow that equals at least baseflow for these streams. Adequate water volume will be available, given sourcing from the Nam Ngiep River Re-regulation Reservoir;
- Ensure continuous hydrologic connectivity of the Houay Soup Noi and Houay Soup Ngai with the Nam Ngiep River to allow for continued fish residency and migration. Engineer the irrigation channels to allow continuous stream flow to bypass the irrigation system or merge them with discharge outlets at the river; and
- Rehabilitate and revegetate unused logging road network in the PFA to restrict vehicular access, minimising the likelihood of large-scale timber operations in the higher elevations of the PFA.



# 1 INTRODUCTION

This Initial Environmental Examination (IEE) has been prepared by Earth Systems on behalf of the Nam Ngiep 1 Power Company (NNP1) to identify and assess the potential environmental and social impacts of the proposed development of the Houay Soup Resettlement Area (HSRA).

## 1.1 Background

Nam Ngiep 1 Power Company (NNP1) has received a Concession Agreement (CA) from the Government of Lao PDR (GOL) to build and operate the Nam Ngiep 1 Hydropower Project (NN1HP) in Central Lao PDR. The NN1HP will generate power from a Main Dam (272 MW) and a Re-regulation Dam (18 MW) on the Nam Ngiep River in Bolikhan District, Bolikhamsay Province. As many as 3,300 project affected people (PAPs) from up to 750 households in five (5) communities are expected to require relocation.

The Houay Soup Resettlement Area (HSRA) is the Nam Ngiep 1 Hydropower Project's designated resettlement site (refer to the Project's Concession Agreement, Annex C). This site was selected in consultation with PAPs after extensive analysis of a number of resettlement site options. The HSRA totals 6,108 ha and is located on the right bank of the Nam Ngiep River, immediately south of NN1HP's Re-regulation Dam (refer to Figure 2-1).

The HSRA has previously been assessed for the Project's Environmental Impact Assessment (EIA Social Impact Assessment (SIA) and Resettlement Action Plan (RAP) (KANSAI et al. 2012a,b,c). These documents were approved by the Ministry of Environmental and Natural Resources (MONRE). The documents were then revised by NNP1 in 2014 to ensure compliance with ADB Safeguard Policies (ADB 2009). The revised EIA (ERM 2014), SIA (NNP1 2014a) and Resettlement and Ethnic Development Plan (REDP) (NNP1 2014b) provided further assessment and management measures for the development and operations of the HSRA.

A number of significant developments have occurred since these assessments were completed:

- *Preliminary Survey of the HSRA*

Following a joint (GOL and NNP1) field survey of the proposed 6,108 ha site in June 2014, MONRE approved 1,745 ha of unallocated government land for the purpose of resettlement and livelihood restoration for NN1HP Project Affected People (PAP) (MONRE Decision 6423, September 2014). The remaining 4,363 ha was identified as overlapping with the Nam Ngiep Nam Mang Protected Forest Area (PFA), a National Protected Forest (MAF Decree 333, 2010). The GOL has since approved the annexure of 648 ha from the PFA for resettlement site development (MONRE Decision 4466, July 2015) and has indicated that the remaining 3,715 ha area may be used by PAPs as long as it is managed in accordance with a sustainable management plan.

- *Revised design of the HSRA*

The design of the HSRA has been revised by NNP1 to accommodate the potential relocation of up to 750 households (up from an estimated 417 households as outlined in the REDP, (NNP1, 2014b)). More detailed design documents for key infrastructure are also now available.

- *Host Communities and Affected People*

The NNP1 Concession Agreement identifies host communities as Ban Hat Gniun and Ban Thaheua. A Confirmation Survey conducted by NNP1 (2014) confirmed that villagers from Ban Hat Gniun, Ban Hatsaykham and Ban Somseun currently use land within the HSRA and villagers from Ban Thaheua do not.

At the IAP and ADB Missions of December 2014, both parties requested a more comprehensive assessment be conducted based on the revised design of the HSRA; and greater attention be given to how the resources in the PFA land, particularly forests, were going to be managed.

This IEE has been conducted in compliance with the ADB's Safeguard Policy Statement (ADB 2009). It includes an Integrated Natural Resource Management Plan and a Public Consultation and Dissemination Plan for the construction and 'operation' of the HSRA.

## 1.2 Objectives and Scope of the IEE

The objectives of this investigation are to:

- Characterise the physical, social and biological baseline conditions of the HSRA;
- Identify and assess the potential environmental and social impacts of the HSRA development to host communities and resettled communities during construction and operations;
- Identify management and mitigation measures to avoid, minimise or mitigate potential impacts during construction and operations;
- Describe maintenance requirements for the HSRA infrastructure and identify suitable mechanisms for handover of responsibility from NNP1 to the village and GOL;
- Assess the capability of natural resources within the HSRA to support the livelihoods of resettled communities and outline management measures, in the form of an INRMP, to protect and enhance the integrity and sustainability of these resources; and
- Ensure the conduct of public consultation and dissemination activities in compliance with the EIA / SIA (ERM 2014; NNP1 2014a) and the ADB Safeguards Policy (ADB 2009) through the development and implementation of a standalone public consultation and dissemination plan for the HSRA development.

This assessment covers the 6,108 ha HSRA, including the main construction and operation of the 2,393 ha resettlement development site (RDS) and the sustainable management of the 3,715 ha protected forest area (PFA).

Preliminary works including the preliminary access road, bridge abutment and ferry crossing, and the 22 kV village transmission line are covered in separate IEE's completed by Earth Systems in July 2015 (Earth Systems, 2015a) and August 2014 (Earth Systems, 2014) respectively.

## 1.3 HSRA Developer and IEE Consultant

### 1.3.1 Nam Ngiep 1 Power Company

NNP1 is owned by KPIC, a subsidiary of Kansai Electric Power Co. Inc. (Kansai Electric); the Electricity Generating Authority of Thailand (EGAT-I) International Co. Ltd; and Lao Holding State Enterprise. The Company is headquartered in Vientiane, Lao PDR. The owners of NNP1 have extensive experience in the design, construction and operation of large-scale hydroelectric power projects.

The contact details for NNP1 are as follows:

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### 1.3.2 Earth Systems

The Earth Systems Group is a multidisciplinary environmental and social consulting firm. Earth Systems has been operating in Lao PDR for more than 15 years and is a registered EIA consultant with the Department of Environmental and Social Impact Assessment, MONRE.

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## 1.4 Methodology

Earth Systems undertook the following activities to complete its assessment:

- A literature review of available background information available for preliminary and final technical design specifications for HSRA Project components;
- Detailed desk-based analysis of the proposed HSRA footprint utilising high-resolution satellite imagery;
- The conduct of a series of site investigations including village consultations, soil sampling, hydrological observations, water quality sampling and terrestrial biodiversity assessments;
- Mapping and analysis of current land uses, water resources, and habitat values in the HSRA;
- Assessment of the environmental and social risks and potential impacts for host communities and resettlement communities;
- Consultations with Project stakeholders (GOL, host communities and resettlement communities) on the preliminary results of the assessment; and
- The preparation of the IEE Report including INRMP and PCDP.

## 2 DESCRIPTION OF THE HSRA

### 2.1 HSRA Location

The Nam Ngiep Hydropower Project Houay Soup Resettlement Area (HSRA), located in Bolikhan District, Bolikhamsay Province, abuts the Nam Ngiep River immediately south (river right) of the Project's Main Dam and Re-Regulation Dam (refer to Figure 2-1). The closest settlements to the HSRA are on the opposite bank of the river and include Ban Hatsaykham, Ban Hat Gniun and Ban Thaheua.

#### 2.1.1 Current Land Zoning

The total village area for the HSRA will include 6,108 ha which is comprised of 1,745 ha of land previously allocated to Ban Hat Gniun and Ban Somseun (Resettlement Development Site – RDS) and 4,363 ha within the Nam Ngiep Nam Mang Protected Forest Area (PFA) - a National Protection Forest established in 2012. NNP1 has recently gained approval to annex 648 ha of the 4,363 ha PFA for expansion of the RDS bringing the total area to 2,393 ha (MONRE Decision 4466, 2015).

All major infrastructure will be developed within the 2,393 ha RDS. The remaining 3,715 ha PFA will be zoned for protection forest, conservation forest, and utilisation forest (refer to the Houay Soup Resettlement Area Integrated Natural Resources Management Plan, Appendix A).

A summary of the land zones designated within the HSRA is provided in Table 2-1.

**Table 2-1 Current Land Zoning within the HSRA**

Current Zoning	Brief description	Total area (ha)
Resettlement Development Site (RDS)	1,745 ha previously 'unallocated land' currently utilised by villagers of Ban Hat Gniun, Ban Hatsaykham, and Ban Somseun. Approved by GOL for HSRA resettlement development (MONRE Decision 6423/2014).  648 ha previously part of the PFA, now annexed for the RDS (MONRE Decision 4466/2015)	2,393
Protected Forest Area (PFA)	The remaining portion of the HSRA within the Nam Ngiep Nam Mang Protected Forest Area.	3,715
<b>Total</b>		<b>6,108</b>

Source: NNP1 2015



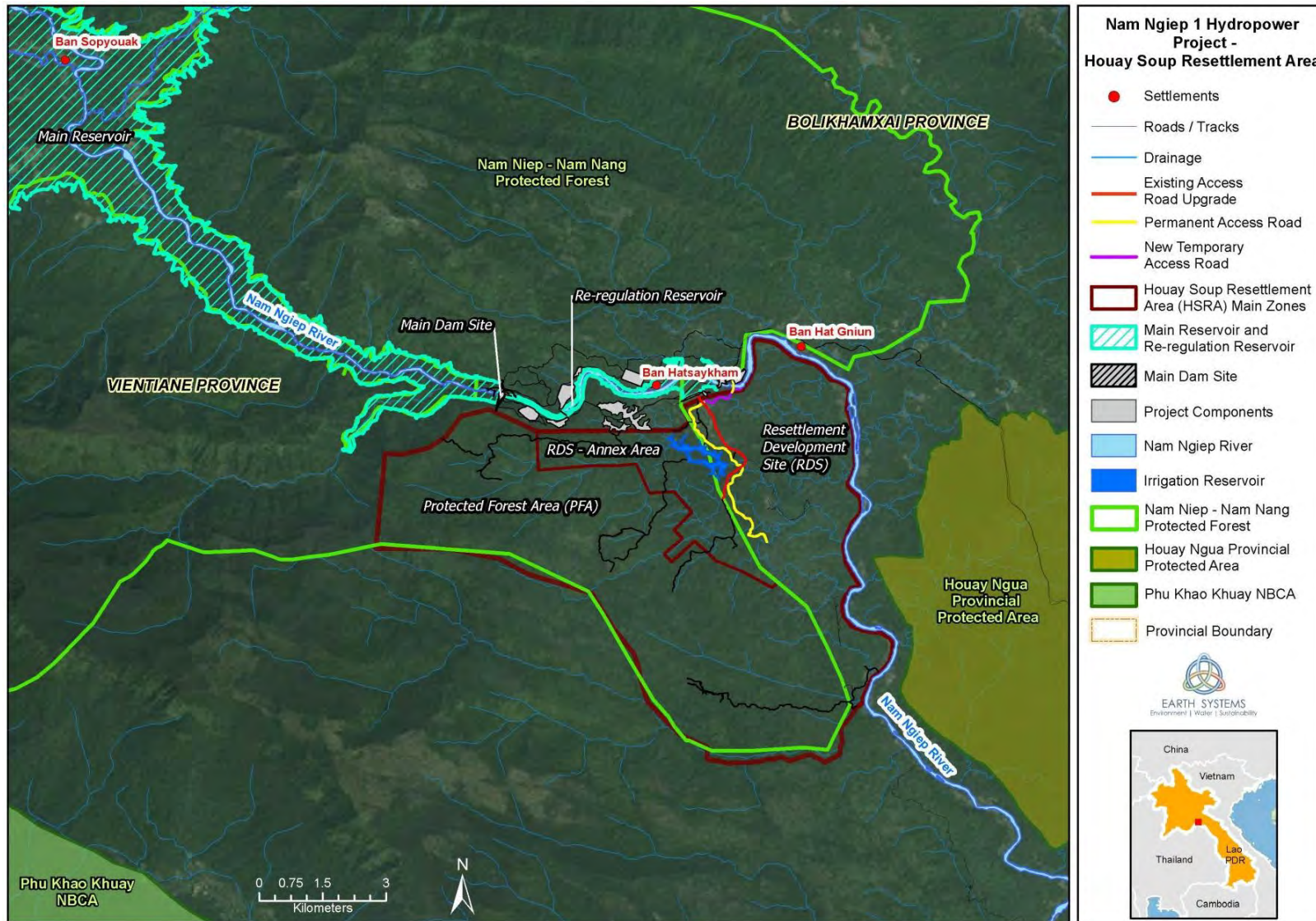


Figure 2-1 Location of the HSRA

Source: Earth Systems 2015



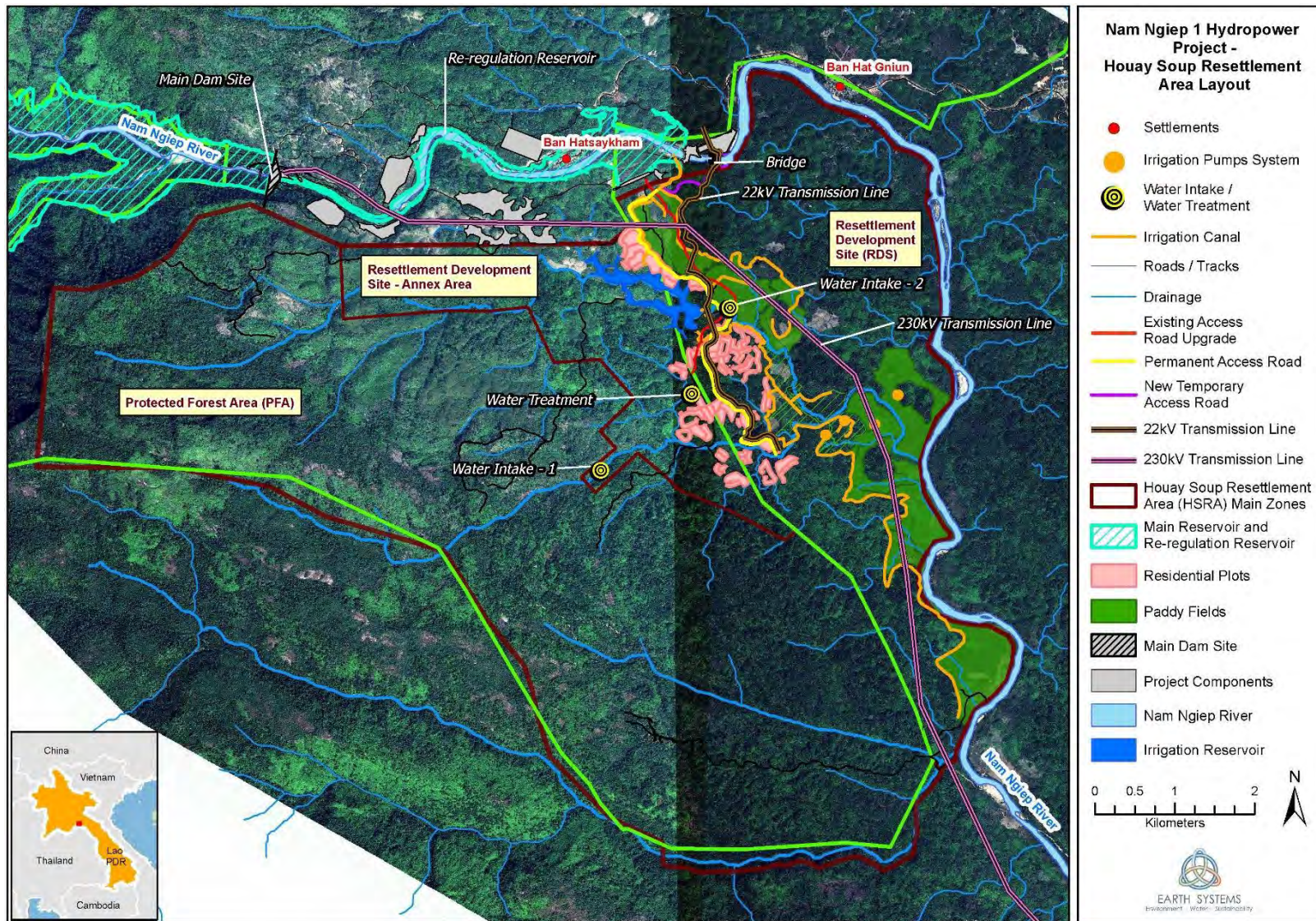


Figure 2-2 Proposed Resettlement Development Site Layout

Source: Earth Systems 2015



## 2.2 HSRA Description and Design

### 2.2.1 Infrastructure

The completed village infrastructure will include up to 750 individual households and additional community assets (refer to Table 2-2) and utilities. Construction and resettlement will occur in phases, with preliminary construction works (temporary roads, barges, etc.), permanent road infrastructure, and residential / community infrastructure implemented for some 40 households that will be relocated from Ban Hatsaykham in April, 2016. The remainder of the primary infrastructure will be completed over the following 1 – 2 years, with some agricultural plots / plantation established post-construction.

Further detail on this infrastructure is outlined in the following sections.

**Table 2-2 Primary HSRA Infrastructure**

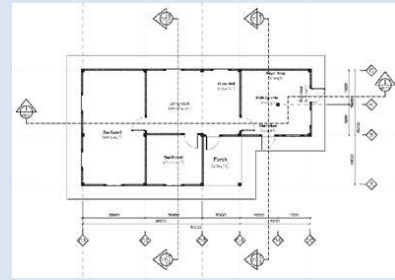
Item	Description
House	750 houses: main building (75 m <sup>2</sup> for medium), toilet and kitchen in 800 m <sup>2</sup> plot with fence
Access Road	Main road (sealed) from Nam Ngiep River bridge to HSRA town centre and to southern portion of HSRA (20 km) and ancillary roads to each household. Secondary road (unsealed): access to irrigated paddy land (5 km).
Access Bridge	Reinforced concrete and pre-stressed concrete bridge, 132 m length and 6.7 m wide with 2 lane road way (2 x 3m) and 2 parapet pedestrian walkway (2 x 0.35m)
Health Centre	1 ha land, 2 rooms (4 x 4m each), 2 toilets, concrete and slate or tiled roof, adequate first-aid equipment.
Market	Market: 600 m <sup>2</sup> roof covered with 2 toilets, waste facilities, near bus stop and residential areas (1 ha total area).
Bus stop	100 m <sup>2</sup> bus stop building adjacent to market and east end of residential area for mini-buses and song theo; with 2 toilets, 1 ha total area.
Community hall	Village centre 760 m <sup>2</sup> community hall with 2 office rooms, 4 toilets
Village office	
School and related structures	1 nursery (664 m <sup>2</sup> ), 2 primary schools (828 m <sup>2</sup> ), 1 lower secondary school (486 m <sup>2</sup> ) with teachers' house
Community playground	1,600 m <sup>2</sup> playground with equipment
Domestic Water supply	Tap water (two taps) to each house by gravity fed and filter system
Irrigation Reservoir	Irrigation Reservoir on the Houay Soup Noi (67 ha surface area; maximum retention capacity 2.25 million m <sup>3</sup> ; live storage of 400,000 m <sup>3</sup> ; operational depth of 1.5 m).
Irrigation distribution network	Irrigated area 496 ha. Distribution canals totalling 9,143 m including a northern canal (3,850 m); central canal (1,093 m) and southern canal (4,200 m)
Solid waste disposal	1.5 ha disposal area with 6 pits, each W 35 m x L 15 m x D 3 m.
Power line	22 kV: 1 km from the connection point at Ban Hat Gniun and distribution line to each house with current meter
ESD & GOL office	Resettlement Centre at Pilot Plant

Source: Earth Systems 2015

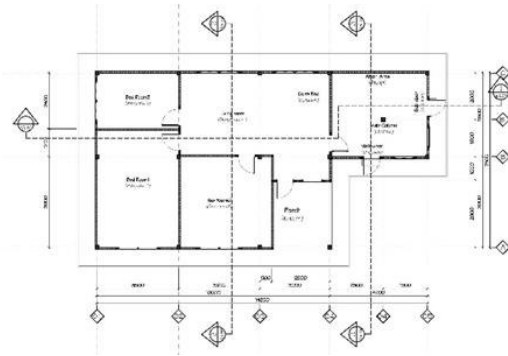
**Housing**

Houses will be constructed with concrete floors and wall and corrugated roofing on 800 m<sup>2</sup> fenced plots, with two (2) water taps and toilet outfitted with a water meter per household. It is anticipated that each household will be provided with one of three models, with the select model pending the number of people in the household and preference according to ethnic tradition (refer to Plates 2-1 to 2-3). Housing standards will be applied independent of the quality of the previously occupied house for each household.

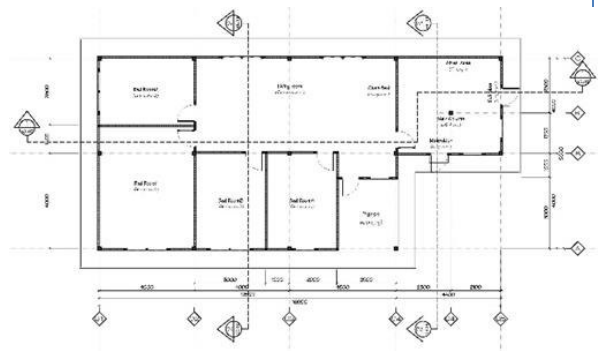
The size of house provided will be based on the number of household members. A minimum of 7.5 m<sup>2</sup> will be provided per person, but average space is expected to be more than 10 m<sup>2</sup> per person (NNP1 2014b). The final designs will be prepared in consultation with the PAPs and will take into account their customs and needs, house orientation, and preferred neighbours to the extent practicable.



**Plate 2-1 House model small**



**Plate 2-2 House model medium**



**Plate 2-3 House model large**

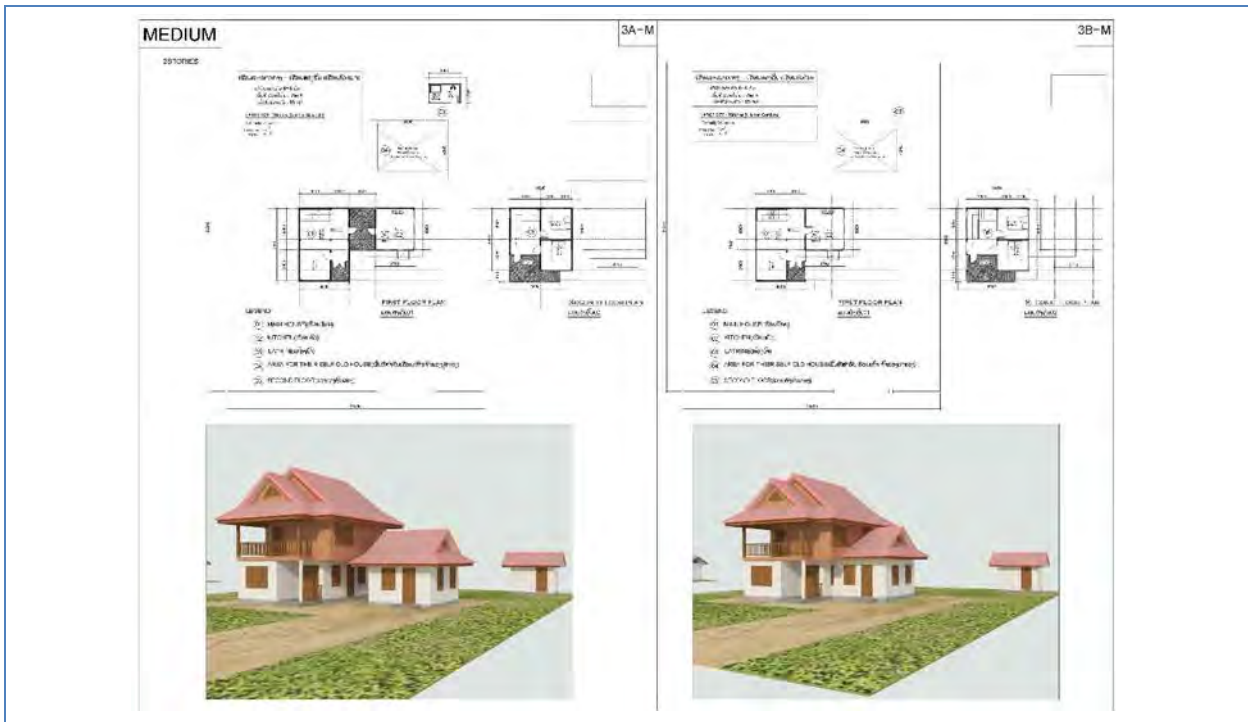


Plate 2-4 House model 2 story medium

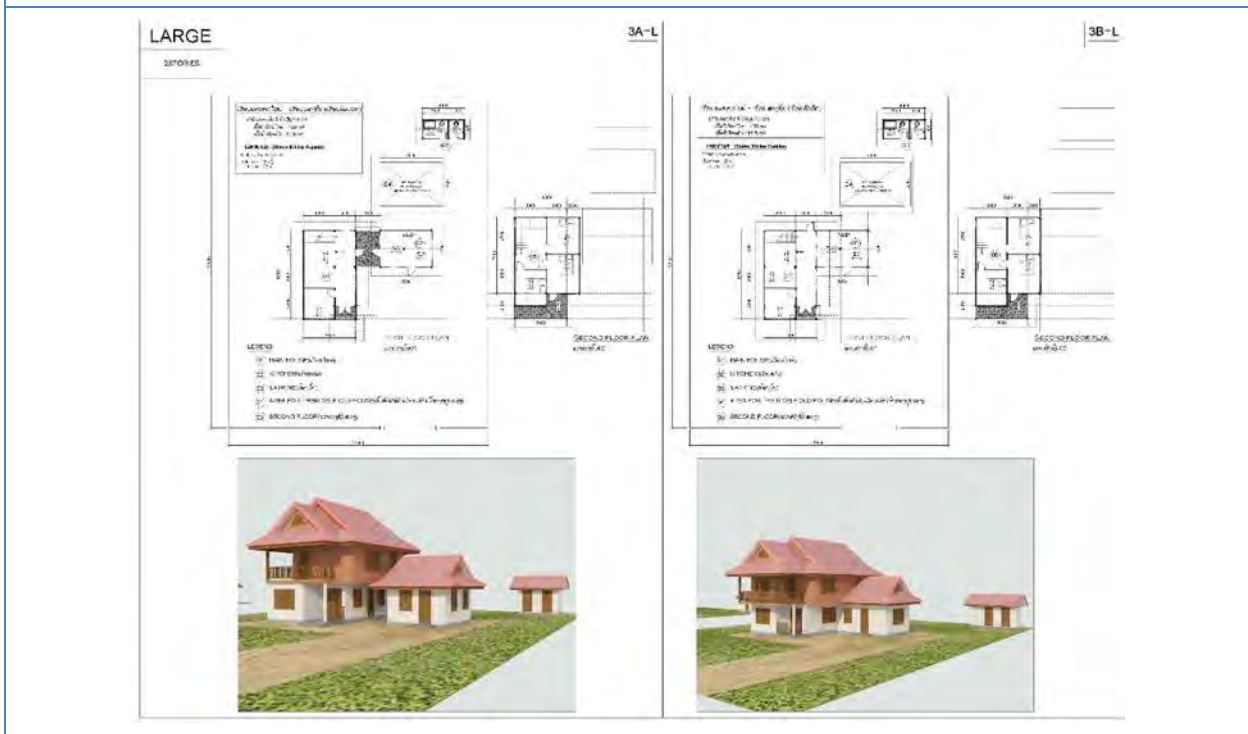


Plate 2-5 House model large

### Community Infrastructure






Community infrastructure will include a market; bus terminal; health centre; village office; nursery, primary (2), and lower secondary schools and playgrounds; and public office and hall (refer to Table 2-3 for component footprints).

**Table 2-3 HSRA schools and associated infrastructure**

Facility	Description
Nursery	Estimated 140 children (50% of 3-5 years old children from 5 PAP communities)
Elementary	Approximately 15 classrooms for 550 students
Lower secondary	Approximately 12 classrooms for 430 students
Teachers' offices	2 rooms
Teachers' housing	1 house
Playgrounds	2 (1.5 ha each)
Toilets	10, separate male and female

Source: NNP1 2015

Community structures are required to follow the regulations of GOL line agencies (Ministry of Education, Health, Public Works and Transport, Home Affairs, etc.) for respective public infrastructure. NNP1 has coordinated with these agencies during design of infrastructure development plans and therefore design considered requests from PAPs in addition to regulatory obligation. Preliminary design has been completed for community structures (refer to Plates 2-4 to 2-8). Final design is expected to include some variation from these concepts.

	
<p align="center"><b>Plate 2-6 Bus station</b></p>	<p align="center"><b>Plate 2-7 Health centre</b></p>
	
<p align="center"><b>Plate 2-8 Market place</b></p>	<p align="center"><b>Plate 2-9 Community hall with village offices</b></p>
	
<p align="center"><b>Plate 2-10 Kindergarten</b></p>	

It is anticipated that small shops will be constructed around the central roofed market area. These shops will be leased to resettled peoples at reduced cost or at commercial rates for outsiders. The income generated from these leases will be used to maintain the market area, including garbage disposal, and may contribute to the village development fund for ongoing operational expenses of village authorities (e.g. teacher salaries), to be managed by the community directly.

**Domestic Water Supply**

The domestic water supply system (intakes, conveyance, and treatment plant) has been designed to supply up to 6,500 people and will accommodate at least an annual population growth rate of 2% beyond 2015. The domestic water supply systems are intended to supply a minimum of 100 litres of water per capita per day (650 m<sup>3</sup> / day for 6500 people). At full capacity, the system will provide 14.5 L / s (1,250 m<sup>3</sup> / day).

- **Intake 1:** Water for domestic uses will be primarily sourced from Houay Soup Ngai. A water intake structure will convey surface water via gravity from the intake at 220.583 metres above sea level (masl) to a water treatment plant at 205.719 masl and 2,380 m from the intake. The 150 mm ductile iron pipe (DIP) at the inlet and 150 mm diameter DIP pipe will convey 14.5 L / s at maximum capacity (anticipated for 8 – 9 months / yr.) and 6 L / s (minimum flow estimate for Houay Soup Ngai) for the remaining 3 - 4 months / yr.
- **Intake 2:** The Irrigation Reservoir (refer to below) will supplement the Houay Soup Ngai domestic water supply during the dry season (approximately 3 - 4 months / yr.). The intake will include an open wet pit collection chamber with two horizontal centrifugal pumps (capacity of 8.5 L / s) and will be reinforced by with concrete. Raw water will be pumped via HDPE 150 mm pipe for 1,300 m to the treatment plant.

The Intake 2 system will only be constructed / operated if village water demand exceeds the supply capacity of Intake 1.

Raw water will enter an inlet chamber and pass through one of two roughing filter tanks (4 x 7.5 x 1.5 m) for pre-treatment. The water will then pass through a slow sand filter tank and will be disinfected using hypo-chlorine injected from separate mixing tanks at the ingress to the clear water tank. The Clear Water Tank will have a capacity to store 200 m<sup>3</sup> of water for distribution to households / public and community buildings. Two (2) taps will be installed at each household.

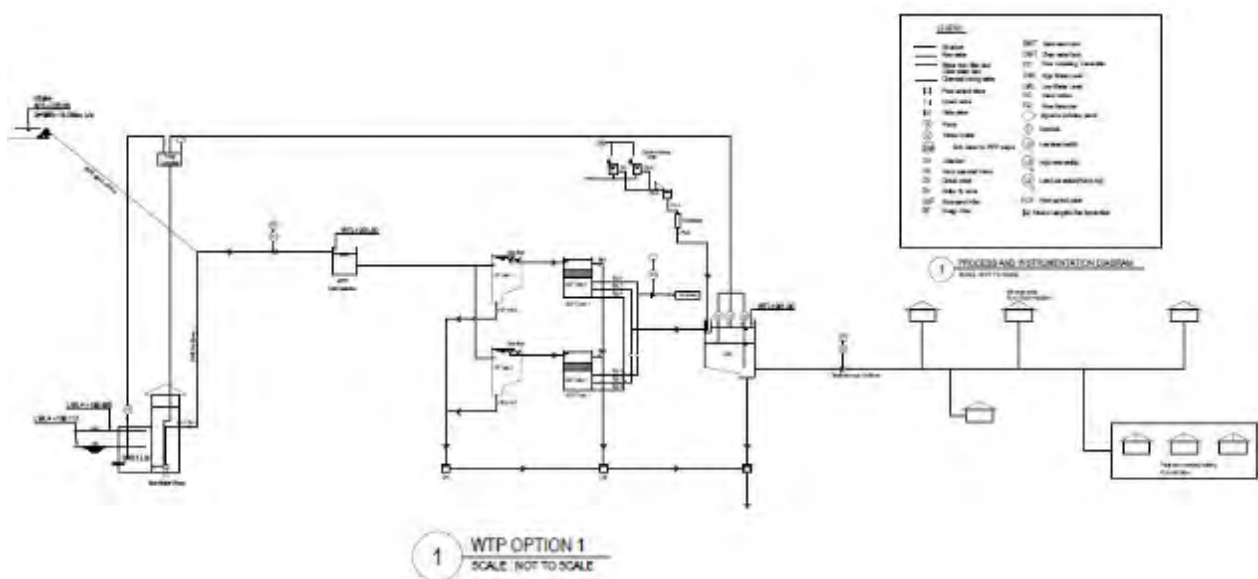


Figure 2-3 Domestic Water Supply System

Source: NNP1 2015



### ***Irrigation Supply***

An irrigation system will be constructed to supply water as much as 420 ha of rice paddy area (North Paddy = 154 ha; South Paddy = 266 ha) for dry and wet season cultivation, though Earth Systems mapping indicated an availability of approximately 369 ha. Water will be primarily sourced from the Nam Ngiep River (Re-regulation Reservoir) with supplementary water from Houay Soup Noi. Water intake from the Re-regulation Reservoir will vary considerably during the wet season when Houay Soup Noi contribution to the Irrigation Reservoir increases.

A simple gate system at the intake will provide  $4.6 \text{ m}^3 / \text{s}$  ( $63,000 \text{ m}^3 / \text{day}$ ) of water which will be gravity fed via an 825 m concrete lined canal from the Re-regulation Dam reservoir to the Irrigation Reservoir (refer to Figure 2-4) for four (4) hours per day when the Re-regulation Dam generator is not operating and the Re-regulation Reservoir subsequently rises.

An Irrigation Reservoir will be developed. This reservoir will also be used for a) aquaculture and b) domestic water supply (see above). The Irrigation Reservoir will cover an area of approximately 67 ha, with a maximum water retention capacity of 2.25 million  $\text{m}^3$  (2,500 megalitres) and live storage of 400,000  $\text{m}^3$  (operational depth of 1.5 m). A 15 m high dam (to 181.2 masl) will be constructed across the Houay Soup Noi stream channel to create the reservoir (dam width 50 m at bottom of channel). Minimum water level in the reservoir will be 176.3 masl and maximum water level 178 masl. Water will be stored in the irrigation pond at night and released to the paddy fields during the day.

An 18 m wide spillway will be constructed (143.5 m long channel) at 177.8 masl (inlet) to 166.6 masl (outlet) to convey stormwater around the dam, protecting the structure (and supplying the Houay Soup Noi with rainy season environmental flow).

The Irrigation Reservoir will have three (3) outlets (gate systems) to canals that will convey water via gravity to three (3) paddy fields.

- Outlet 1 will feed a 3,850 m concrete lined irrigation canal to the northern section of the paddy area. This canal will branch into two sections to supply approximately 68 ha.
- Outlet 2 will feed a 1,093 m concrete lined canal to a 38 ha paddy field in the middle of the paddy area, primarily for relocated residents of Ban Hatsaykham (resettled first in early 2016).
- Outlet 3 will supply  $\sim 2.91 \text{ m}^3 / \text{s}$  to the southern section of the paddy field via a 4,200 m concrete lined canal to directly irrigate 124 ha of paddy field and will supply water to four (4) pumping stations that will pump water to four canals that feed 266 ha of paddy fields in the southeast of the HSRA.

The pumps / canals for the southeast area are as follows:

- Pump 1: 55 kW x 2 units,  $5.6 \text{ m}^3 / \text{s}$  concrete lined canal - 1,383 m;
- Pump 2: 22 kW x 2 units,  $2.1 \text{ m}^3 / \text{s}$  concrete lined canal – 722 m;
- Pump 3: 75 kW x 3 units,  $9.8 \text{ m}^3 / \text{s}$  concrete lined canal - 6,697 m; and
- Pump 4: 37 kW x 2 units,  $9.0 \text{ m}^3 / \text{s}$  concrete lined canal – 524 m.



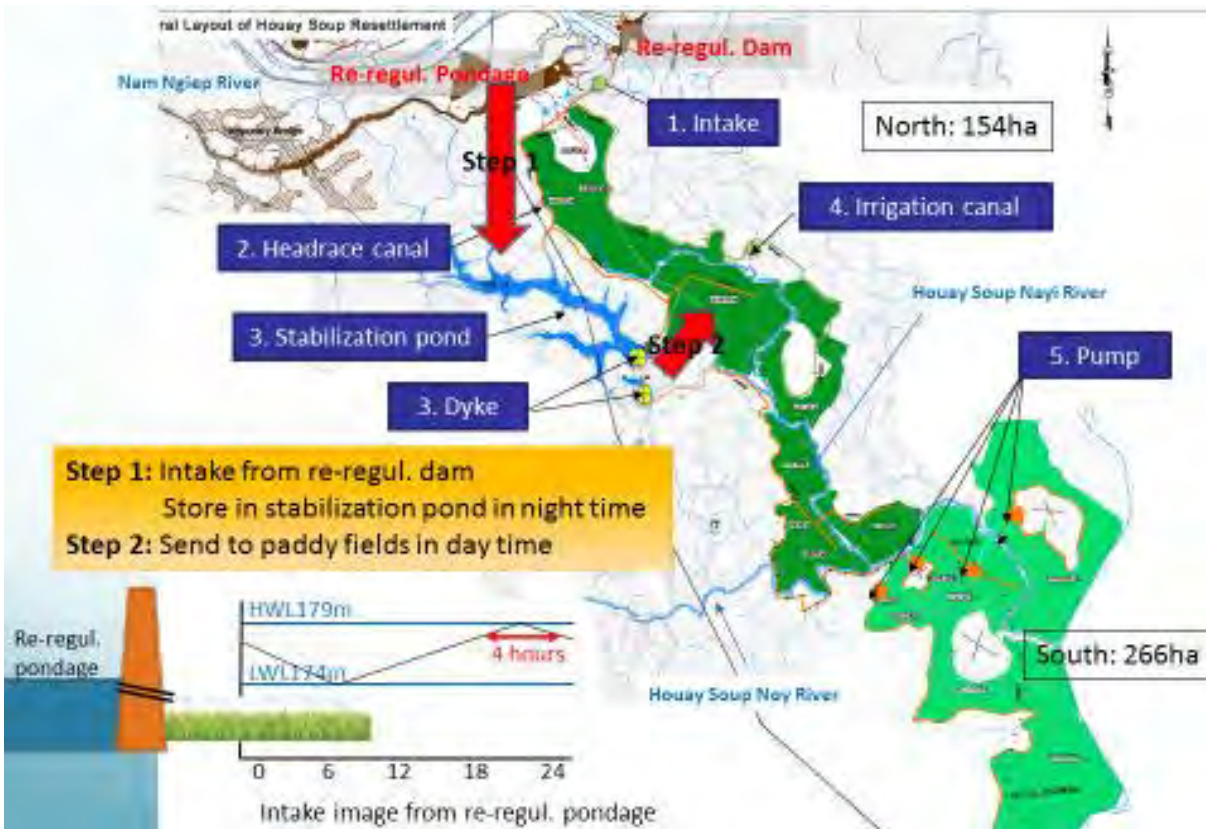


Figure 2-4 HSRA Irrigation System

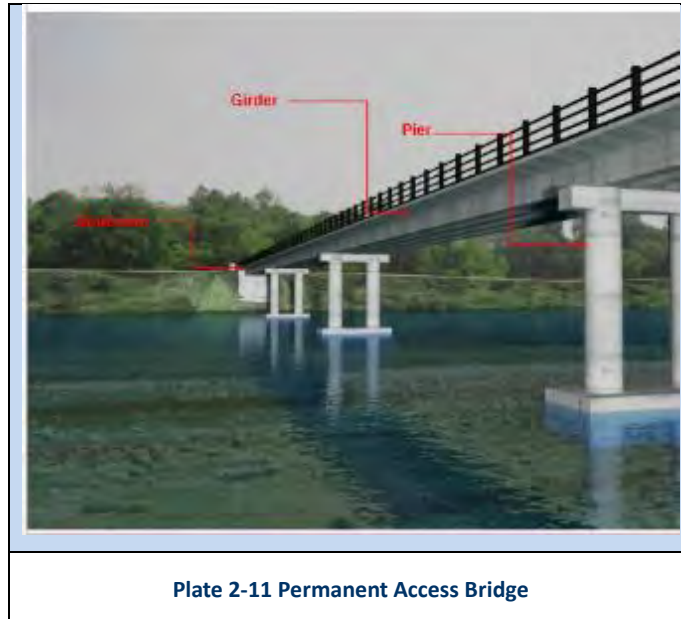
Source: NNP1 2015

**Permanent Access Road (and Bridge)**

A permanent, sealed road (Main Road) and bridge across the Nam Ngiep River will be developed to provide access to the HSRA. Construction for the Main Road will include maintenance for the temporary access road and extension of this road through the HSRA. A portion of this road was constructed during the Preliminary Works for the Houay Soup Resettlement Area and an IEE completed for this work (refer to *Initial Environmental Examination of Preliminary Works for the Houay Soup Resettlement Area* (Earth Systems, June 2015).

Ancillary roads will be constructed that branch from this main road to the front of each house in the HSRA. An existing access road which was upgraded during Preliminary HSRA Construction works will remain in place to provide access to paddy fields and the border of the northern livestock areas.

A reinforced and pre-stressed concrete bridge will be constructed over the Nam Ngiep River. The bridge will have a total width of 6.70 m and length of 132.31 m supporting two (2) road lanes (2 x 3.0 m) and two (2) pedestrian walkways (2 x 0.35 m). The structure will consist of two (2) reinforced concrete abutments (currently being completed as preliminary works – refer to *IEE of Preliminary Works for the Houay Soup Resettlement Area*, Earth Systems, June 2015); three (3) reinforced concrete piers; and two (2) paved approach roads 50 m length and 7 m width. Detailed design is provided in *Design Drawing of the Nam Ngiep River Bridge* (ASA Power Engineering & Vietnam Japan Engineering Consultants 2014).



### Transmission Line

A 22kV transmission line will be constructed along the access road to supply electricity for HSRA construction and subsequently to supply households / applicable infrastructure for the resettlement area - refer to IEE of the 22kV TL (sections 2, 3 & 4) and Ban Houay Soup Distribution Line (Earth Systems, 2014). One (1) km of transmission line was constructed from the connection point at Ban Hat Gniun to the primary development area during Preliminary HSRA Construction Works. This line will be extended, with distribution lines providing power to each house (with a current meter).

The connection to the current EDL line will be changed. The line will connect at EDL pole 315 on the left bank of the Nam Ngiep River, extend along the current Obayashi contractor line to P09, and then will deviate from the line to cross the Nam Ngiep River parallel to and just downstream of the HSRA access bridge (refer to Figure 2-5). The compensation process has been completed for this proposed connection pathway.



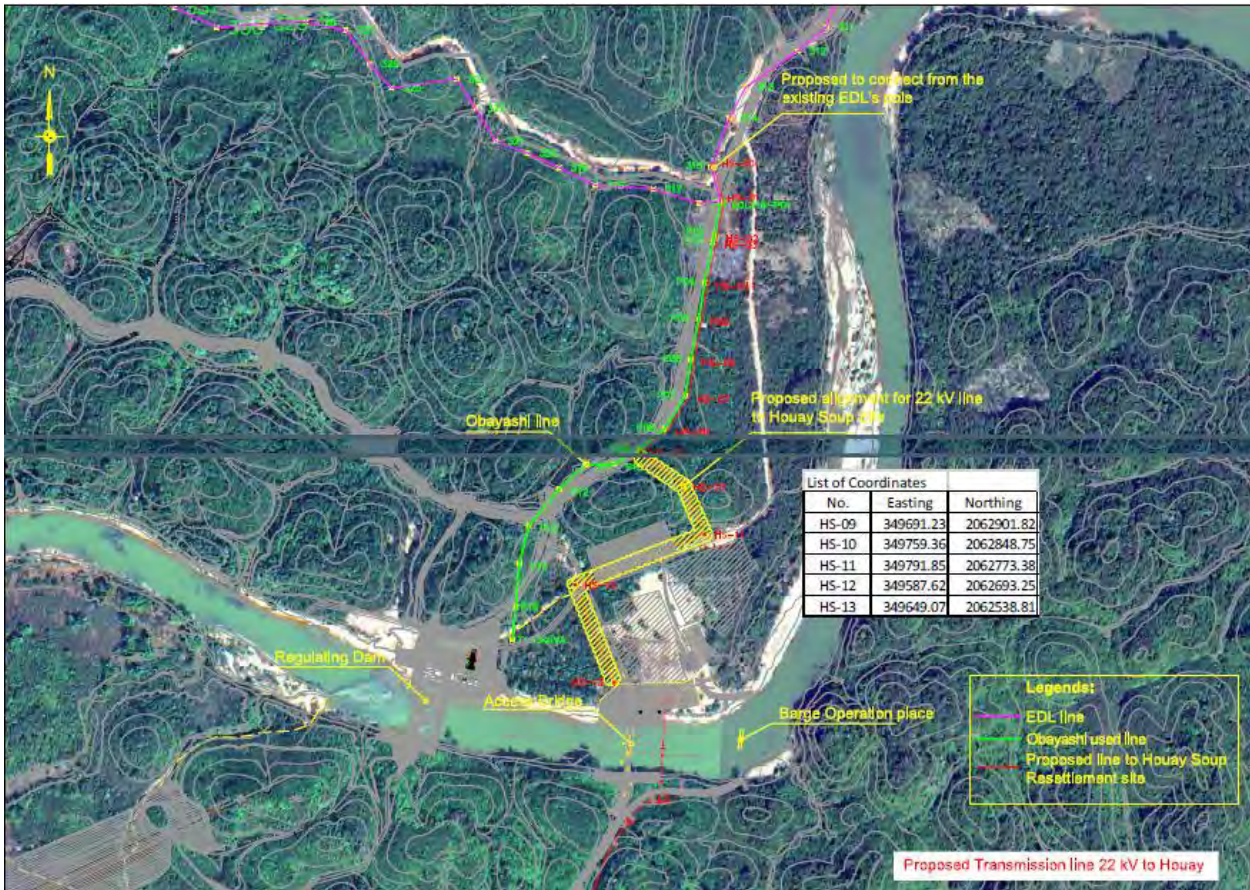


Figure 2-5 Proposed 22kV Transmission Line Connection to the EDL Line

Source NNP1

**Solid Waste Disposal**

The solid waste disposal site will be situated in Disposal Area No.6 (refer to Figure 2-6 and Figure 2-7). Access to Disposal Area No.6 will be via the access road in Houay Soup which will connect to the existing access road on the right bank of the Nam Ngiep River. The waste pit will be appropriately lined to prevent seepage into the groundwater in accordance with applicable environmental regulations (NNP1, 2014b).

NNP1 has designed the facilities to accommodate anticipated disposal requirements for a ten year period. The design is based on per capita waste figures for Lao PDR. Lao urban residents produce about 0.75 kg of solid waste per capita each day. Using a global average rural to urban waste generation ratio of between 0.3 - 0.5, NNP1 expects HSRA residents to produce solid waste of approximately 0.5 kg / capita / day. Based on a population of 3,700, this would total 1,620 m<sup>3</sup>. The expected area of disposal area is 1.5 ha and will consist of 6 pits, each W 35 m x L 15 m x D 3 m. Pit design is shown in Figure 2-6. . One pit will be prepared by NNP1 with sufficient volume for the first 5 years.

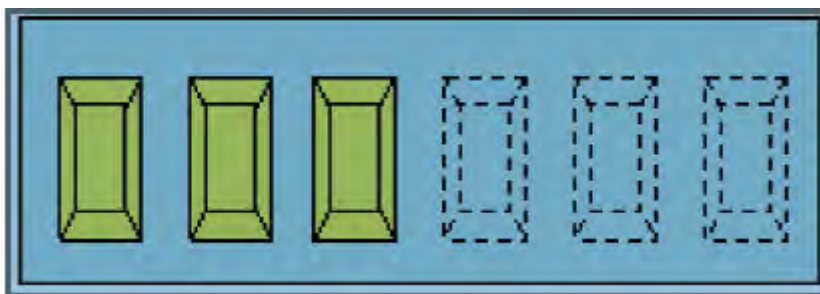


Figure 2-6 Preliminary waste disposal design

Source: NNP1 2015

## Landfill Location Plan

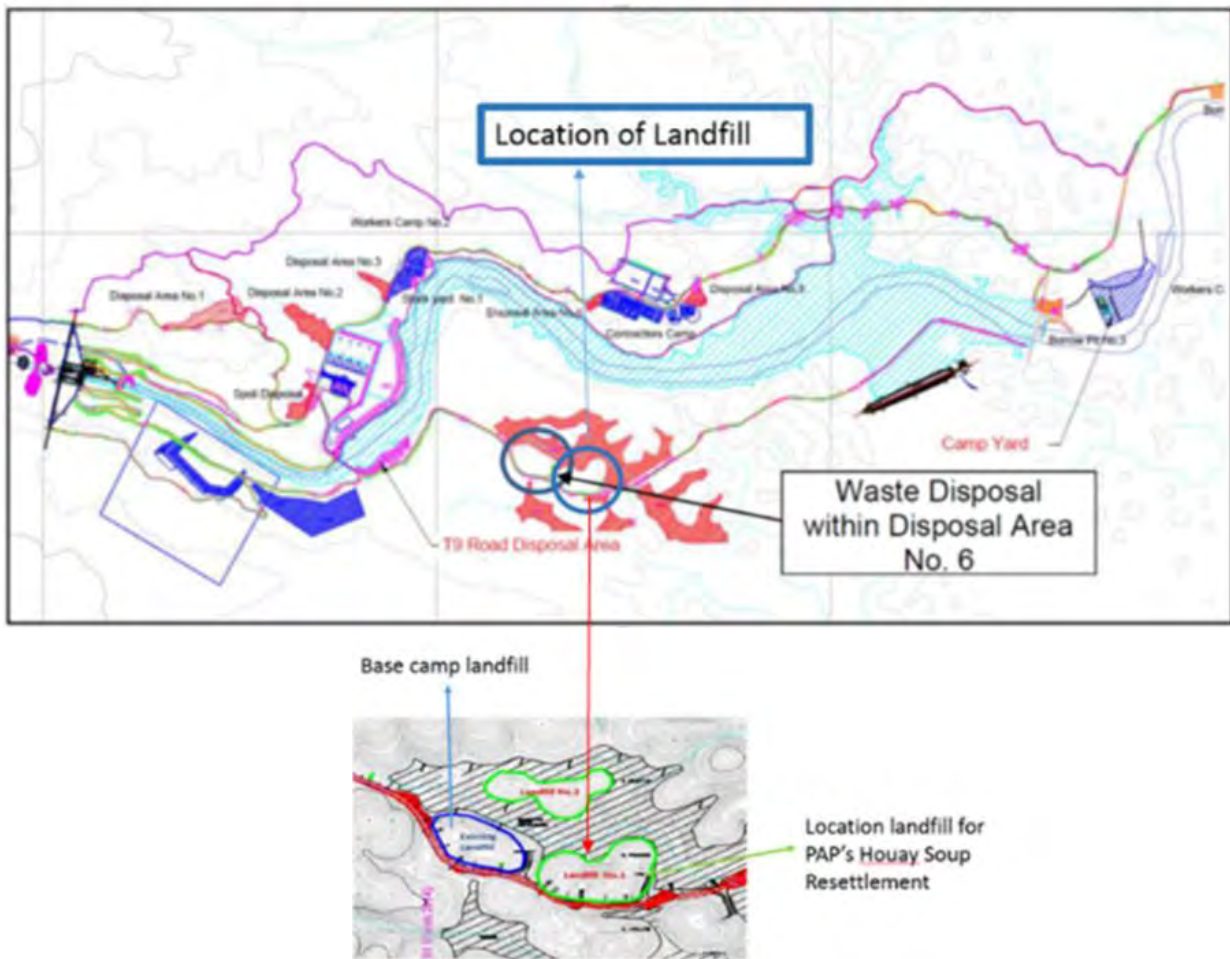


Figure 2-7 Proposed Waste disposal area for the HSRA

### 2.2.2 Temporary Construction Facilities

#### HSRA Preliminary Works Description

A separate IEE was developed for preliminary construction works for the HSRA (refer to *IEE of Preliminary Works for the Houay Soup Resettlement Area* (Earth Systems, 2015a). In summary, the following will be conducted in advance of infrastructure development described above:

- New Temporary Access Road (1.1 km) - Unpaved compacted road with surface shaping and drainage ditch. The road will be cut through a sloped area and will run in parallel with a small ephemeral stream (Houay Kee Hia) above. A pipe culvert will be installed where the stream crosses the road;
- Existing Access Road Upgrade (3.1 km) – An existing rural track which will be upgraded to an unpaved / paved compacted road (refer to Figure 2-8). The road passes through a lowland area and crosses one (1) perennial (Houay Soup Noi) and one (1) ephemeral stream (Houay Na). In a number of places the road will be backfilled and gravel pavement will be used. A v-shaped drainage system will be installed. Gabion boxes will be placed in sensitive areas. Pipe culverts will be installed in four locations;
- Barge landings (Left and Right banks) – The left bank landing will connect to the existing NN1HP road infrastructure. The right bank landing will connect to the proposed temporary access road. Stone / compacted gravel landings will be established on the left and right banks of the Nam Ngiep River.



The sites will be excavated and large stones will be used to construct the landing and for slope protection. A 10 cm gravel pavement will be used to surface the landing. Refer to Plates Plate 2-1 and Plate 2-2; and

- Bridge Abutment – An abutment for the permanent bridge will be constructed on the left bank. This will include an earth / rock frustum slope with stone masonry reinforcement.

A barge will be operated across the Nam Ngiep River, between the two Barge landings. The type of barge and its operation will be confirmed once tendering for this service has been completed.

### ***Ancillary Infrastructure***

Ancillary infrastructure will include:

- The development of work camp / stock yard, borrow area and batching facilities at the TCM / Song Da camp site on the left bank of the Nam Ngiep River. Existing quarries will also be utilised.<sup>1</sup>
- The development of a work camp and stockyard on the old UXO camp site within the HSRA; and
- The development of two (2) new borrow areas - Borrow pit #1 near the Re-regulating Dam and borrow pit #2 in the HSRA.

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<sup>1</sup> These facilities are included under the Main Project EIA and ESMMP-CP.



Figure 2-8 HSRA Preliminary Works Layout

Source: Earth Systems 2015



### 2.2.3 Primary Land Use Designations

The main components of the proposed land uses in the HSRA (Table 2-4) will include residential area and infrastructure; lowland rice fields; plantations and upland crop fields, grazing land, community NTFP forest, firewood collection forest, utilisation forest, conservation forest, protection forest and cemetery.

**Table 2-4 Land Uses and Livelihood Resotration Requirements**

Land use	Allocation for resettled household	Total Land Requirement for 750 HHs (Ha)*
Residential plots (including livestock pens and gardens)	Housing (no less than 800 m <sup>2</sup> for residential land for each household), community buildings and structures.	360
Lowland rice fields	Minimum of 0.1 ha per household member (value multiplied by the number of household members and combined into one land title). Household minimum of 0.3 ha and household maximum of 1.5 ha.	330
Cash crop and upland crop fields	minimum of 0.1 ha of plantation land per person (value multiplied by the number of household members and combined in one land title in the name of both heads of household)	330
Plantation	Minimum of 0.1 ha per household member (value multiplied by the number of household members and combined into one land title).	330
Grazing land	A limit of 5 cattle/buffaloes per household is assumed (for a total of 2,400 cattle and 1,200 of buffalo).	586
Firewood	Minimum of 0.08 ha of designated forest per person (multiplied by the number of household members and combined in one land title). Assumes 1 m <sup>3</sup> of firewood is required per person per year).	264
Utilisation forest	Various NTFP (refer to INRMP)	3,702
Conservation forest		
Protection forest		
Cemetery	One or more cemeteries and / or cemetery forests pending PLUP.	N/A
<b>Total area</b>		<b>5,902</b>

Source: NNP1 2014b

\*Assumes all 750 households with approximately 3,300 people relocate.

The INRMP (Appendix A) details the land use zoning for HSRA and provides information on resource utilisation and conservation requirements for these land uses. A summary is provided in Table 2-5 and Figure 2-9.

**Table 2-5 Proposed land use zoning in the HSRA**

Village Land use category	PFA		RDS		Total	
	Ha	%	Ha	%	Ha	%
Residential	-	-	241.19	10.08%	241.19	3.94%
Lowland agriculture	-	-	368.84	15.41%	368.84	6.03%
Grazing	-	-	586.76	24.51%	586.76	9.60%
Upland agriculture	-	-	427.16	17.85%	427.16	6.99%
Plantation	-	-	262.05	10.95%	262.05	4.29%
Utilisation forest	2047.44	55.03	-	-	2047.44	33.49%
Conservation forest	1103.25	29.65	-	-	1103.25	18.04%
Water source forest (and water supply)^	-	-	225.48	9.42%	225.48	3.69%
Protection Forest*	570.01	15.32	-	-	570.01	9.32%
Other	-	-	282.03	11.78%	282.03	4.61%
<b>Total</b>	<b>3720.7</b>	<b>100</b>	<b>2393.5</b>	<b>100</b>	<b>6114.2#</b>	<b>100</b>

Source: Earth Systems 2015b

^ Includes water source protection forests, water supply area and Irrigation Reservoir

# GIS files supplied by NNP1 cover 6,114.2 ha (while HSRA is 6,108 ha).

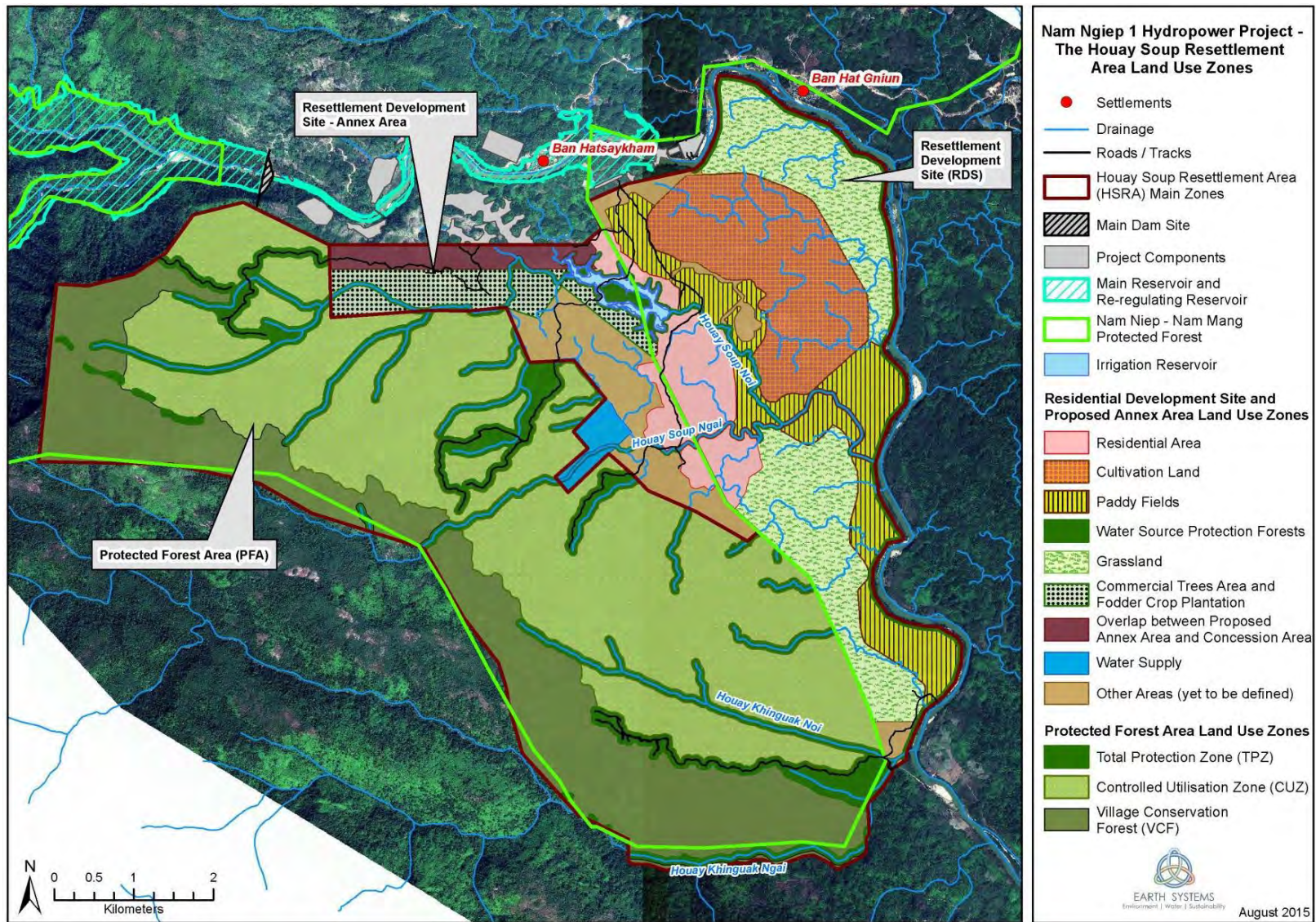


Figure 2-9 Preliminary HSRA Land Use Zoning

Source: Earth Systems 2015



## 2.3 HSRA Development Schedule

### 2.3.1 Construction Phase

Main construction for the resettlement village will commence in October, 2015. It is planned that the Ban Hatsaykham community (~40 households) will relocate in approximately April 2016, while the 2LR communities (~507 households) will relocate during the 2017-18 period following the rainy season. The number of households relocating is currently in the process of negotiation (up to 750).

Accordingly, the Construction Phase will be carried out in two stages. The first phase of construction (commencing in October 2015) will include the construction of a portion of the housing as well as community infrastructure and buildings, domestic and irrigation water systems, paddy rice fields, soil improvement, and pasture development.

The second stage, extending until late 2017-18, will involve the construction of remaining houses for villagers from 2LR (~507 households) and the finalisation of all resettlement infrastructure within the HSRA, including paddy rice fields, pastures, cash crop fields developed, and the southern irrigation system for the paddy rice fields.

### 2.3.2 Post Construction Phase

The Post Construction Phase for the HSRA is divided into two distinct phases: (a) HSRA Stabilization Period (as per the REDP, *Livelihood Restoration and Income Plan*); and (b) Operations and Maintenance.

It is understood that NNP1 involvement in livelihood restoration activities for PAPs (in accordance with the NNP1 REDP) will continue for 10 years following the pre-construction period of the Main Project (December 2013) and for up to five (5) years during a stabilisation phase after NN1HPP COD.

NNP1 involvement in post-construction maintenance and operation of the resettlement infrastructure is expected to commence in 2018 following the resettlement of 2LR households. Operational responsibility by the village and / or GOL for village infrastructure will commence following the official transfer of the HSRA to the village / GOL. Official transfer will occur after MONRE is satisfied that CA requirements have been met (e.g. training requirements for villagers, financial planning for operations and maintenance completed, land tenure certificates registered, etc.).

NNP1 involvement in HSRA post-construction management, mitigation, monitoring, maintenance, training, etc. will continue, at a minimum, until official transfer of the HSRA from NNP1 ownership to village / GOL ownership.

## 2.4 Models of financing for Operations and Maintenance of infrastructure

NNP1 will negotiate with new inhabitants of the HSRA and applicable GOL staff to develop models of financing operation and maintenance of infrastructure (post-transfer date). Current planning includes several options (NNP1 2014b):

- Operation and Maintenance by a commercial operator, financed by fees to be provided by the inhabitants of the resettlement site;
- Operation and Maintenance from a village fund, which would require determination of how this village fund would be financed. The Project will establish market booths, which the village can rent out to achieve income for village activities;
- Operation and Maintenance from the Project's Community Development Program, in the event that it can be implemented without creating dependencies and reduced ownership;

- Operation and Maintenance via neighbourhood groups; or
- Operation and Maintenance by self-funding measures, for example fees at the bus station for its maintenance.

## 2.5 HSRA Alternatives

A number of alternative sites for resettlement and / or options for resettled villagers have been considered throughout the resettlement planning process.

### 2.5.1 Alternative Sites

One of the most important concerns raised by PAPs has been the selection of the resettlement site – with PAPs affected by the main reservoir expressing a preference to be relocated near to their current location.

NNP1 along with PAPs and applicable GOL authorities investigated several potential resettlement sites throughout the ESIA process (refer to EIA (Kansai et al. 2012a); EIA (ERM 2014); SIA (NNP1 2014a)), including:

- Samtoey area, Vientiane Province (for 2LR);
- Phalavaek area, Vientiane Province (for 2LR);
- Phukatha area, Vientiane Province (for 2LR);
- Pha-Aen area, Vientiane Province (for 2LR);
- Nam Choi, Bolikhamxay Province (for 2LR);
- Hat Gniun, Bolikhamxay Province (for Z3); and
- Houay Soup, Bolikhamxay Province (for Z3 and 2LR together).

A detailed account of the site selection process is provided in the SIA and REDP (NNP1 2014a,b).

The Houay Soup area, located on the opposite bank of Ban Hat Gniun in Bolikhan district, Bolikhamxay Province, was selected as the most appropriate resettlement area. This area was extensively studied and enlarged in size to 6000 ha from the original allocation of 2000 ha, to have sufficient land available for livelihood activities.

### 2.5.2 Alternative Layouts

Consultation (initiated in 2007) in Project affected communities identified villagers' preferences regarding the configuration and composition of the prospective resettlement communities.

A number of prospective land use zoning configurations were considered pre-feasibility assessment for the HSRA, with the layout of housing and community infrastructure reconfigured a number of times to accommodate evolving numbers of prospective relocated peoples (refer to Kansai et al. 2012a,b; ERM 2014; NNP1 2014a,b; *Resettlement and Ethnic Minority Development Plan Report – Nam Ngiep 1 Hydropower Project*, etc.). The size and configuration of lowland and upland agricultural areas, plantations, community forests, etc. have similarly been progressed through a number of iterations to ensure appropriate land availability for food security and livelihoods for the HSRA population.

### 2.5.3 Resettlement Options

NNP1 has agreed to three (3) resettlement options for resettlers in consultation with PAPs and GOL:

- Resettlement to a site agreed by PAPs, the GOL and NNP1 (i.e. the HSRA);
- Self-resettlement within the Project area of influence with follow-up activities by the project; and

- Self-resettlement outside the Project area of influence with no follow-up by the Project.

It is understood that the resettlement of up to 750 households is based on the assumption that the majority of PAPs will select the option to resettle to the HSRA.

#### **2.5.4 No HSRA Alternative**

As the NN1HP will inundate settlements and agricultural lands of communities in Zones 2LR and 3, village resettlement or financial settlement is required. As a number of PAPs have indicated a desire to be resettled, the 'No Project Alternative' has is not analysed in this IEE.



## 3 LEGAL CONTEXT

### 3.1 Project Obligations

NNP1 is committed to developing the NN1HP in accordance with GOL legislation and international standards / best practice.

Documents describing Project specific environmental and social obligations for developing and operating the NN1HP (including the HSRA) are outlined in Table 3-1.

**Table 3-1 Relevant Lao PDR Laws and Policies for the HSRA and PFA**

Author	Document	Year
KANSAI	Environmental Impact Assessment Report (approved by GOL)	2012
GOL	NN1HP Concession Agreement	2013
ERM	Environmental Impact Assessment (revised to meet ADB safeguard standards)	2014
NNP1	Social Impact Assessment (revised to meet ADB safeguard standards)	2014
ERM	NN1HP Environmental and Social Monitoring and Management Plan for the Construction Phase	2014
NNP1	NN1HP Resettlement and Ethnic Development Plan including: <ul style="list-style-type: none"> <li>• Livelihood and Income Restoration Plan</li> <li>• Ethnic Peoples Development Plan</li> <li>• Public Consultation, Participation and Disclosure Plan</li> </ul>	2014

Source: Earth Systems 2015

### 3.2 HSRA Development

The Houay Soup Resettlement Area (HSRA) has been selected as the Project's designated resettlement site. This site was selected in consultation with PAPs and the GOL after extensive analysis of a number of resettlement site options.

Detailed assessment of the environmental and social aspects of the proposed site, including a number of preliminary design concepts was conducted through the Project's EIA (KANSAI et al. 2012a) and later through the updated EIA (ERM 2014), SIA (NNP1 2014a), REDP (NNP1 2014b) and other social development plans in accordance with GOL legislation and the ADB's Safeguards Policy Statement (ADB 2009).

In May 2014 the Governor of Bolikhamxay Province officially proposed the HSRA to the Central Government and National Assembly. This proposal triggered the conduct of a joint GOL-NNP1 site survey of the HSRA lead by the MONRE which resulted in:

- Approval of 1,745 ha of land to for the purpose of resettlement and livelihood restoration for NNP1 PAPs (the Resettlement Development Site);
- Identification of the remaining 4,363 ha as overlapping with the Nam Ngiep Nam Mang Protected Forest Area, established in 2012 in accordance with PM Decree 333 on National Protected Forest Areas;
- GOL recognition of the importance of the PFA for resettlers' livelihoods and agreement that resettlers could use this area as long as it was managed according to a sustainability plan; and
- GOL agreement to consider the annexure of 648 ha of the PFA for further resettlement development. In July 2015, MONRE approved the annexure request.

Key approval documents relevant to the development and operation of the HSRA are summarised in Table 3-2.

**Table 3-2 Relevant HSRA Development Approval Documents**

Author	Document Name	Year
Governor	Proposal from the Governor of Bolikhamsay Province on the HSRA, No. 035 / BP	2014
PONRE	Report on the site survey for 6,108 ha of land (Houay Soup) for the purpose of resettlement and livelihood restoration for NN1HP PAPs	2014
PONRE	Minutes of the Provincial Meeting on the results of the site survey for 6,108 ha of land (Houay Soup) for the purpose of resettlement and livelihood restoration for NN1HP PAPs	2014
MONRE	Decision on the Approval of State's Land to be used as the Resettlement and Livelihood Restoration Area for NN1HP PAPs (1,745 ha)	2014
MONRE	Decision on the Approval of State's Land to be used as the Resettlement and Livelihood Restoration Area for NN1HP PAPs (648 ha PFA Annex)	2015

Source: Earth Systems 2015

### 3.3 Environmental and Social Impact Assessment and Natural Resource Management

The IEE has been prepared in accordance with Government of Lao (GOL) policies and legislation, and relevant requirements of the Asian Development Bank's (ADB) Safeguard Policy Statement (ADB 2009).

A detailed description of legal requirements and obligations is provided in the EIA (ERM 2014) and SIA (NNP1 2014a). Key documents are summarised in the following sections.

#### 3.3.1 National Environmental and Social Impact Assessment Framework

The policy and legal framework for environmental and social impact assessment and resettlement in Lao PDR is summarised in Table 3-3.

**Table 3-3 Lao PDR Environmental and Social Impact Assessment Framework**

Legislation	Year
Environment	
Regulations and Implementing Decree 192/PM on Compensation and Resettlement of People Affected by Development Projects	2006
Agreement on National Environmental Standards	2009
Prime Ministerial Decree on Environment Impact Assessment.	2010
Technical Guidelines on Compensation and Resettlement of People Affected by Development Projects	2010
Law on Environmental Protection	2013
The Ministerial Instruction on the Environmental and Social Impact Assessment for the Investment Projects and Activities	2013
Policy on Sustainable Hydropower Development in Lao PDR	2015

Source: Earth Systems 2015

### 3.3.2 ADB Safeguard Requirements

Relevant environmental and social safeguards for the HSRA and PFA are outlined in Table 3-4, according to the Project Concession Agreement.

**Table 3-4 Relevant environmental and social standards for the HSRA and PFA**

Institution	Policy and Standards	Year
ADB	ADB Safeguard Policy Statement (2009)	2009
ADB	Public Communications Policy	2011
IFC	IFC Sustainability Framework	2012

Source: Earth Systems 2015

### 3.3.3 Integrated Natural Resource Management

The legal and policy framework for the management of natural resources in Lao PDR is outlined in Table 3-5. More detailed analysis of this framework is provided in the INRMP (Appendix A).

Key documents for the development of the INRMP include:

- Prime Ministerial Decree 333 on Protected Forests which defines the principles, procedures and management measures regarding the protection, conservation, development and sustainable use of the Protection Forest and Protection Forestry lands. Protection forests are divided into two categories: the absolutely/total prohibited zones and the utilisation zones; and
- MAF / NLMA (2010) Manual on Participatory Agriculture and Forest Land Use Planning which outlines the formal process for village establishment and land and forest land use planning.

**Table 3-5 Relevant Lao PDR Laws and Policies for Natural Resource Management**

INRM Aspect	Key Policy and Legislation
Settlements (and socio-economic development)	<ul style="list-style-type: none"> <li>• Constitution of Lao PDR 1991 (amended 2003)</li> <li>• <i>Land Law 2003</i></li> <li>• National Socio-economic Development Strategy</li> </ul>
Agricultural Resources	<ul style="list-style-type: none"> <li>• <i>Law on Agriculture 1998</i></li> <li>• <i>Law on Irrigation 2012</i></li> <li>• Agricultural Development Strategy 2011-2020</li> <li>• MAF Instruction 0822 on Land and Forest Allocation for Management and Use</li> <li>• MAF / NLMA Participatory Agriculture and Forest Land Use Planning Manual 2010</li> </ul>
Forests and Terrestrial Resources	<ul style="list-style-type: none"> <li>• <i>Law on Forestry 2007</i></li> <li>• Forestry Strategy to the year 2020</li> <li>• Prime Ministerial Decree 333/2010 on Protected Forests</li> </ul>
Water and Aquatic Resources	<ul style="list-style-type: none"> <li>• <i>Law on Water and Water Resources 1996</i></li> <li>• Draft National Water Resources Strategy 2010</li> </ul>
Biodiversity	<ul style="list-style-type: none"> <li>• <i>Law on Wildlife and Aquatic Biodiversity</i></li> <li>• National Biodiversity Strategy and Action Plan to 2020</li> </ul>
Cultural Heritage Resources	<ul style="list-style-type: none"> <li>• <i>Law on National Heritage 2013</i></li> </ul>

## 4 PHYSICAL SETTING

### 4.1 Atmosphere and Climate

#### 4.1.1 Climate

The HSRA is situated within a tropical climate influenced by a south-western monsoon regime, which divides the year into a distinct dry season and a distinct rainy season. The wet season typically occurs between April and October (with the heaviest rains typically in June - August, while the dry season begins in November and extends until March (or later during drought years) (refer to Figure 4-1). The average annual rainfall at the nearest rainfall gauging stations along the Nam Ngiep near the HSRA is approximately 2,950 mm at Ban Hat Gniun (based on rainfall data collected since 2011), 3,700 mm Muong Main (R3), and 3,000 mm at Paksan (R2), respectively (Lao Consulting Group 2014).

The area generally experiences more moderate weather conditions than elsewhere in Lao PDR, with less extremes of temperature. Meteorological data collected from the nearest weather station at Ban Hat Gniun (since April 2011) indicates average ambient temperatures ranges from 12°C to 38°C. During the wet season from June to September, temperatures ranged from 22°C to 36°C; and during the dry season from December to February, temperatures ranged from 12°C to 38°C (NNP1 2014b).

Occasional tropical storms or typhoons move inland (westward) from the South China Sea bringing torrential rains (potentially) over a prolonged period, typically during the wet season or early in the dry season (when the official typhoon season starts from June to December each year). These storms are predicted to become both more intense and frequent in the coming decades due to climate change, leading to an increased likelihood of flooding in the area (ICEM 2015).

Further meteorological data of the HSRA is provided in the REDP (NNP1 2014b) and the NNP1 EIA (ERM 2014).

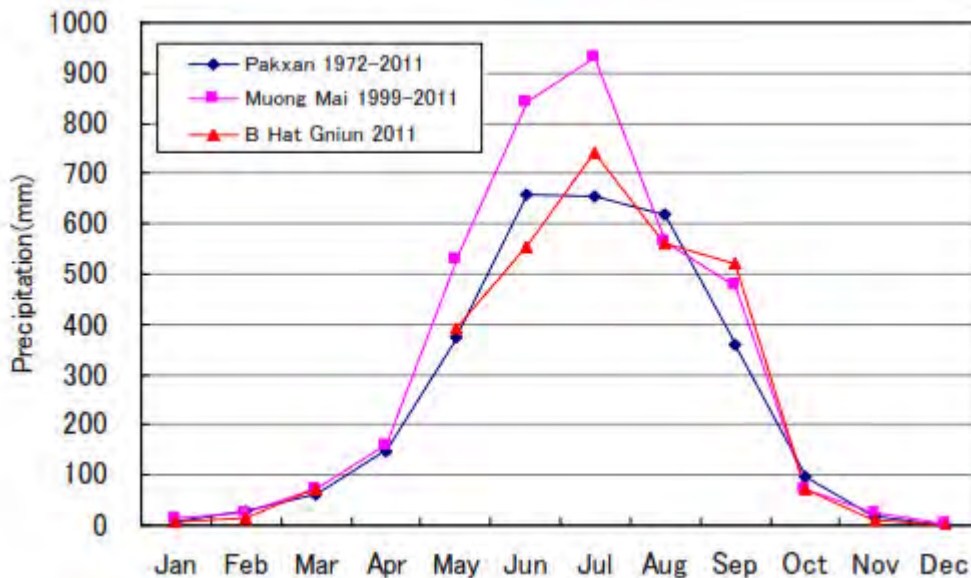


Figure 4-1 Monthly rainfall at Hat Gniun, Muong Mai, and Paksan (Bolikhamsay Province)



### 4.1.2 Atmosphere

The air quality in the HSRA is typical of a rural environment in Lao PDR, and is considered generally good. There are no major industrial pollution sources in the vicinity of the HSRA, and transportation density is still relatively low. The main sources of air pollutants are likely from frequent vegetation burns for preparatory work associated with shifting cultivation and other purposes (e.g. hunting), as well as burning associated with rubbish disposal. Transportation on unsealed roads, particularly during the dry season, contributes short term particulate matter to the atmosphere.

### 4.2 Topography

The HSRA is bounded by the Nam Ngiep to the north and east, the Houay Khinguk Ngai to the south, and mountains / plateau with elevations of up to 1,600 masl to the west / northwest. The HSRA is generally characterised by flat to hilly and undulating topography, with low-lying floodplains bordering the Nam Ngiep and its major tributaries, and steep escarpments and granite outcrops in higher areas to the south and west / northwest (refer to Figure 4-2).

According to topographical survey mapping conducted in 2011, the HSRA land generally slopes down towards the east from about 1,500 masl in the north and west to about 180 masl to the east. The lower areas along the Nam Ngiep River, Houay Soup Noi and Houay Soup Ngai include flat plains and rolling lands with gentle slopes between elevations of 174 and 177 masl, suitable for agriculture and grazing (Lao Consulting Group 2014).

The mountain range bordering the south of the HSRA includes Phu Kata (peak at 2,071 masl) and Phu Samsao (peak at 2,426 masl) (NNP1 2014b).

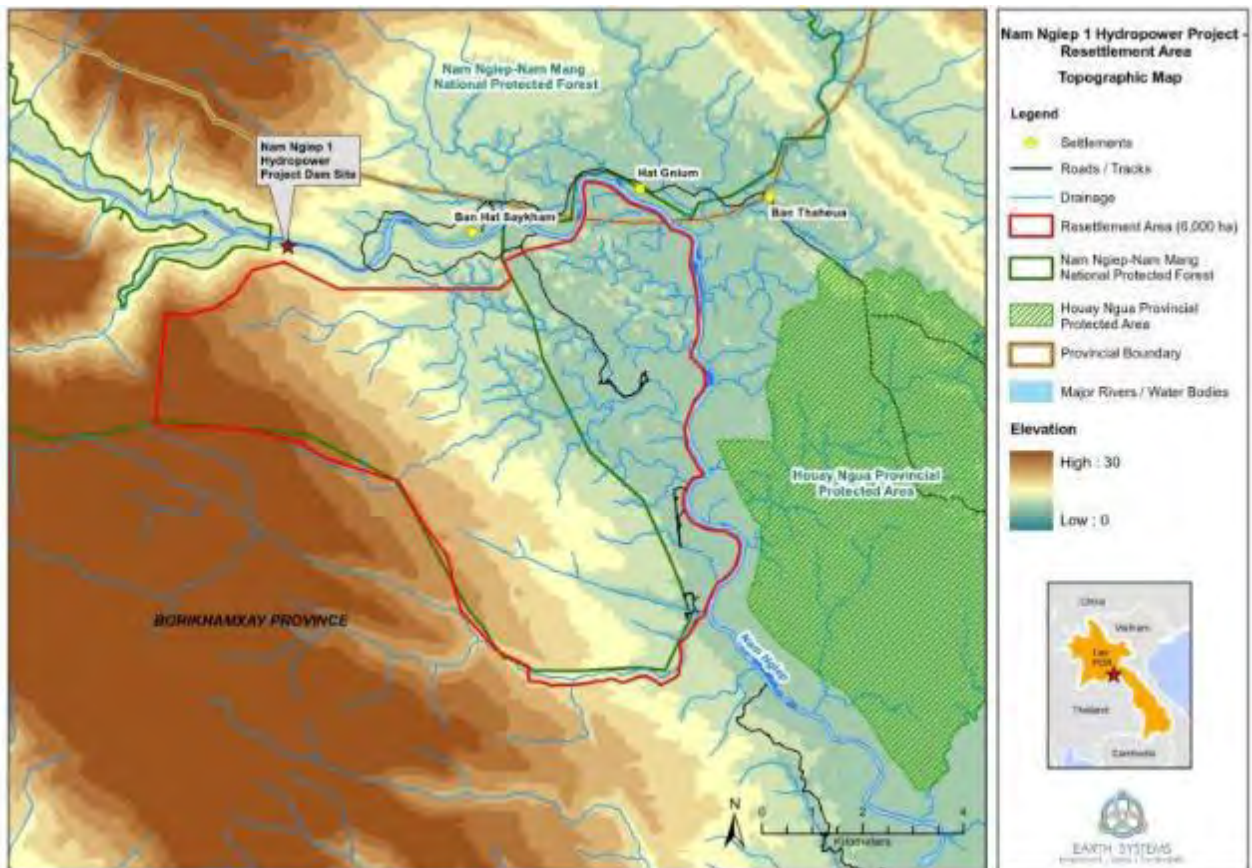


Figure 4-2 Topography of the Houay Soup Resettlement Area and surrounds

Source: Earth Systems 2015

## 4.3 Geology

The geology of the HSRA is mainly characterised by Quaternary sediments comprising alluvium deposits found along the river and riverside (NNP1 2014b). These overlie Palaeozoic sedimentary and igneous rocks. Further description of the geology of the region can be found in the EIA (ERM 2014).

The geological structure of the HSRA is considered stable and seismic activities in the Nam Ngiep River basin are rare (ERM 2014).

## 4.4 Soils

### 4.4.1 Soil types

The dominant soil types within the HSRA are Acrisols (FAO classification), including Ferric Acrisols found primarily in elevated areas across the HSRA (e.g. PFA), Haplic Acrisols in the majority of the HSRA development area and along the Nam Ngiep River, and Plinthic Acrisols in a small area bordering the Nam Ngiep River (refer to Figure 4-3).

Acrisols are characterised by an accumulation of low activity clays with low cation exchange capacity (CEC) in the subsurface and by typically low base saturation level. Acrisols generally have low fertility (likely a result of low CEC and nutrient leaching) and are often acidic, with corresponding elevated aluminium concentrations (potentially toxic levels for plants) and high proportions of fixed (unavailable) phosphorous. Acrisols generally form on upper ridge slopes of escarpments / plateaus and are derived from weathered weak sandstone. The soils are often characterised by a dark red loamy surface horizon overlying a bleached subsurface horizon.

The Acrisols in the HSRA are divided into subclasses based on the following criteria:

- Ferric Acrisols: characterised by coarse mottles / redoximorphic features indicating saturated conditions (poor drainage / aeration) for an extended period;
- Haplic Acrisols: uniform colour in the upper 0.5 m of the soil profile; and
- Plinthic Acrisols: presence of iron-rich, humus-poor material, which hardens upon repeated wetting and drying.

### 4.4.2 Soil properties

The results of physio-chemical assessment of soil samples collected during 2011 and 2015 surveys are provided in Appendix G (refer to Figure 4-4 for sampling locations). With few exceptions, the physical and chemical properties of the soil samples are very similar across the large geographic range sampled and for both sampling events.

The general properties of the HSRA soils are as follows:

- Soil texture is predominately sandy loam and loam, with localised areas of sandy clay loam, clay loam, loamy sand, clayey loam, and sand;
- Topsoils (A horizons) are shallow (ranging from 0 - 12 to 0 - 20 cm), and subsoil clay content is generally higher than in topsoils (a feature of Acrisols that lends to poor drainage);
- pH ranges from very acidic to acidic (pH = 3.8 – 4.7), with a median pH of 4.4;
- Soil fertility is poor, with nutrient content very low or low for phosphorous, potassium, calcium, magnesium, and sodium, with moderately low to moderate nitrogen availability;
- Phosphorous and potassium are likely growth limiting nutrients;
- Soil organic matter is low for each of the topsoil and subsoil samples; and

- CEC is moderately low for each of the samples.

2011 and 2015 laboratory analyses confirmed that the HSRA Acrisol soils are generally not suited to agriculture without implementation of a soil improvement program, primarily for soil pH and nutrient content, while additions of organic matter would also likely be beneficial with respect to elevating CEC and providing additional nutrient value.

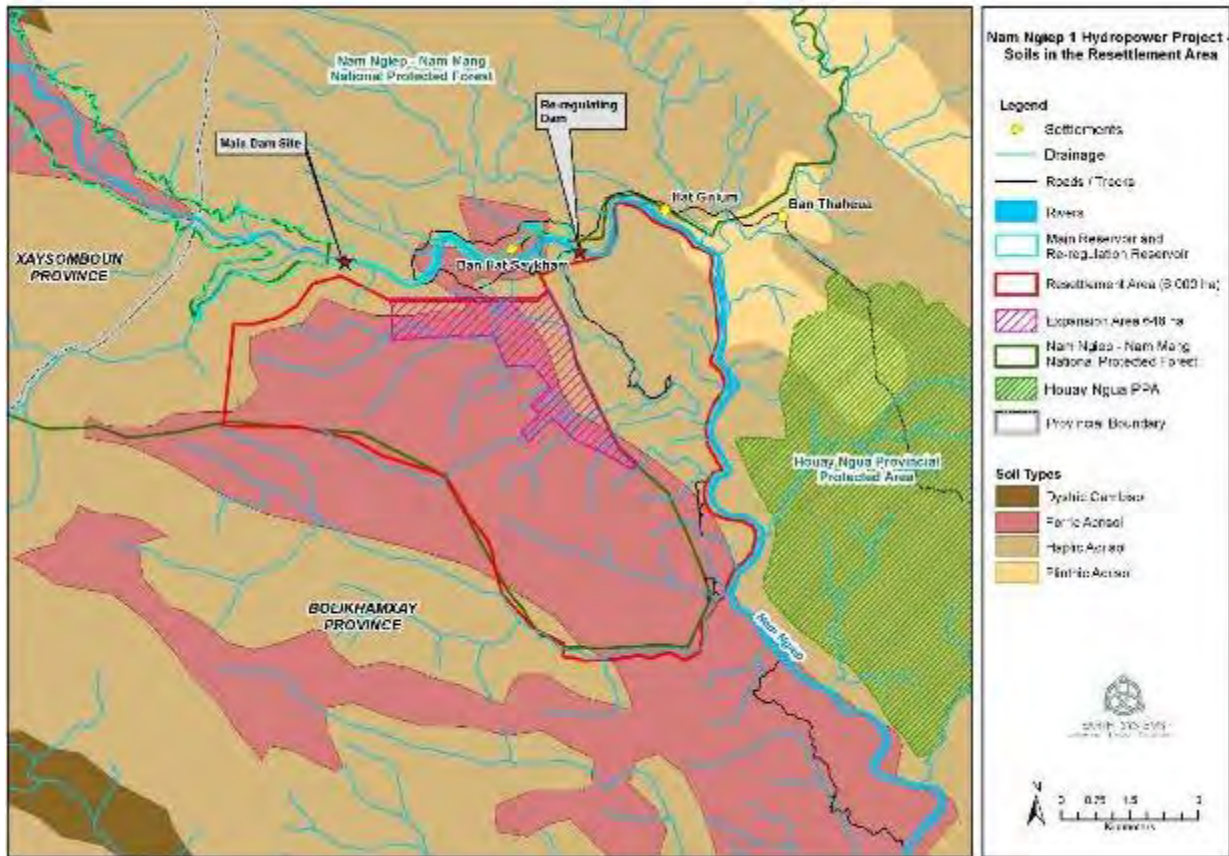


Figure 4-3 Soil Classification in the HSRA

Source: Earth Systems 2015



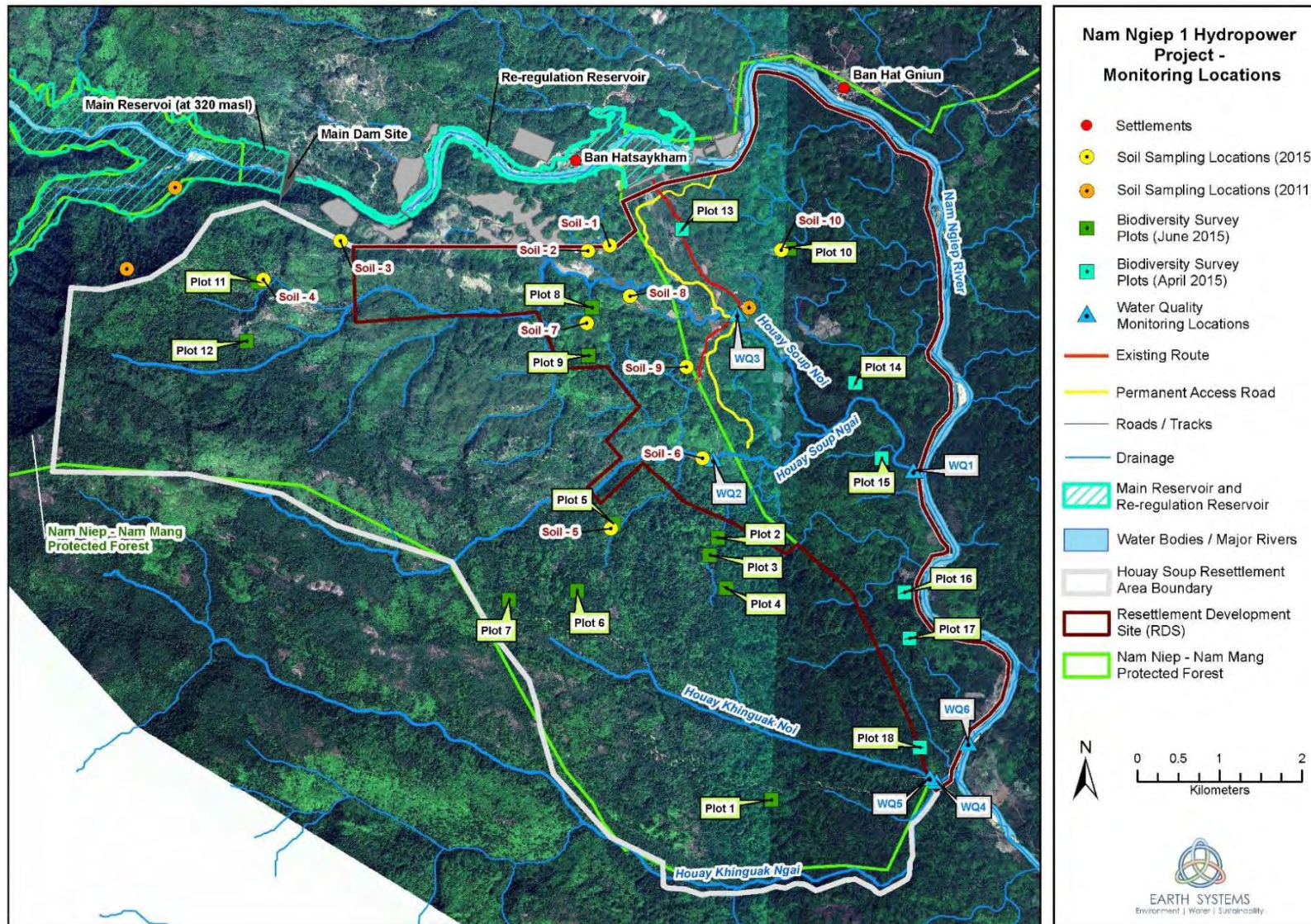


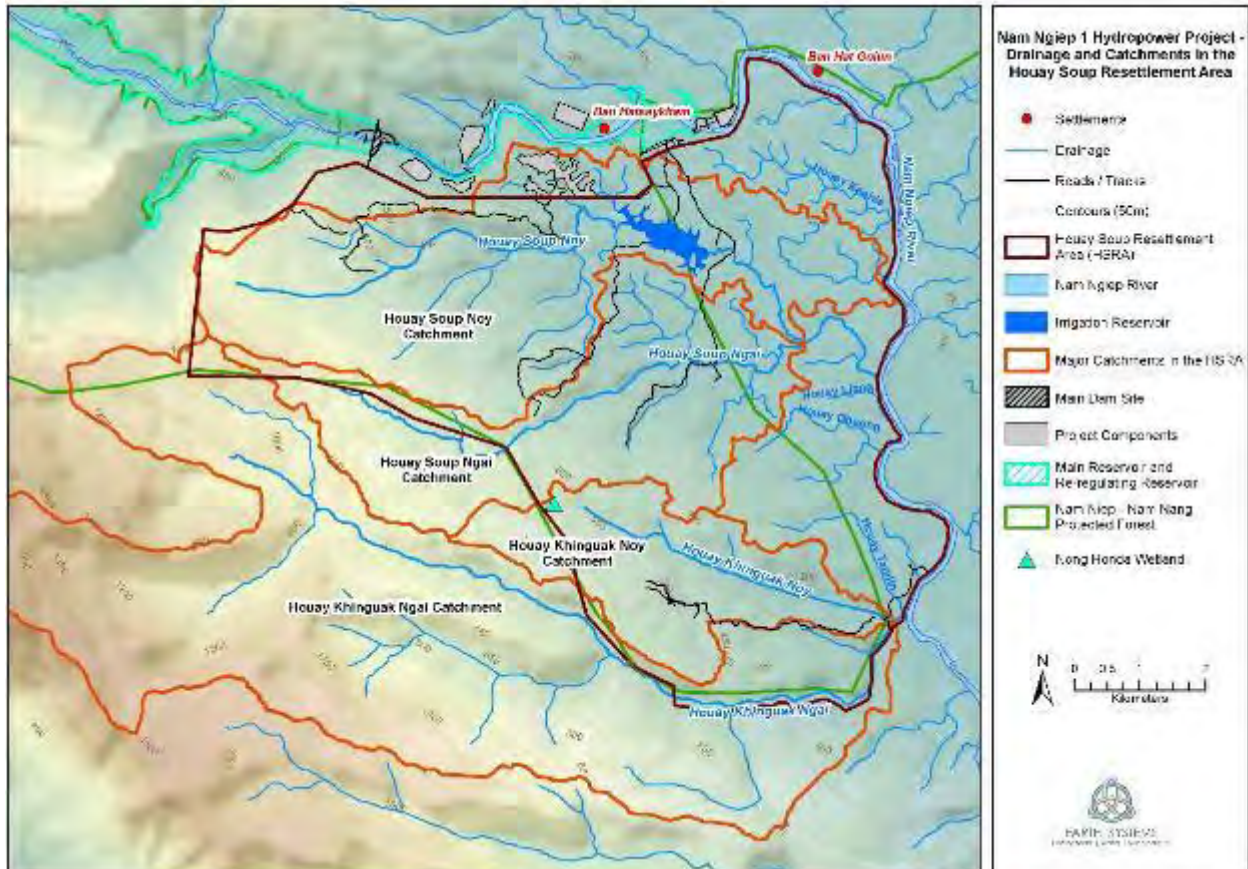
Figure 4-4 June 2015 sampling locations for soil, water quality, and vegetation

Source: Earth Systems 2015



## 4.5 Hydrology

The HSRA is located in the mid to lower catchments of the Nam Ngiep River catchment, downstream of the NN1HP Main Dam and Re-regulation Dam (refer to Figure 4-5). The HSRA is comprised of two primary catchments: the Houay Soup and Houay Khinguak. All of the HSRA sub-catchments flow from those two streams or are direct tributaries to the Nam Ngiep River which flows to the north and east of the HSRA. The upper catchment ridgeline to the west of the HSRA (approximately 800 – 1200 m in elevation) forms the western most catchment boundary for the HSRA water catchments.



**Figure 4-5 Nam Ngiep 1 Hydropower Project -Drainage and Catchments in the Houay Soup Resettlement Area**

Source: Earth Systems 2015

Catchments in the project area are generally steeper around the western edges with average slopes at ridgelines (1000 - 1200 masl) at 18-30%, mid catchment areas (300 - 400 masl) at 16-20% and flattening to less than 10-14% towards lower catchment areas as streams enter the floodplain of the Nam Ngiep River at around 180-200 masl (refer to Figure 4-6 for a 3D model of the HSRA topography and catchment boundaries).

The most significant streams of the HSRA (with respect to surface water flow, aquatic habitat, and aquatic biodiversity) include the Houay Soup Noi, Houay Soup Ngai, Houay Khinguak Ngai and Houay Khinguak Noi (from north to south). Though water abstraction for the HSRA is planned only for Houay Soup Noi and Houay Soup Ngai, each of the perennial streams are described below as future expansion of the resettlement area may provide impetus for further water resource utilisation. The region was subjected to relative drought conditions leading up to the June site visit, therefore reported stream flow / depth (field reporting) was likely considerably lesser than average mid-June conditions. According to local guides present during surveys, the dry ephemeral streams would generally be flowing in June.

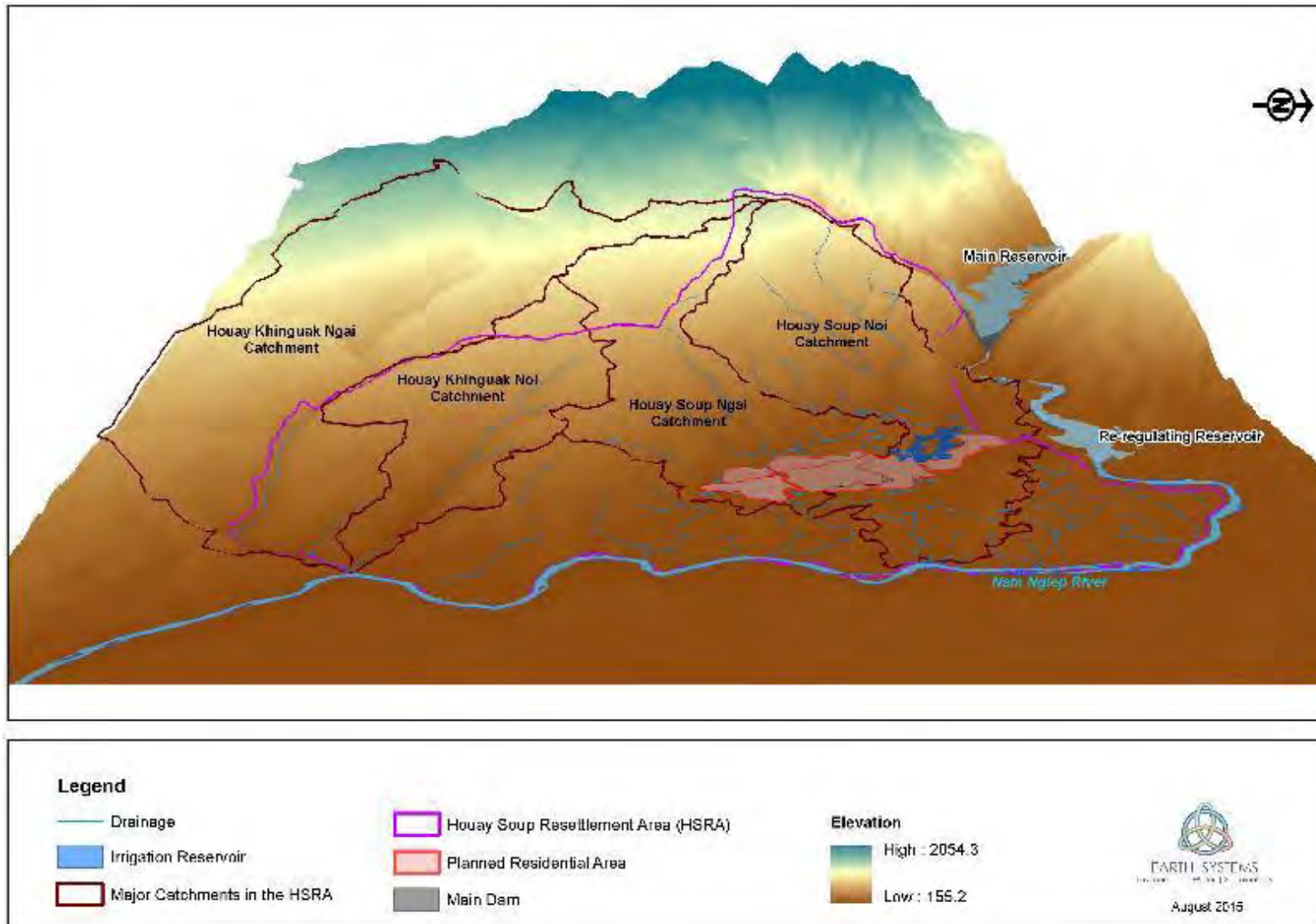


Figure 4-6 Topographic Digital Elevation Model projection - HSRA, Irrigation Reservoir and Catchment Boundaries

Source: Earth Systems 2015



Hydrology modelling has been conducted for the Houay Soup Noi, Houay Soup Ngai, Houay Khinguak Noi, and Houay Khinguak Ngai (refer to Table 4-1). The results display the expected high peak nature due to the small and steep catchments with some limited sustained flow after each storm event. The upper to mid catchment granite aquifers, highly forested land use percentage at greater than 95% of the catchment area, and relatively impermeable soils, interact to produce a small but sustained baseflow developing in the streams of the HSRA estimated at 0.006 - 0.25 m<sup>3</sup> / s when estimated during the dry season with no appreciable antecedent rainfall. The effects of small local springs are difficult to incorporate individually into the model as no hydrographic data exists to model spring behaviour, so this data has been included as a simple baseflow component based on field observations of flow in the dry season.

**Table 4-1 Modelled flow data for perennial HSRA streams**

	Houay Khinguak Ngai	Houay Khinguak Noi	Houay Soup Noi	Houay Soup Ngai
	m <sup>3</sup> / sec			
<b>Max. flow</b>	38.21	19.41	34.89	72.00
<b>95%</b>	9.75	1.80	4.78	8.31
<b>75%</b>	0.54	0.03	0.09	0.40
<b>Median (50%)</b>	0.25	0.01	0.01	0.21
<b>25%</b>	0.25	0.01	0.01	0.21
<b>Min. flow</b>	0.25	0.01	0.01	0.01

Source: Earth Systems 2015

**Houay Soup** – The Houay Soup is formed at the confluence of the Houay Soup Noi and Houay Soup Ngai, within the HSRA boundaries (east of the PFA), ~1.4 km from its confluence with the Nam Ngiep River. More than 99% of its catchment exists within the proposed 6,108 ha HSRA boundary. This stream meanders through a very low gradient plain. Flow was estimated to be < 0.25 m / s during June site visit, with very few pools or significant features in its morphology. The channel bottom is comprised of sediment, with no aquatic vegetation observed in the channel near the Nam Ngiep River and increasingly more aquatic vegetation near the Houay Soup Noi / Houay Soup Ngai confluence. With higher flows some of the riparian (hydrophytic) vegetation will be submerged within the channel, providing refugia and possibly spawning habitat for aquatic fauna.



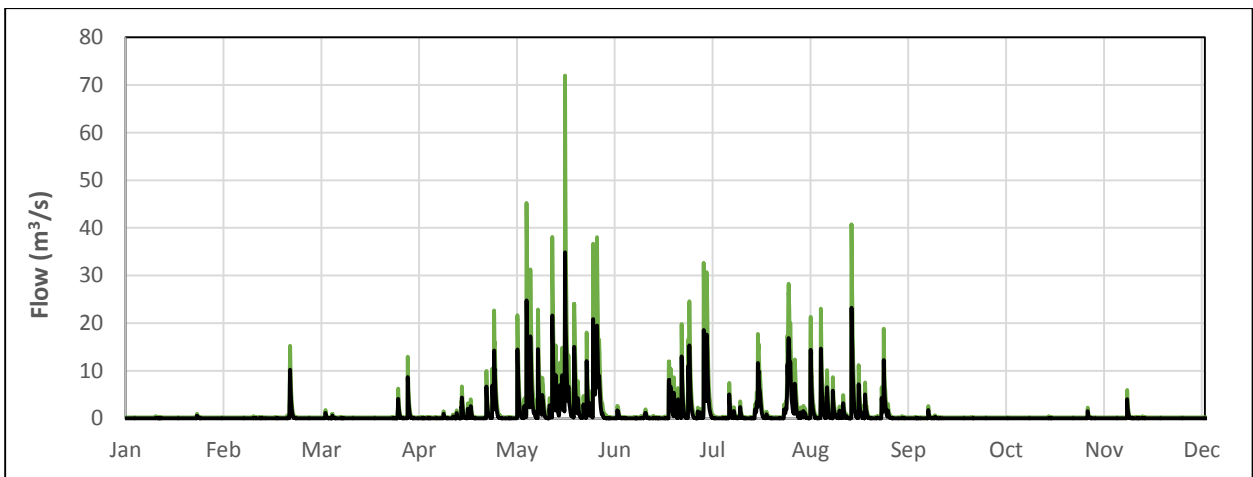
**Plate 4-1 Houay Soup, 20 m from confluence with Nam Ngiep River**



**Plate 4-2 Houay Soup, at WQ1 Monitoring Site (~300m from Nam Ngiep River)**

**Houay Soup Noi**

Houay Soup Noi is a significant perennial tributary of the Nam Ngiep River (forms the Houay Soup at its convergence with Houay Soup Ngai), both for its current utility for five primary communities (fishing and other aquatic resources as well as drinking, bathing, clothes washing, etc. during agricultural work in the area – refer to Section 6.2.7) and for its provision of spawning grounds for migratory fish that venture up the Nam Ngiep River in approximately June of each year. The stream is the larger of the two primary Houay Soup tributaries during the dry season (wider channels, deeper pools, greater flow), but has less peak flow during the rainy season (refer to Figure 4-7). The stream has a very low gradient from its confluence with the Houay Soup Ngai (refer to Plate 4-3) for approximately 4 – 5 km upstream, with slow dry season flows, a meandering pattern, and a morphology comprised of deep pools (some > 2 m) and shallow runs (0.5 – 4 m wide). Dense aquatic vegetation lines the bottom of much of the lower reach of this stream.

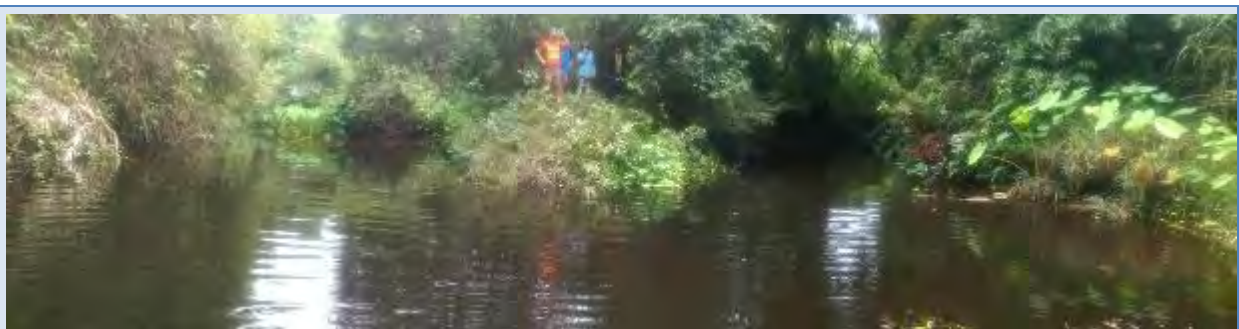


**Figure 4-7 Predicted median year stream flow at Houay Soup Ngai (green) and Houay Soup Noi (black), 2012**

Source: Earth Systems 2015

The gradient abruptly transitions to a high gradient stream in its upper reaches. Here the Houay Soup Noi (and its many unnamed tributaries) flows more swiftly through large boulders under a moderately dense canopy of mixed deciduous forest. The morphology is comprised of riffles, runs (< 1 m wide), and small pools (<0.5 m deep).

The Houay Soup Noi is spring-fed, presumably with the majority of its flow sourced from these springs during the later months of the dry season. The springs emerge from fissures in granite outcropping toward the higher elevations for the PFA.



**Plate 4-3 Houay Soup Noi and Houay Soup Ngai confluence – note two braids of Houay Soup Noi discharge to the right sight of the photograph and the Houay Soup Ngai at the upper left corner (forming the Houay Soup).**





**Plate 4-4 Upper reaches of the Houay Soup Noi (approximately 10 km from Nam Ngiep River).**

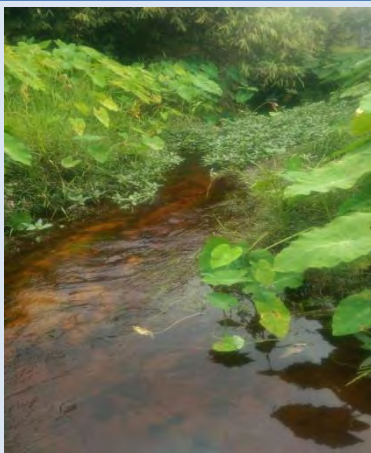


**Plate 4-5 Dry Houay Soup Noi channel – part of the braided channel network near confluence with Houay Soup Ngai.**

***Houay Soup Ngai***

Houay Soup Ngai is comprised of a series of tributaries (though the domestic water intake is upstream of its tributaries), some of which originate from small springs in the Nam Ngiep Nam Mang PFA. The tributaries combine to form the perennial stream and dissect a portion of the HSRA before its confluence with the Houay Soup Noi / formation of the Houay Soup. The upper reaches of the stream in the PFA are high gradient, with water flowing through large granite boulders with intermittent pools.

Houay Soup Ngai has a very low gradient at its confluence with the Houay Soup Noi. The channel meanders through the plain for approximately 1.2 km in its lower reach. The stream morphology is comprised of long runs with moderately deep pools (1 – 4 m wide; > 1.0 m deep) throughout the lower reach. The stream flow was low during June 2015 surveys (< 0.25 m<sup>3</sup> / s), though as noted, precipitation in May – June 2015 was well below average for the region. Aquatic vegetation lines the bottom of much of the lower reach of this stream.



**Plate 4-6 Houay Soup Ngai at WQ3 Monitoring Station**



**Plate 4-7 Houay Soup Ngai at WQ3 Monitoring Station**

***Houay Dhakong***

Houay Dhakong is a small perennial stream, originating from a spring in the HSRA (south of the PFA boundary) which provides surface water throughout the year. The spring was not found during surveys due to difficult access. The stream flow was less than 0.1 m<sup>3</sup> / s during the 24 / 6 / 15 site visit (approximately 8

cm deep x 0.3 m wide). The village guide from Ban Somseun indicated that the flow is usually greater at this time of year, due to the relative drought (or late arrival of 2015 rainy season). However this stream does not currently provide water resources (with the possible exception of drinking water for those working in proximity) and is not considered a viable fishery by those villagers interviewed (Ban Hatsaykham, Ban Hat Gniun, and Ban Somseun). This stream will not be managed for HSRA utilisation.

***Houay Thamdin and Houay Liang***

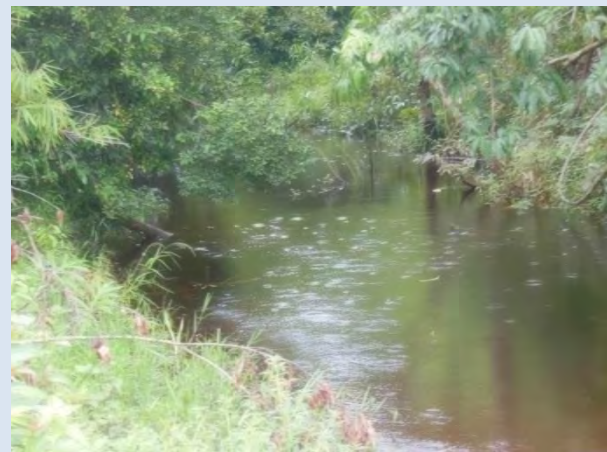
Houay Thamdin and Houay Liang are small ephemeral streams, with channel width of approximately 0.5 m near their confluence with the Nam Ngiep River. The streams were dry during June surveys though likely would have flowing during an average rainfall year. Neither stream is not spring fed, relying on rainfall input for seasonal flow. Neither are utilised for water resources or fishing and will not likely be managed for HSRA utilisation.

***Houay Khinguak Noi***

Houay Khinguak Noi is a relatively small perennial stream near the southern boundary of the proposed HSRA. It is presumed that the stream is spring-fed during the dry season as the catchment is fairly small and the stream originates at the steep incline in the PFA. The stream channel is primarily comprised of sand / silt, with pools intersecting long runs through the low to moderate gradient stream. Stream flow was less than 0.25 m<sup>3</sup> / s during the June site visit.



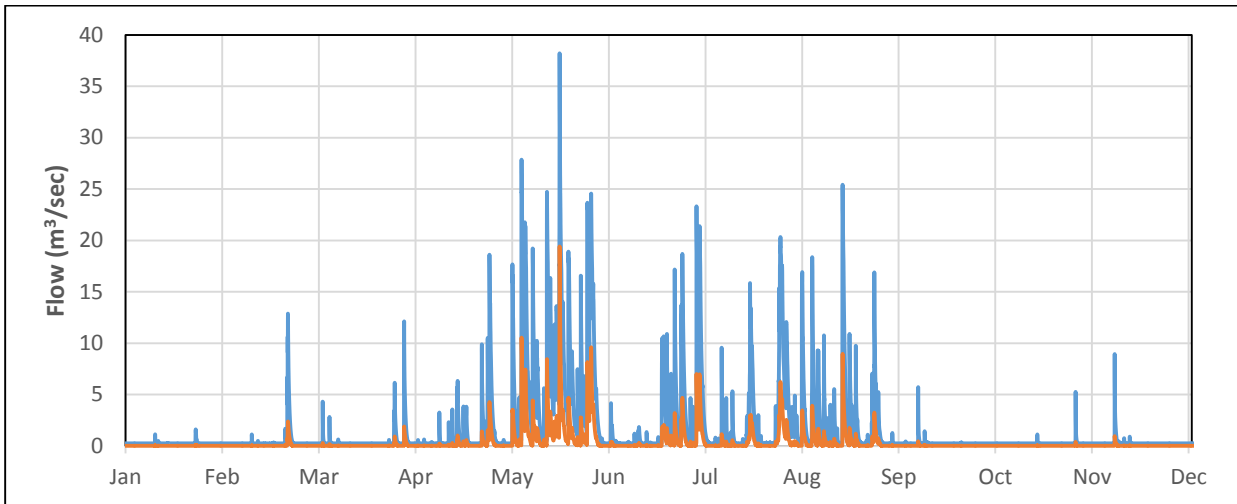
**Plate 4-8 Houay Khinguak Noi 20m from confluence with H. Khinguak Ngai**



**Plate 4-9 Houay Khinguak Noi 30m from confluence with H. Khinguak Ngai**

**Houay Khinguak Ngai**

Houay Khinguak Ngai, which comprises the southern boundary of the HSRA, is the largest stream of the HSRA area. It is a perennial stream that reaches a width of > 20 m at its confluence with the Nam Ngiep River during the dry season. Houay Khinguak Ngai has a steep gradient in its headwaters in the higher elevations of the PFA, with riffles, runs and pools through granite boulders and rock-lined channels where a number of tributaries join to form the large stream. It emerges into flatter terrain for the lower ~1.8 km, and comprises a mix of long runs with intermittent deep channels.



**Figure 4-8 Predicted median year stream flow at Houay Khinguak Ngai (blue) and Houay Khinguak Noi (tan),2012 Source: Earth Systems 2015**



**Plate 4-10 Houay Khinguak immediately upstream of confluence with Nam Ngiep River**

A preliminary flood assessment was undertaken using the predicted peak flow values for the Nam Ngiep River and hydrologic modelling of design rainfall events for the 1:100 ARI and 1:1000 ARI flood (NNP1 2013b), and preliminary peak flow modelling of Houay Soup Ngai, Houay Soup Noi and their tributaries. The results of this assessment indicate there is potential that periodic peak storm events may inundate a portion of the main access road for a short duration. More robust modelling is required to determine whether some of the residential area footprint is at risk from flooding from major storm events (e.g. 1:100 ARI - 1:1000 ARI peak floods).

Flood modelling conducted for this IEE is considered indicative only. Data gaps were identified (e.g. the precision of channel bathymetry / HSRA Digital Elevation Model (DEM) and lack of stream discharge values) that prohibited the conduct of more robust flood modelling. Surveys should be conducted to refine understanding of channel bathymetry / HSRA DEM, and stream discharge measured to provide suitable data to assess risk for (a) temporary isolation of communities; (b) the need for ongoing maintenance of the access road; and (c) siting of residential areas / community safety.



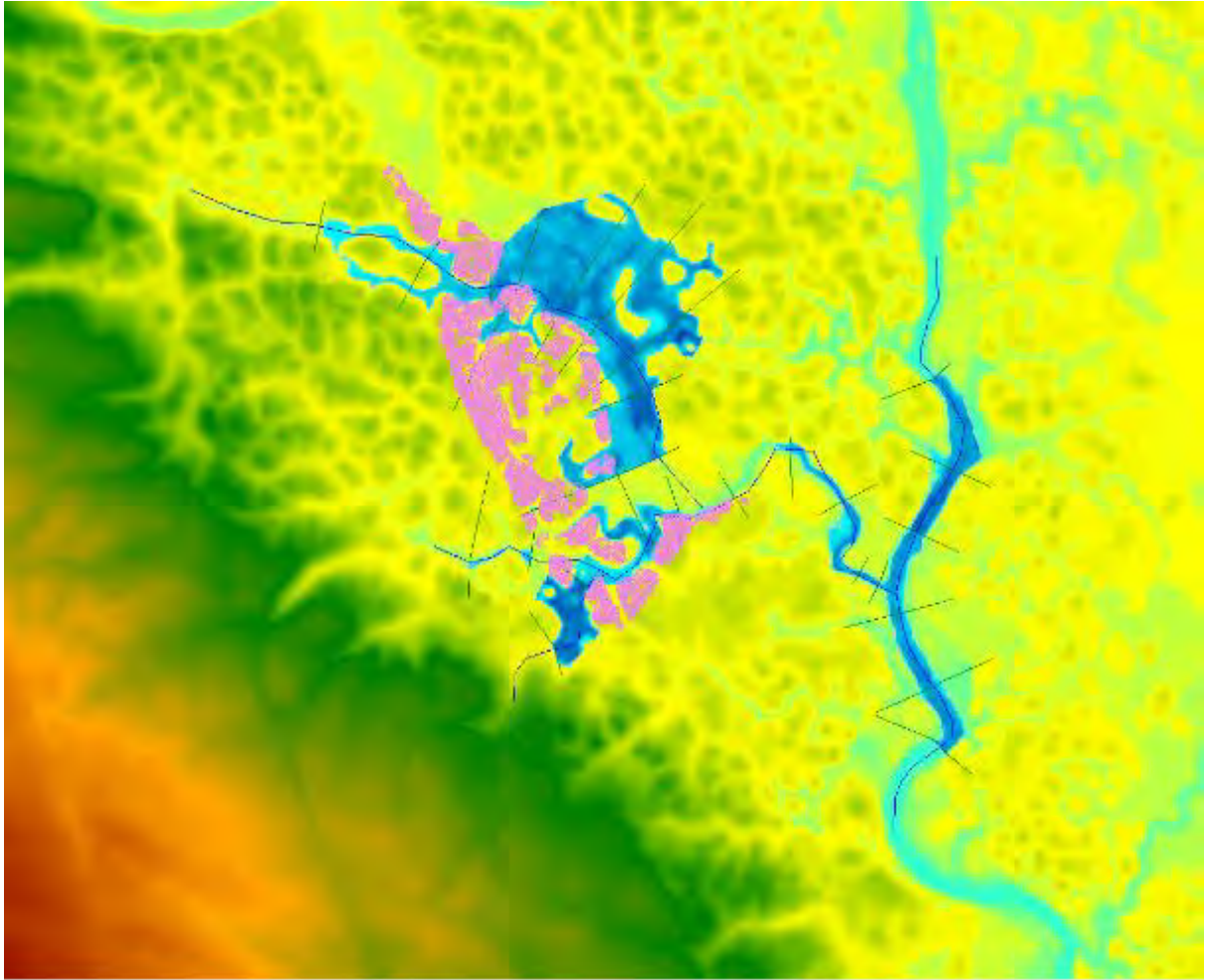


Figure 4-9 Predicted flooding extent and depth for 1:100 ARI in the HSRA

Source: Earth Systems 2015

The predicted depth of the Houay Soup Noi is shown below in Figure 4-10.

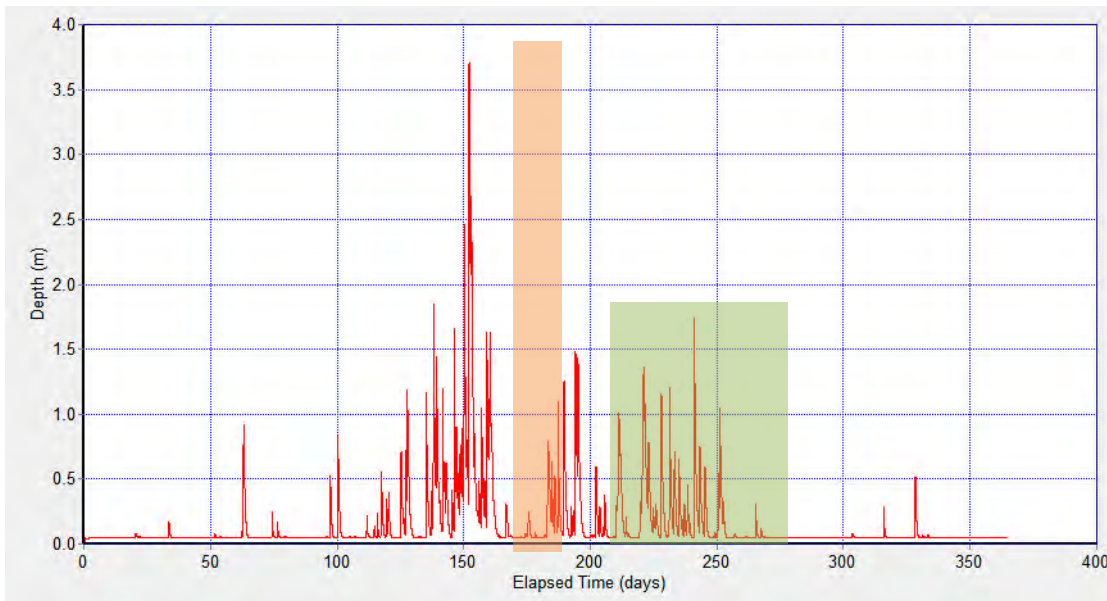
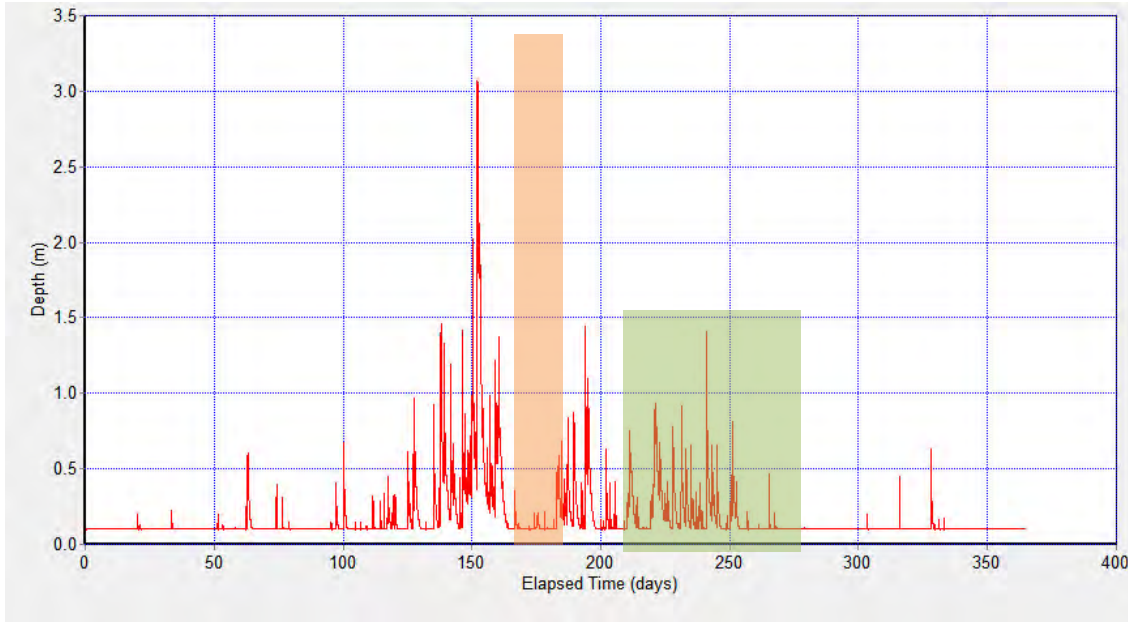


Figure 4-10 Predicted flooding depths for Houay Soup Noi median year with 1:100 ARI in the HSRA (Source: Earth Systems 2015)



Baseflow conditions create a flow depth of approximately 0.1 - 0.5 m with peak flows in the median year data (highlighted in green) reaching approximate depths of 1.5 m - 1.75 m. The 1:100 peak flow event at day 150 (highlighted in orange) shows a short 24 hour flow peak of 3.75 m in the depression area in the Houay Soup Noi. This data matches the results of the hydraulic model predictions and is considered to be of acceptable accuracy based on the available data.

The predicted depth of the Houay Soup Ngai is provided below in Figure 4-11.



**Figure 4-11 Predicted flooding depths for Houay Soup Ngai median year with 1:100 ARI in the southern HSRA (Source: Earth Systems 2015)**

Baseflow conditions in the Houay Soup Ngai creates a slightly higher flow depth of approximately 0.2 - 0.5 m with peak flows in the median year data (highlighted in green) reaching approximate depths of 1.0 - 1.5 m. The 1:100 peak flow event at day 150 (highlighted in orange) shows a short sub - 24 hour flow peak of 3.1 m in the southern flood zone. This data also matches the results of the hydraulic model predictions and is considered to be of acceptable accuracy based on the available data.

## 4.6 Surface and Ground Water Quality

Earth Systems conducted field water quality analyses and sampled for laboratory analysis on 24-25 June, 2015 (refer to Table 4-2) on Houay Soup (below the confluence of Houay Soup Ngai and Houay Soup Noi), Houay Soup Noi, Houay Soup Ngai, Houay Khinguak Noi, Houay Khinguak Ngai, and the Nam Ngiep River (for comparison). More extensive analyses were conducted for Houay Soup Noi and Houay Soup Ngai as these waters will be used for irrigation and domestic water supply, respectively. Surface water samples indicated the water quality is generally good, with the exception of pathogens and pathogenic indicators (e.g. COD).

**Table 4-2 Water quality of the HSRA streams**

Parameter	Houay Soup (WQ1)	Houay Soup Ngai (WQ2)	Houay Soup Noi (WQ3)	Houay Khinguak Ngai (WQ4)	Houay Khinguak Noi (WQ5)	Nam Ngiep River (WQ6)	Project Drinking Water Guidelines	Ambient Water Quality Guidelines
Sampling Date	24/6/15	25/6/15	25/6/15	24/6/15	24/6/15	24/6/15		
<b>Field Parameters</b>								

Parameter	Houay Soup (WQ1)	Houay Soup Ngai (WQ2)	Houay Soup Noi (WQ3)	Houay Khinguak Ngai (WQ4)	Houay Khinguak Noi (WQ5)	Nam Ngiep River (WQ6)	Project Drinking Water Guidelines	Ambient Water Quality Guidelines
Sampling Date	24/6/15	25/6/15	25/6/15	24/6/15	24/6/15	24/6/15		
pH (units)	6.04	6.13	5.72	4.71	4.65	6.00	6.5 - 8.5	5-9
Temp (°C)	26.2	24.5	27.3	23.4	23.7	27.6	35	-
EC (mg/L)	25.3	18.9	28.1	12.8	8.6	85.4	1,000	-
Turbidity (NTU)	55.3	0.2	1.6	5.0	4.6	129.9	10	-
DO (mg/L)	6.75	6.05	5.02	6.43	5.76	6.19	-	>6.0
ORP	+125	+145	+147	+184	+165	+79	-	-
<b>Laboratory Parameters</b>								
pH	-	6.64	6.80	6.83	-	-	6.5-8.5	5-9
Total Coliform	-	680	2300	-	-	-	<2.2 MPN / 100ml	5,000
Faecal Coliform	-	200	180	-	-	-	0 MPN / 100ml	1,000
E. Coli	-	<0.25	<0.25	-	-	-	0 MPN / 100ml	-
TSS	-	<0.25	<0.25	11	-	-	-	-
TDS	-	9	8	11	-	-	600	-
Sulphate	-	7	3	6	-	-	250	-
NO <sub>3</sub> <sup>-</sup>	-	<0.01	0.07	<0.01	-	-	50	-
NO <sub>2</sub>	-	<0.1	<0.1	<0.1	-	-	3	-
NO <sub>3</sub> -N	-	<0.01	0.07	<0.01	-	-	-	5.0
COD	-	27	19	21	-	-	-	5.0
<b>Total Metal Concentrations (Mg/L)</b>								
Aluminium	-	0.31	0.07	-	-	-	0.2	-
Antimony	-	<0.001	<0.001	-	-	-	0.0005	-
Arsenic	-	<0.001	<0.001	-	-	-	0.01	0.1
Beryllium	-	<0.001	<0.001	-	-	-	-	-
Barium	-	0.012	0.015	-	-	-	0.7	-
Bismuth	-	<0.001	<0.001	-	-	-	-	-
Cadmium	-	<0.0001	<0.0001	-	-	-	0.003	0.005
Cerium	-	<0.001	<0.001	-	-	-	-	-
Cesium	-	<0.001	<0.001	-	-	-	-	-
Chromium	-	<0.001	0.002	-	-	-	-	0.05
Cobalt	-	<0.001	<0.001	-	-	-	-	-
Copper	-	0.002	<0.001	-	-	-	1.0	0.1
Dysprosium	-	<0.001	<0.001	-	-	-	-	-
Erbium	-	<0.001	<0.001	-	-	-	-	-
Europium	-	<0.001	<0.001	-	-	-	-	-
Gadolinium	-	<0.001	<0.001	-	-	-	-	-
Gallium	-	<0.001	<0.001	-	-	-	-	-
Hafnium	-	<0.01	<0.01	-	-	-	-	-
Holmium	-	<0.001	<0.001	-	-	-	-	-
Indium	-	<0.001	<0.001	-	-	-	-	-
Lanthanum	-	<0.001	<0.001	-	-	-	-	-
Lead	-	<0.001	<0.001	-	-	-	0.01	0.05

Lithium	-	<0.001	<0.001	-	-	-	-	-
Lutetium	-	<0.001	<0.001	-	-	-	-	-
Manganese	-	0.024	0.045	-	-	-	0.5	1.0
Molybdenum	-	<0.001	<0.001	-	-	-	-	-
Neodymium	-	<0.001	<0.001	-	-	-	-	-
Nickel	-	<0.001	<0.001	-	-	-	-	-
Praseodymium	-	<0.001	<0.001	-	-	-	-	-
Rubidium	-	<0.001	<0.001	-	-	-	-	-
Samarium	-	<0.001	<0.001	-	-	-	-	-
Selenium	-	<0.01	<0.01	-	-	-	0.01	-
Silver	-	<0.001	<0.001	-	-	-	-	-
Strontium	-	0.007	0.009	-	-	-	-	-
Tellurium	-	<0.005	<0.005	-	-	-	-	-
Terbium	-	<0.001	<0.001	-	-	-	-	-
Thallium	-	<0.001	<0.001	-	-	-	-	-
Thorium	-	<0.001	<0.001	-	-	-	-	-
Thulium	-	<0.001	<0.001	-	-	-	-	-
Tin	-	<0.001	<0.001	-	-	-	-	-
Titanium	-	<0.01	<0.01	-	-	-	-	-
Uranium	-	<0.001	<0.001	-	-	-	-	-
Vanadium	-	<0.01	<0.01	-	-	-	-	-
Ytterbium	-	<0.001	<0.001	-	-	-	-	-
Yttrium	-	<0.001	<0.001	-	-	-	-	-
Zinc	-	0.009	0.008	-	-	-	5.0	1.0
Zirconium	-	<0.005	<0.005	-	-	-	-	-
Boron	-	<0.05	<0.05	-	-	-	-	-
Iron	-	0.52	0.88	-	-	-	1.0	-

Source: Earth Systems 2015

Earth Systems' sampling indicated the following:

- Total coliform in Houay Soup Noi and Houay Soup Ngai surface water exceeded Project drinking water guidelines but were below ambient water quality guidelines;
- Faecal coliform concentrations in Houay Soup Noi and Houay Soup Ngai exceeded Project drinking water guidelines, but were below ambient water quality guidelines;
- E. Coli was not detected in Houay Soup Noi or Houay Soup Ngai water, but the laboratory detection limit (2.5 MPN / 100mL) is above the drinking water guideline (0 MPN / 100 mL);
- COD is elevated in Houay Soup Noi, Houay Soup Ngai, and Khinguak Noi (27, 19, and 21 mg / L, respectively), above the Project ambient water quality guideline of 5 mg/L;
- pH in Houay Soup and its tributaries was recorded below Project drinking water guidelines during field assessment (ranged from pH 5.72 – 6.13) but was within Project guidelines for laboratory assessment (6.64 – 6.83);
- HSRA steams were significantly less turbid than the Nam Ngiep River. The Houay Soup, measured near the confluence with the Nam Ngiep River was more turbid than for upstream monitoring locations (55 NTU), likely a result of intensive shifting cultivation and the unsealed road network as the stream approaches in river. However, this value is considered slightly higher than it would have otherwise been due to the boat disturbing the fine silt on the channel bottom;

- Total metal concentrations were low, with the majority below detection limit and only aluminium exceeding Project drinking water guidelines or Project ambient water quality guidelines (refer to Appendix C, Concession Agreement for comprehensive guidelines); and
- Total aluminium in Houay Soup Ngai was measured at 0.31 mg/L, above the Project drinking water guideline of 0.2 mg/L.

**Table 4-3 Houay Soup water quality data (NNP1 sampling)**

Parameter*	Sampling Date	Value
Temperature	15/06/15	26.1 °C
	06/07/15	24.8 °C
	21/07/15	24.5 °C
pH	15/06/15	7.23
	06/07/15	6.34
	21/07/15	6.26
Dissolved Oxygen	15/06/15	7.5 mg / L
	06/07/15	9.1 mg / L
	21/07/15	6.8 mg / L
Turbidity	15/06/15	10.8 NTU
	06/07/15	6.9 NTU
	21/07/15	4.5 NTU
BOD <sub>5</sub>	01/06/15	2.0
	15/06/15	1.0
COD	01/06/15	30.5
	15/06/15	34.8
Faecal Coliform	01/06/15	>240 MPN/100 ML
	01/07/15	2,400 MPN/100 ML
Total Coliform	01/06/15	>240 MPN/100 ML
	01/07/15	3,500 MPN/100 ML
Arsenic	01/06/15	0.0462

Source: Earth Systems 2015

\*Additional parameter were assessed, but not included in the Table (metals and nutrients and were found to be well below guidelines)

NNP1 sampling for June and July 2015 indicated similar results, with the following key issues identified:

- BOD, COD, faecal coliform, and total coliform levels were elevated, above Project drinking water guidelines and in some cases (BOD and COD) above ambient water quality guidelines;
- Total and faecal coliform levels are likely a result of livestock utilising the area, with unrestricted access to surface waters, as there are no upstream communities;
- The reasons for elevated COD cannot be conclusively determined. The pathogens play a role in the elevated BOD and COD, while suspended solids are likely rich in organic material and additional oxidising agents; and
- Arsenic was measured at 0.0462 mg / L, above the Project drinking water guideline of 0.01 mg / L. While it is considered likely that detection is a result of laboratory error (arsenic was not found in either Houay Soup tributaries during Earth Systems sampling), the potential health effects of arsenic in drinking water are significant, therefore further test work is required to verify seasonal arsenic levels in Houay Soup.

As baseflow for Houay Soup is spring-fed, arsenic contamination may be sourced from local aquifers. Test work conducted for groundwater sampled in 10 July 2014 from the HSRA found arsenic at 2.21



µg / L, (following initial test work that indicated higher concentrations). Further test work is required to verify arsenic levels in groundwater.

#### **4.6.1 Groundwater**

NNP1 drilled a well in the HSRA (20 m depth). An initial test of the groundwater found the water table at 16 m depth of generally acceptable quality. Initial test work found elevated levels of mercury and arsenic, both of which exceeded Project drinking water guidelines. Due to doubts regarding the accuracy of initial test work, bore water from the HSRA was re-tested and arsenic concentrations (2.21 µg / L) and mercury concentrations (0.25 µg / L) were detected at far lower concentrations and below Project drinking water guidelines (LCG, 2014).

Groundwater should be periodically tested, as the streams in the HSRA are spring fed, and the village may at some point require bores to supplement domestic water supply in the event that option 2 (irrigation pond water supply for domestic water) is not constructed.

#### **4.7 UXO**

The NNP1 EIA (ERM 2014) and SIA (NNP1 2014a) report that there is a relatively low level of UXO contamination in the greater Nam Ngiep Hydropower Project area. Figure 4-12 provides a map of aerial bombing data from the US government. This indicates a low UXO risk in the HSRA. The access road, village development area and paddy rice field area for Hatsaykham have been cleared. No live UXO were identified during the UXO clearance. However, the absence of UXO cannot be assumed. Areas cleared to date are shown in Figure 4-13. Further analysis of UXO risk is provided in Section 7.3.10.

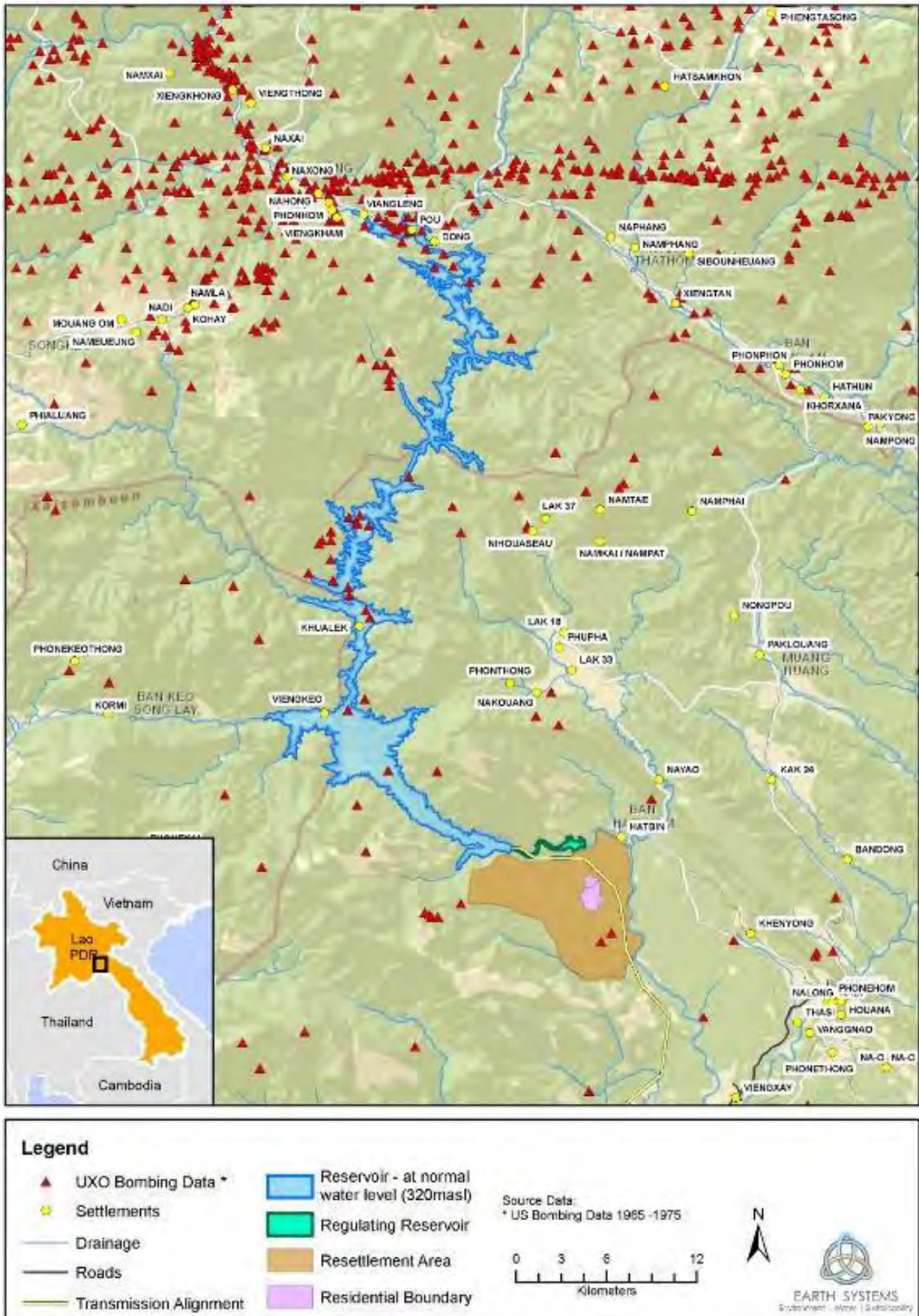


Figure 4-12 US Aerial bombing Data

Source: US Embassy 2006

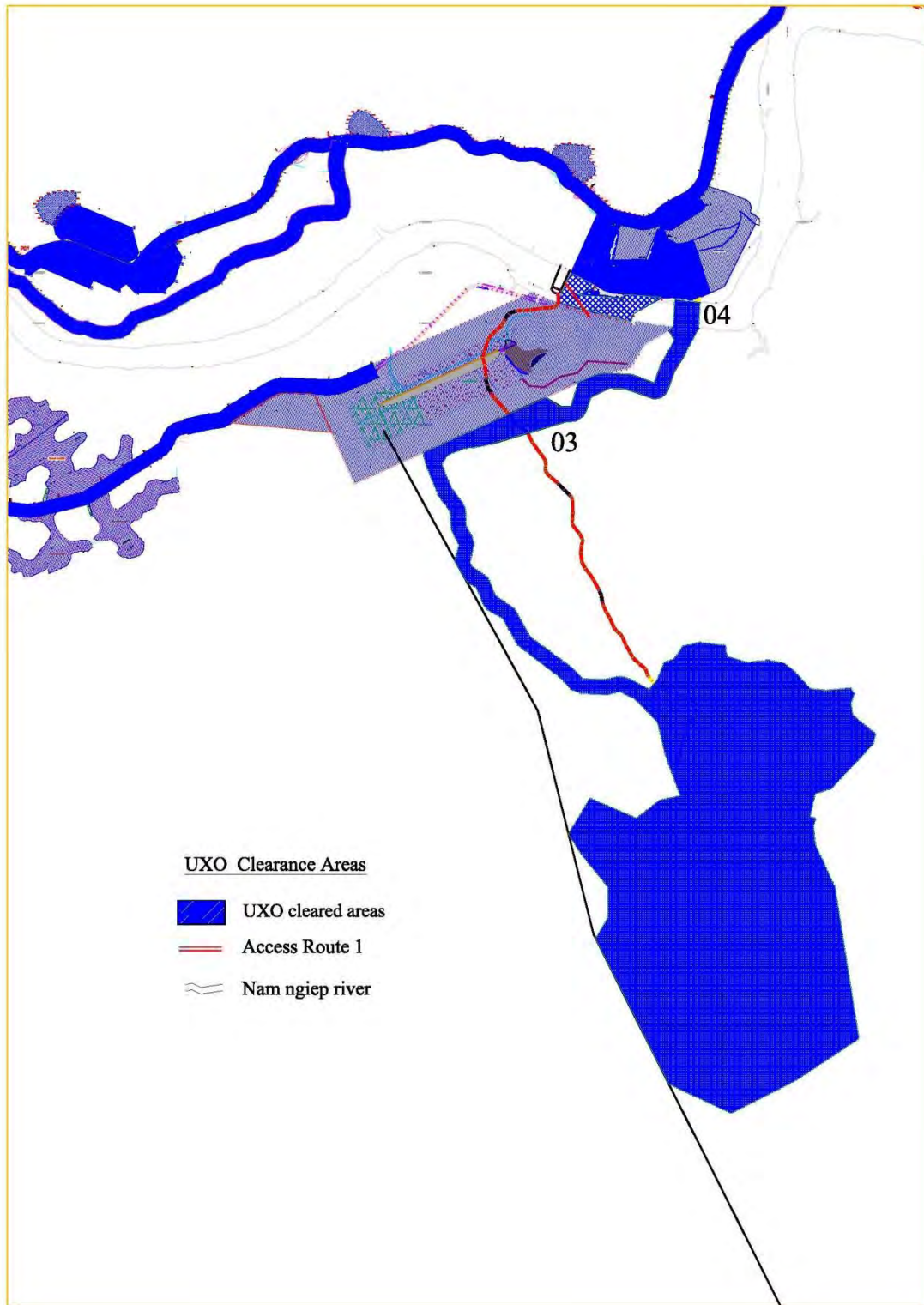


Figure 4-13 UXO Clearance Areas

Source: NNP1 2015



## 5 BIOLOGICAL SETTING

### 5.1 Protected Areas and Forests

The HSRA footprint overlaps the Nam Ngiep Nam Mang PFA. PFAs are primarily managed to protect water resources, reduce soil erosion, and conserve forest ecology / habitat. Utilisation of timber forest products (TFP) and non-timber forest products (NTFP) is not prohibited, however these activities must be conducted according to an accepted sustainable development plan (refer to the INRMP, Appendix A) and all utilisation of resources must be conducted outside of Total Protection Zones, which include areas of steep slopes, buffers near watercourses, and other sensitive areas.

The Project Development Site (HSRA infrastructure) will be located outside the PFA, however according to livelihood requirements and the INRMP, HSRA villagers may utilise designated areas within the 3,715 ha PFA / HSRA overlap for TFP and NTFP as long as these activities are conducted according to the sustainability planning (Appendix A).

The Houay Ngua Provincial Protection Area (PPA) is located approximately 8 km downstream and the Phou Ngou PPA is located approximately 11 km downstream from the NNP1 HPP.

### 5.2 Land Use, Habitat Distribution and Quality

The HSRA is primarily comprised of Upper Mixed Deciduous Forest, Mixed Deciduous Forest / Bamboo mosaic, Bamboo Forest, Old Fallow, and Young Fallow, with smaller areas of Riparian Forest, granite outcrops, and watercourses (refer to Figure 5-1 and Section 5.3 for a detailed description of vegetative communities established in the HSRA).

HSRA forest communities / land use designations differ considerably for the 2,393 ha Project Development Site and the 3,715 ha Protected Forest Area,

The Project Development Site (not including the recently annexed area) is primarily comprised of Young Fallow (594 ha) and Old Fallow (919 ha), with pockets of Upper Mixed Deciduous Forest (58 ha) and Mixed Deciduous / Bamboo mosaic (77 ha) predominantly in the south of the HSRA PDS. A recent history of commercial logging, slash and burn agriculture, and livestock grazing has altered the landscape in a manner that it currently provides very little of its natural ecological function. Small areas of recent upland agriculture (81 ha) have not yet developed into Young Fallow. A very small eucalyptus plantation occurs within the PDS, which is likely nearing the end of its rotation (within the next 2 - 4 years). More than 91% of the 1,745 ha original RDS area is not classified as 'natural forest' (i.e. is Fallow or Agricultural land).

The 648 ha PDS annex area is similarly very disturbed, but has a higher proportion of 'natural habitat' (as defined by ADB, 2009 – refer to Section 5.3.1) than the remainder of the PDS. The annexed area is primarily comprised of Old and Young Fallow (~492 ha equals 76% of the PDS annex), but a relatively large area (117 ha) of moderately to highly disturbed Mixed Deciduous / Bamboo mosaic occurs adjacent the Houay Soup Noi tributaries. Overall, the vegetative structure and the quality of habitat in the PDS annex is largely defined by degradation from historic logging and clearing for swidden agriculture. Approximately 19% is covered by disturbed 'natural habitat'.

In contrast, the majority of the 3,715 ha PFA is comprised of Upper Mixed Deciduous Forest, Mixed Deciduous Forest / Bamboo Mosaic, or Bamboo Forest (approximately 83% is natural habitat as defined by ADB, 2009). Much of the PFA has been disturbed by historic logging, however timber harvest appears to have been largely selective logging and clearing for agriculture has not occurred. At the higher elevations of the PFA (northern section) some pristine forest remains as massive granite boulders / outcrops that preclude vehicular access / road construction and the forests are far enough from settlements that other means of timber hauling have not occurred. The more accessible portions of the PFA (refer to logging



roads in Figure 2-2) have been degraded by logging activity, but forest canopy, mid-level canopies and shrub / herbaceous vegetation is contiguous to the extent that the ecological function of PFA forests remains largely intact.

**Table 5-1 Vegetative communities in the HSRA Project Development Site and HSRA Protected Forest Area**

Vegetative Community / Land Use	Project Development Site (ha)		HSRA PFA Land (ha)
	Original 1,745 ha	Annexed 648 ha	
Mixed Deciduous Forest	57.96	1.68	163.05
Mixed Deciduous / Bamboo Mosaic	76.80	117.27	2325.63
Bamboo Forest	-	7.13	284.05
Riparian Forest	13.10	1.98	-
Old Fallow	918.54	185.55	307.36
Young Fallow	593.65	306.62	469.58
Agricultural Land	80.08	22.07	1.10
Grassland	-	2.99	81.83
Rock Outcrops	-	-	69.98
Watercourses	0.90	-	7.19
Roads / Tracks	2.84	3.47	10.92
Nam Ngiep Demonstration Farm	0.89	-	-
<b>Total</b>	<b>1744.76</b>	<b>648.75</b>	<b>3720.70</b>

Source: Earth Systems 2015

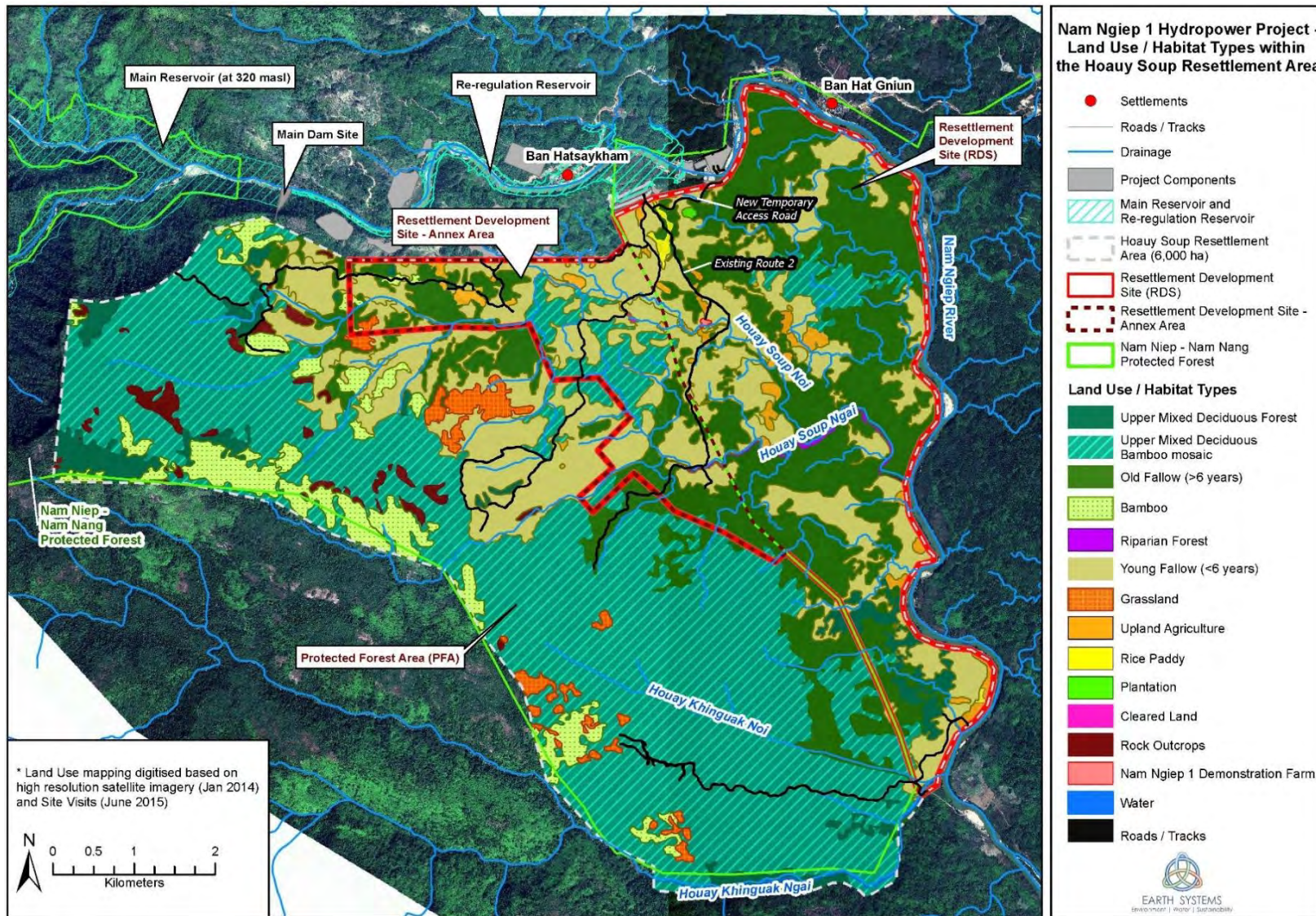


Figure 5-1 Current (Pre-HSRA) Habitat Types / Vegetative Communities and Land Use in the HSRA

Source: Earth Systems 2015



## 5.3 Vegetation / Habitat Types

### 5.3.1 Land Cover Types

Vegetation identified during June 2015 surveys included a mix of 'natural habitat' and modified habitat (refer to below). Natural Habitat, as defined by the ADB Safeguard Policy Statement (ADB 2009) refers to "Land and water areas where the biological communities are formed largely by native plant and animal species, and where human activity has not essentially modified the area's primary ecological functions."

#### *Natural Habitat*

- Upper Mixed Deciduous Forest;
- Mixed Deciduous Forest / Bamboo mosaic;
- Bamboo Forest;
- Riparian Forest.

#### *Modified Habitat*

- Old Fallow – left to regenerate > 8 years;
- Young Fallow – left to regenerate < 8 years;
- Agricultural Plantation; and
- Rice Paddy

Descriptions of each land cover type identified in the field are provided below.

#### ***Upper Mixed Deciduous Forest***

Upper mixed deciduous (UMD) forest in the HSRA (primarily PFA) is characterised by a dominance of deciduous tree species representing more than 50% of the stand. Most areas of UMD had a continuous canopy. Lower structural layers were less dense as the canopy prevents light from reaching these lower layers and cover was typically less than 20%.

Upper mixed deciduous forest was the most species rich habitat surveyed (73% of species identified), in particular all conservation significant species identified in the HSRA were found in UMD (refer to Appendix D). Common canopy species were *Anisoptera costata*, *Hopea ferrea* and *Ormosia pinnata*. *Gonocaryum lobbianum* and *Mallotus thorelii* were the most common species within the mid-storey, both being small trees or shrubs. Bamboo species were also common in the mid-storey, such as *Oxytenanthera albociliata* and *O. parvifolia*. Herbaceous plants and climbers were dominant within the understorey, particularly species within the ginger family (*Zingiberaceae*) and euphorb family (*Euphorbiaceae*), some with spectacular floescence's.

A few native species have become dominant in the habitat type, particularly *Scleria terrestris* as it establishes quickly following disturbance.

Much of the UMD within the HSRA PFA appears to be minimally disturbed (refer to Table 5-3) as access to logging vehicles is restricted at some of the higher elevations. The remainder of UMD in the PFA has been disturbed by historic logging / fire but has retained a relatively continuous canopy, very few or no introduced species, large trees and little evidence of human disturbance. Patches of moderately to highly disturbed UMD exist in close proximity to human activity, such as roads and settlements. The level of disturbance to UMD was correlated with distance to human activity and accessibility for historic logging operations.

**Table 5-2 Most common species found within each of the three structural components of upper mixed deciduous forest in the Project Area**

Structural Component	Scientific Name	
Canopy 5 – 50% cover Tree height 4 - 30 m	<i>Anisoptera costata</i>	<i>Ormosia pinnata</i>
	<i>Crypteronia paniculata</i>	<i>Schima wallichii</i>
	<i>Hopea ferrea</i>	<i>Syzygium cumini</i>
	<i>Irvingia malayana</i>	
Mid-storey 5 – 30% cover Plant height ≥ 1 - 4 m	<i>Alangium kurzii</i>	<i>Mallotus thorelii</i>
	<i>Cinnamomum iners</i>	<i>Oxytenanthera albociliata</i>
	<i>Gonocaryum lobbianum</i>	<i>Oxytenanthera parvifolia</i>
	<i>Mallotus paniculatus</i>	<i>Trema orientalis</i>
Understorey or ground cover 5 – 45% cover Plant height < 1	<i>Alpinia galanga</i>	<i>Dracaena angustifolia</i>
	<i>Ancistrocladus tectorius</i>	<i>Embelia libers</i>
	<i>Catimbum bracteatum</i>	<i>Globba reflexa</i>
	<i>Cissus assamica</i>	<i>Scleria terrestris</i>

Source: Earth Systems 2015

**Table 5-3 Definition of low and moderate/high quality mixed deciduous forest (includes upper and lower forest)**

Condition	Definition
Low disturbance	<p>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. Mixed Deciduous forest includes both Upper and Lower 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 Mixed Deciduous forest.</p> <p>This forest type is considered 'low disturbance' when the majority of the following criteria are met:</p> <ul style="list-style-type: none"> <li>• Tree canopy dominated by trees with greater than 30 cm DBH.</li> <li>• Tree canopy cover greater than 50%;</li> <li>• Alien species rare (e.g. represent less than 5% of the stand);</li> <li>• Level of disturbance from factors such as selective logging and fire is relatively low.</li> </ul>
Moderate / high disturbance	<p>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.</p> <p>This forest type is considered 'moderate/high disturbance' when:</p> <ul style="list-style-type: none"> <li>• Tree canopy dominated by trees with less than 30 cm DBH.</li> <li>• Tree canopy cover greater than 10% but less than 50%;</li> <li>• Alien species can be widespread (e.g. represent &gt; 10% of the stand);</li> <li>• Level of disturbance from factors such as selective logging and fire is high.</li> </ul>

Source: Earth Systems 2015



### Bamboo Forest

Bamboo forest typically occurred on low-quality soil or granite outcropping and was dominated (in biomass) by species of the sub-tribe *Bambusoideae*. This forest type is defined as having over 80% of the biomass being made up of bamboo species. The most common bamboo species were *Cephalostachyum virgatum* and *Oxytenanthera parvifolia*. Bamboo generally occurred in dense stands or clumps, predominantly in the mid-storey.

A tree canopy was almost absent, with a few scattered trees (refer to Table 5-4). Ground cover was also relatively sparse because of the dense mid-storey canopy of bamboo. Bamboo forests are native to many regions and are a common natural habitat type in Lao PDR. Due to the rapid establishment and growth of bamboo it often becomes dominant in areas that have been cleared. The composition and density of the bamboo forest surveyed in the Project Area indicated that some areas are likely the natural habitat type (on fractured granite with very little soil), while other areas had dominant bamboo stands that likely established following tree harvest operations.

**Table 5-4 Common species found within the structural components of bamboo forest in the Project Area**

Structural Component	Scientific Name	
Canopy 0 – 2% cover Tree height 4 - 15 m	<i>Cratogeomys formosus</i> var. <i>pruniflorum</i>	<i>Pterocymbium dussaudii</i>
	<i>Glochidion sphaerogynum</i>	<i>Schima wallichii</i>
	<i>Macaranga denticulata</i>	<i>Vitex tripinnata</i>
	<i>Ormosia pinnata</i>	<i>Wrightia arborea</i>
Mid-storey 50 – 60% cover Plant height ≥ 1 - 4 m	<i>Alangium kurzii</i>	<i>Mallotus paniculatus</i>
	<i>Aporosa ficifolia</i>	<i>Mallotus thorelii</i>
	<i>Cephalostachyum virgatum</i>	<i>Oxytenanthera parvifolia</i>
	<i>Cinnamomum iners</i>	<i>Rinorea boissieu</i>
	<i>Gonocaryum lobbianum</i>	<i>Trema orientalis</i>
Understorey or ground cover 10 – 15% cover Plant height < 1 m	<i>Ancistrocladus tectorius</i>	<i>Embelia libers</i>
	<i>Caryota mitis</i>	<i>Globba reflexa</i>
	<i>Catimbiium bracteatum</i>	<i>Lygodium flexuosum</i>
	<i>Cyclea barbata</i>	<i>Scleria terrestris</i>
	<i>Dracaena angustifolia</i>	

Source: Earth Systems 2015

### Old Fallow

Old fallow is where secondary regrowth dominates; where native and non-native species have regenerated for at least 8 years after disturbance or clearing. The forest may retain structural and floristic similarities to the natural habitats (e.g. canopy, understorey), but is not readily classified as a particular recognised natural forest type. Although old fallow forest has been highly modified and is considered as modified habitat, it retains many native species and provides habitat for wildlife. Old fallow was particularly species rich, but most species are common and widespread, with no conservation species present (refer to Table 5-5).

**Table 5-5 Most common species found within Old Fallow in the Project Area**

Structural Component	Scientific Name	
Canopy 10 – 30% cover	<i>Cratogeomys formosus</i> var. <i>pruniflorum</i>	<i>Peltophorum dasyrrhachis</i>

Structural Component	Scientific Name	
Tree height > 4 m	<i>Crypteronia paniculata</i>	<i>Sapium discolor</i>
	<i>Glochidion sphaerogynum</i>	<i>Schima wallichii</i>
	<i>Irvingia malayana</i>	<i>Vitex tripinnata</i>
	<i>Ormosia pinnata</i>	
Mid-storey 10 – 20% cover Plant height ≥ 1 - 4 m	<i>Aporosa ficifolia</i>	<i>Grewia paniculata</i>
	<i>Cephalostachyum virgatum</i>	<i>Oxytenanthera albociliata</i>
	<i>Croton cascarilloides</i>	<i>Oxytenanthera parvifolia</i>
	<i>Gonocaryum lobbianum</i>	<i>Peltophorum dasyrrhachis</i>
Understorey or ground cover 1 – 5% cover Plant height < 1 m	<i>Ardisia helferiana</i>	<i>Lygodium flexuosum</i>
	<i>Curculigo orchioides</i>	<i>Scleria terrestris</i>
	<i>Dracaena angustifolia</i>	<i>Thysanolaena maxima</i>
	<i>Forrestia griffithii</i>	<i>Uvaria macrophylla</i>

Source: Earth Systems 2015

### Young fallow

Young fallow was where the land has been cleared recently (< 8 years), and native and non-native species have begun to regenerate. As with old fallow, the forest may retain similarities to natural habitat, but cannot be considered as natural. Bamboo could be quite common within the mid-storey, forming large stands or clumps (Table 5-6).

*Chromolaena odorata*, a non-native plant and considered as one of the world's worst invasive species, was common within the mid-storey of young fallow (ISSG 2015). The fast growing perennial shrub is an aggressive competitor and forms dense stands that prevent other species from establishing.

**Table 5-6 Dominant and common species within young fallow in the Project Area**

Structural Component	Scientific Name	
Canopy 0 – 5% cover Tree height > 4 m	<i>Cratoxylum formosum var. pruniflorum</i>	<i>Ormosia pinnata</i>
	<i>Crypteronia paniculata</i>	<i>Schima wallichii</i>
	<i>Glochidion sphaerogynum</i>	
Mid-storey 30 – 70% cover Plant height ≥ 1 - 4 m	<i>Alangium kurzii</i>	<i>Mallotus paniculatus</i>
	<i>Aporosa ficifolia</i>	<i>Mallotus thorelii</i>
	<i>Cinnamomum iners</i>	<i>Oxytenanthera albociliata</i>
	<i>Gonocaryum lobbianum</i>	<i>Peltophorum dasyrrhachis</i>
	<i>Macaranga denticulata</i>	<i>Trema orientalis</i>
	<i>Maesa ramentacea</i>	
Understorey or ground cover 5 – 20% cover Plant height < 1 m	<i>Alpinia galanga</i>	<i>Cyclea barbata</i>
	<i>Ancistrocladus tectorius</i>	<i>Dracaena angustifolia</i>
	<i>Caryota mitis</i>	<i>Embelia libers</i>
	<i>Catimbum bracteatum</i>	<i>Globba reflexa</i>

	<i>Chromolaena odorata</i>	<i>Scleria terrestris</i>
	<i>Cissus assamica</i>	<i>Thysanolaena maxima</i>

Source: Earth Systems 2015

## 5.4 Terrestrial Flora

Ninety-three species of flora were recorded within the HSRA (Appendix D). These 93 species belong to 53 families with all except one species being from *Tracheophyta* (vascular plants). The only non-vascular plant identified was a fern. Many non-vascular plants are difficult to detect (e.g. mushrooms, lichen) and thus more targeted studies would be required for a comprehensive data set. Interviews with local villagers indicated that several species of mushrooms and ferns are found within the region. Hence, it can be assumed that there are many more species in the HSRA.

The majority of species (73%) were found within UMD and 51 species were exclusive to UMD. Only eight (8) species were found in all habitat types. Based on other studies within Lao PDR and the greater South-east Asian region most species are common, widespread or secure within the region surrounding the HSRA and/or Lao PDR. However, the majority of these species have not been assessed for their global conservation significance (i.e. IUCN Red List).

Nine ecologically important species were identified in the surveyed areas and six of these are considered globally threatened (i.e. IUCN status of Vulnerable, Endangered or Critically Endangered). Most of these species are also economically important, many as important timber species. The most threatened species identified, two Critically Endangered (CR) species, *Aquilaria crassna* and *Dipterocarpus turbinatus*, are commercially important. The importance and overexploitation of these trees for their wood or other products has generally led to their rarity, as well as deforestation of UMD and other forest types in the greater region (e.g. evergreen forest). The other four threatened species *Anisoptera costata*, *Dipterocarpus costatus*, *Hopea ferrea* and *Vatica cinerea* are globally Endangered as they occur on fertile, arable land, are subject to deforestation and are overexploited for their timber (IUCN 2015).

All except the mango tree (*Mangifera indica*) of these globally threatened and conservation significant species are also considered priority species for the conservation of Lao PDR forest genetic resources (refer to Table 5-7). A list of priority species was compiled by the Ministry of Agriculture and Forestry (MAF) in coalition with the Asia Pacific Forest Genetic Resources Programme (APFORGEN) (Phongoudome et al 2004). A priority species was defined by a) indigenous to Lao PDR, b) economically important now or in the near future and c) threatened as a result of over-use or destruction of natural habitats.

Twenty-one of these priority forest genetic resource species were identified in the Project Area, including the six globally threatened trees. In general, the distribution of these species has not been mapped across the globe, or the region, as has been done for other globally threatened species. However, the APFORGEN led by international and Lao specialists assessed many of these species for their security and local conservation status. The assessment considered each species geographical range and rarity, habitat specificity, protection of their habitat and the human impact on the habitat and species. Species were assigned conservation statuses similar to the IUCN Red List of Threatened Species, however there was no Critically Endangered category. Some of the species lacked sufficient information to make an assessment of their local conservation significance (i.e. Data Deficient).

A few of the threatened species could not be assessed due to a lack of information, while others retained a local threatened status. However, *Anisoptera costata* was considered as lower risk, conservation dependent and nearly threatened, predominantly due to its ability to grow in different ecoregions and habitats. The species is found across several ecological zones, has low habitat specificity, and its habitat is moderately common; however humans have had a high impact on the species (Phongoudome et al 2004).

**Table 5-7 Species of global conservation significance and threatened flora species identified in the HSRA**

Scientific Name	English Common Name	IUCN Red List Status	Major Threats
<i>Anisoptera costata</i>		EN	Occurs on fertile, arable land
<i>Aquilaria crassna</i>	Agarwood / Eagle wood	CR	Wood used in perfume, other parts used for incense, medicine, cosmetics
<i>Dalbergia cultrata</i>	Burma blackwood	NT	Deforestation and overexploitation of timber
<i>Dialium cochinchinense</i>	Velvet tamarind	LR/NT	Overexploitation of timber
<i>Dipterocarpus costatus</i>		EN	Timber and resin used for construction, e.g. boat building
<i>Dipterocarpus turbinatus</i>		CR	Deforestation and overexploitation of timber
<i>Hopea ferrea</i>		EN	Commercially important tree, deforestation and overexploitation of timber
<i>Mangifera indica</i>	Mango	DD	Locally and commercially important fruit tree
<i>Vatica cinerea</i>		EN	Deforestation and overexploitation of timber

Source: Earth Systems 2015

Key: CR – Critically Endangered; EN – Endangered; DD – Data Deficient; NT – Near Threatened; LR – Lower Risk

**Table 5-8 Flora species identified within the HSRA that are considered priority forest resource species\***

Scientific Name	English Common Name	Family	IUCN Red List Status	Lao PDR APFORGEN Status
<i>Alstonia scholaris</i>	White cheesewood	Apocynaceae	LR/LC	LR/LC
<i>Anisoptera costata</i>		Dipterocarpaceae	EN	LR/CD/NT
<i>Aquilaria crassna</i>	Agarwood / Eagle wood	Thymeleaceae	CR	EN
<i>Cinnamomum iners</i>		Lauraceae	N/A	LR/LC
<i>Dalbergia cultrata</i>	Burma blackwood	Leguminosae	NT	VU
<i>Dialium cochinchinense</i>	Velvet tamarind	Leguminosae	LR/NT	LR/CD/NT
<i>Dipterocarpus costatus</i>		Dipterocarpaceae	EN	VU
<i>Dipterocarpus turbinatus</i>		Dipterocarpaceae	CR	DD
<i>Elaeocarpus stipularis</i>		Elaeocarpaceae	N/A	LR/CD/NT
<i>Fagraea fragrans</i>	Tembusu	Gentianaceae	N/A	VU
<i>Garcinia frangeoides</i>		Clusiaceae	N/A	VU
<i>Gmelina arborea</i>	Malay beechwood	Lamiaceae	N/A	LR/CD/NT
<i>Hopea ferrea</i>		Dipterocarpaceae	EN	VU
<i>Irvingia malayana</i>		Irvingiaceae	LR/LC	LR/CD/NT
<i>Mesua ferrea</i>		Calophyllaceae	N/A	VU
<i>Peltophorum dasyrrhachis</i>		Fabaceae	N/A	LR/LC
<i>Schima wallichii</i>		Theaceae	N/A	LR/CD/NT



Scientific Name	English Common Name	Family	IUCN Red List Status	Lao PDR APFORGEN Status
<i>Sindora siamensis</i> var. <i>siamensis</i>		Leguminosae	LC	VU
<i>Syzygium chloranthum</i>		Myrtaceae	N/A	VU
<i>Vatica cinerea</i>		Dipterocarpaceae	EN	DD
<i>Wrightia arborea</i>		Apocynaceae	N/A	LR/CD/NT

Source: Earth Systems 2015

\*Species given priority designation for Lao PDR Ministry of Agriculture and Forestry (MAF) and research centre coalition Asia Pacific Forest Genetic Resources Programme (APFORGEN) (Phongoudome et al 2004)

Key: CR – Critically Endangered; EN – Endangered; VU – Vulnerable; DD – Data Deficient; NT – Near Threatened; LR – Lower Risk; LC – Least Concern; CD – Conservation Dependent; N/A – Not Assessed

## 5.5 Terrestrial Fauna

### 5.5.1 Field Surveys

Twelve terrestrial fauna species were observed via indirect and direct methods (e.g. prints, sight) during June, 2015 field surveys (refer to Table 5-9). The majority of species identified were mammals and birds common to the local area and throughout Lao PDR and South-east Asia. Surveys for this IEE have not produced a comprehensive list of species within the Project Area. Targeted field survey methods would be required to detect a mostly cryptic and nocturnal species assemblage (e.g. small cats, rodents, owls).

Two globally significant species were identified during field surveys, the Vulnerable Asiatic black bear (*Ursus thibetanus*) and the Near Threatened Large Indian civet (*Viverra zibetha*).

**Table 5-9 Fauna identified as occurring in the HSRA during field surveys**

English Common Name	Scientific Name	Local name	IUCN Red List Status	Lao PDR Status
Tree squirrel	<i>Callociurus</i> sp.	Ka hok	N/A	
Greater coucal	<i>Centropus sinensis</i>	Nok kod	LC	
Feral/domestic chicken*	<i>Gallus</i>	Kai pah	LC	LKL
Silver pheasant	<i>Lophura nycthemera</i>	Kai khoua louang	LC	
Southern red muntjac	<i>Muntiacus muntjak</i>	Fan	LC	
Common palm civet	<i>Paradoxurus hermaphroditus</i>	Ngen dug/om	LC	
Red-necked keelback	<i>Rhabdophis subminiatus</i>	Ngou dang hae	LC	
Asiatic black bear	<i>Ursus thibetanus</i>	Mee	VU	ARL
Common/feral bore*	<i>Sus scrofa</i>	Mou pah	LC	
Common tree shrew	<i>Tupaia glis</i>	Ka nai	LC	
Large Indian civet	<i>Viverra zibetha</i>	Ngen hang kan	NT	
Ratsnake	<i>Zamenis</i> sp.	Ngou sing dong	N/A	

Source: Earth Systems 2015

Key: \* - Introduced, not native; VU – Vulnerable; NT – Near Threatened; LR – Lower Risk; LC – Least Concern; N/A – Not Assessed; LKL – Little Known in Lao PDR; ARL – At Risk in Lao PDR

## 5.5.2 Local Knowledge Surveys

Eighty-six species of fauna were identified by villagers as being seen in the HSRA / PFA (Appendix E). Most species are common and widespread in Lao PDR, Southeast Asia and/or globally. Similarly, many of the species are disturbance-tolerant and a few are non-native, non-indigenous or introduced.

Of the 86 species, 17 species of global conservation significant species were identified, while 11 species are considered globally threatened (i.e. Vulnerable, Endangered IUCN status). The majority of these species are also considered “At Risk” within Lao PDR. Three Endangered mammals, Dhole (*Cuon alpinus*), Hairy-nosed otter (*Lutra sumatrana*) and Sunda pangolin (*Manis javanica*) are very rarely seen by local villagers and only the Sunda pangolin was reported by representatives from all three communities interviewed. Similarly the other threatened mammals are rarely seen, including the Asiatic black bear.

Five globally threatened herpetofauna were identified by local villagers. The king cobra (*Ophiophagus hannah*) is reportedly common to the region, but is globally Vulnerable and considered Potentially At Risk in Lao PDR. This snake is commonly hunted for its skin, meat and for the Chinese medicine trade (IUCN 2015). Three of the five threatened herpetofauna were turtles. There is limited information regarding these species, but it appears that their spread across Southeast Asia may be influenced by the historic and current food and medicine trade.

### **Species Assemblage**

All species identified during field surveys were identified by local villagers. Overall there were 86 species of terrestrial fauna reportedly inhabiting the HSRA and surrounds. This includes 27 mammals, 33 birds, 9 amphibians and 17 reptiles. It is assumed that there are more species undetected, targeted surveys for more cryptic and nocturnal species would need to be undertaken.

### 5.5.3 Invasive Species

Several invasive and non-indigenous flora species were identified in the habitats of the Project Area (refer Table 5-10). The majority of species were identified growing in fallow land and other modified habitats, while only a few were found in natural habitats. The number of invasive species and the dominance of these species increased with decreasing distance from human activity (e.g. roads).

Six of the species identified are considered as globally significant weed species, with three on the list of the Top 100 World's Worst Invaders. *Chromolaena odorata* was more widespread than the other significant weed species, being found in fallow land and disturbed upper mixed deciduous forest. *Imperata cylindrical* is native to Asia and it has become a particularly invasive weed in areas where it historically did not occur, such as Lao PDR (ISSG 2015). The other two species are native to South and Central America. These three species are especially efficient at colonising areas that have been disturbed by fire, clearing, selective harvesting and other anthropogenic sources of disturbance.

**Table 5-10 Invasive and non-indigenous flora species identified in the Project Area**

Scientific Name	ISSG status	Description
<i>Chromolaena odorata</i>	Top 100 worst invaders	Fast-growing perennial shrub, native to South America and Central America. It has been introduced into the tropical regions of Asia, Africa and the Pacific, where it is an invasive weed. It forms dense stands that prevent the establishment of other plant species. It is an aggressive competitor and a nuisance weed in agricultural land and commercial plantations
<i>Curculigo orchioides</i>		Flowering plant that may also be used in traditional medicine
<i>Dracaena angustifolia</i>		Species often used as an ornamental house-plant, but can grow large when unrestrained
<i>Globba reflexa</i>		Rhizomatous, perennial herb, found in various shaded to open, wet to seasonally dry habitats
<i>Imperata cylindrical</i>	Top 100 worst invaders	Native to Asia, common in the humid tropics and has spread to the warmer temperate zones worldwide. Its extensive rhizome system, adaptation to poor soils, drought tolerance, genetic plasticity and fire adaptability make it a formidable invasive grass. Species displaces native plant and animal species and alters fire regimes.
<i>Mimosa pigra</i>	Top 100 worst invaders	It reproduces via buoyant seed pods that can be spread long distances in flood waters and has the potential to spread through natural grassland floodplain ecosystems and pastures, converting them into unproductive scrubland which are only able to sustain lower levels of biodiversity.
<i>Mimosa pudica</i>	Listed	Native to South America, but has become a pan-tropical weed. It was introduced to many countries as an ornamental plant and is still widely available for sale. <i>Mimosa pudica</i> has become a pest in forest plantations, cropland, orchards and pasture, but is used as a medicinal plant in many regions
<i>Oxytenanthera parvifolia</i>		Medium to large bamboo species that forms clumps
<i>Ricinus communis</i>	Listed	Perennial shrub that can assume tree-like status if it establishes in a suitable climate, especially riparian areas. The seed are toxic to variety of species including humans. Consuming only a few seeds can be fatal.

Scientific Name	ISSG status	Description
<i>Solanum torvum</i>	Listed	Often found in disturbed areas, it can form dense impenetrable stands. <i>Solanum torvum</i> is considered to be a serious threat to the productivity and sustainability of pasture and competes with native species.
<i>Thysanolaena maxima</i>		Perennial grass plant found in hilly regions, flowers can be used as cleaning tool or broom
<i>Uvaria macrophylla</i>		Large climbing shrub with large leaves and striking flowers, and is harvested from the wild and used locally for food, medicines and fibre.

Source: Earth Systems 2015

## 5.6 Aquatic Biodiversity

### 5.6.1 Aquatic Habitat

The Nam Ngiep River is a major tributary of the Mekong River, flowing in a southerly direction for approximately 160 km and joining the Mekong River near township of Paksan. The Nam Ngiep River and its tributaries provide habitat for resident aquatic biodiversity and migratory species adapted to the significant seasonal variability in flow.

Streams in the HSRA are a mix of perennial (spring-fed) and ephemeral streams and are predominantly lined by fallow, bamboo, or highly disturbed Upper Mixed Deciduous Forest near their confluence with the Nam Ngiep River. At higher elevations (in the PFA) the perennial streams are lined by contiguous canopies, including some areas of pristine forest or high value intact forest. The lower reaches of the perennial streams have a very high proportion of their channel bottoms covered in aquatic vegetation, providing habitat spawning, juvenile fish, and a host of aquatic biodiversity. During Local Knowledge Surveys (Earth Systems, June 2015), villagers indicated that the lower to middle reaches of Houay Soup Noi and Houay Khinguak Ngai are the most productive fisheries in the HSRA, though fish are caught in Houay Soup Ngai and Houay Khinguak Noi.

According to the results of Local Knowledge Surveys with villagers from Ban Hatsaykham, Ban Hat Gniun, and Bat Somseun, the HSRA streams host a number of migratory fish from approximately May / June when they make their way up the Nam Ngiep River to October when the last of the migratory fish reportedly leave the tributaries and migrate downstream to the Nam Ngiep River and the Mekong. The HSRA is a spawning ground for migratory and resident populations. Fish likely utilise the areas of aquatic vegetation and the flooded fields (adjacent streams) during the rainy season spawn, in addition to the variety of stream channel substrates (pending individual species' requirements). The HSRA streams are similar in morphology to a number of perennial and ephemeral tributaries to the Nam Ngiep River for the ~47 km stretch of river downstream of the HSRA.

One perennial wetland (Nong Pa) and two seasonal wetlands (Nong Da and Houay Na) exist within the HSRA. The Houay Na seasonal wetland results from overbank flooding of the stream, whereas the Nong Pa and Nong Da (also referred to as Nong Honda) are spring fed wetlands with no hydrologic connectivity to streams. The wetlands provide habitat for a host of aquatic biodiversity, including hydrophytic vegetation, frogs, crustaceans, aquatic insects, etc. Overbank flooding / annual creation of Houay Na presumably provides spawning habitat (in addition to paddy rice production area utilised by villagers of Ban Somseun).

### 5.6.2 Aquatic Biology

Several fish surveys have been undertaken within the Nam Ngiep River and in many of its tributaries during the last 20 years, upstream and downstream of the greater NN1HP area - refer to NNP1 EIA (ERM 2014). More than 100 species had previously been identified during direct and indirect surveys for the NN1HP.



For the streams of the HSRA, Earth Systems conducted Local Knowledge Surveys / focus group discussions in June 2015 with villagers from Ban Hatsaykham, Ban Hat Gniun, and Ban Somseun (men and women that fish the HSRA streams at least occasionally). Results are limited to those fish identified by villagers from a comprehensive set of photographs provided. Direct sampling of the streams was not conducted, therefore results are considered indicative only.

106 fish species were identified that may inhabit HSRA streams for at least some portion of the year. However, it is believed that a number of these species are likely found only in the Nam Ngiep River. Villagers indicated that many of the Nam Ngiep River fish populate or migrate into HSRA streams with the notable exception of “fish without scales”, presumably referring to the various catfish species that inhabit the Nam Ngiep River. The fish species listed in Appendix F is therefore considered an over-representation of fish populating or migrating to and from HSRA streams. Lao Consulting Group (LCG) identified 22 fish species during May 2014 sampling of the HSRA. It should be noted that fish migration into HSRA streams occurs in June / July – October, so this sampling event under-represents species richness in perennial HSRA streams.

The HSRA perennial streams are known to support a host of resident and migratory fish species as they are viable fisheries for villagers of Ban Hatsaykham, Ban Hat Gniun, and Ban Somseun, amongst others. Representative from each community indicated that the fisheries are in decline over the past 5 years, and indicated that increased fishing pressure (more people fishing) and new fishing techniques (electro-fishing and spear fishing) are the primary reasons for this decline (refer to Section 6.1.6 for community fish resource extraction from HSRA streams).

Of the 106 fish identified during LKS, five (5) are listed as threatened (refer to Table 5-11) according to the IUCN Red List of Threatened Species (Critically Endangered, Endangered, or Vulnerable). An additional eight (8) species were identified in the NN1HP EIA *Biodiversity Baseline Assessment Report* (ERM 2014) as potentially new to science and / or endemic to the Nam Ngiep River Basin (refer to Kottelat 2014, Appendix A to BBAP). However, due to their similarity in appearance to other non-threatened species, their occurrence cannot be confirmed without direct sampling by a qualified aquatic biologist. While it cannot be determined with certainty that each of these species occur in HSRA waters, their known habitat and ecology and geologic range is generally consistent with the Nam Ngiep River tributaries.

The five (5) IUCN listed species were not assessed for the NN1HP. The additional eight (8) species of conservation significance have been evaluated during NN1HP assessment, and the populations of these species are not considered at risk from NN1HP development (Kottelat, 2014). HSRA development is not expected to impact the populations of fish of conservation significance, as only one (1) perennial stream (Houay Soup) and its tributaries will be impacted by development. The streams passing through the HSRA are relatively small and do not constitute a significant portion of the habitat for any of the fish species identified during focus group discussions.

The Nam Ngiep River continues downstream for approximately 47 km from the Houay Soup, with many perennial and ephemeral tributaries of similar morphology to the Houay Soup. While increased fishing may occur throughout the HSRA (pending Conservation status of streams determined during PLUP), impacts may be locally significant but are not expected to have regional significance.

**Table 5-11 Fish species identified during Focus Group Discussions for HSRA streams and IUCN status**

Scientific Name	Lao Name	Comments	IUCN Red List Status
<i>Datnioides pulcher</i>	Pa seux	This species inhabits mainstreams and tributaries, preferring submerged woods and rocky crevices. Known throughout Indochina, with rare reported sightings in Lao PDR.	CR
<i>Datnioides undecimradiatus</i>	Pa seux	Found throughout the middle to lower Mekong basin in Thailand, Lao PDR, Cambodia and Vietnam. Found primarily in rivers and large tributaries.	VU
<i>Epalzeorhynchus munense</i>	Pa pan dang	Distributed throughout Thailand, Lao PDR and Cambodia. The species is found among boulders and rocks. During the flood season,	VU

Scientific Name	Lao Name	Comments	IUCN Red List Status
		it moves into inundated tributaries / forests / grasslands and returns to the rivers as water levels receded.	
<i>Hemimyzon confluens</i>	Pa korhin	This species is currently known only to the Nam Ngum basin, found under stones in fast flowing streams and rivers.	VU
<i>Oreoglanis delacouri</i>	Pa kor	Currently known only to the Nam Ngiep basin. Found in the Nam Ngiep and a number of tributaries during Project surveys of fast-water habitat.	NE
<i>Poropuntius aff. carinatus</i>	Pa kang	Currently known only to the Nam Ngiep basin. Found in the Nam Ngiep River and a number of tributaries during Project surveys of fast-water habitat.	NE
<i>Poropuntius sp. n</i>	Pa pok	Found in the Nam Ngiep and a number of tributaries during Project surveys of fast-water habitat.	NE
<i>Rhinogobius albimaculatus</i>	Pa kang	This species is currently known only to the Nam Ngum basin	VU
<i>Schistura aff. defectiva</i>	Pa muman	Currently known only to tributaries of the Nam Ngiep River	NE
<i>Schistura aff. ephelis</i>	Pamuman	Currently known only to the Nam Ngiep basin. Found throughout the Nam Ngiep River and tributaries during Project surveys of fast-water habitat.	NE
<i>Schistura sp. 'compact'</i>	Pamuman	Currently known only to the Nam Ngiep basin. Found in the Nam Ngiep and a number of tributaries during Project surveys of fast-water habitat.	NE
<i>Schistura sp. N. 'Nam Youak'</i>	Pa khanglai	This species is currently known only to tributaries of the Nam Ngiep River, generally in fast flowing water.	NE
<i>Schistura sp. N. 'slender'</i>	Pamuman	Currently known only to the Nam Ngiep basin. Found in the Nam Ngiep River and a number of tributaries during Project surveys of fast-water habitat.	NE

Source: Earth Systems 2015

\*Introduced or species beyond their normal range; IUCN Status Red List Categories: EN – Endangered, VU – Vulnerable, NT – Near Threatened, DD – Data Deficient, LC – Least Concern; NE – Not Evaluated

Additional aquatic species identified in vicinity of the Project included crustaceans, eel, snail, aquatic insects and reptiles. Of particular interest, is the globally Vulnerable Asiatic softshell turtle (*Amyda cartilaginea*) which was identified in the HSRA during previous surveys. The turtle's population is relatively secure and widespread in protected areas, but the consumption trade of tonnes per day is counteracting gains achieved in protected areas. The habitat of the HSRA streams is similar to that of many of the Nam Ngiep River tributaries. The species' population is not expected to be impacted by HSRA development.

## 6 SOCIO-ECONOMIC SETTING

The scope of the socio-economic baseline of this IEE includes:

- *Host Communities:* Ban Hat Gniun (including Ban Hatsaykham sub-village) and a number of households from Ban Somseun located downstream of the main dam and currently using the proposed HSRA area; and
- *Proposed Resettlement Communities:* Ban Hatsaykham settlement located in the regulation reservoir area and Ban Houaypamom, Ban Sopphuane, Ban Sopyouak and Ban Namyouak located in the main reservoir area (also referred to as 2LR or lower reservoir communities).

This section provides an overview of the socio-economic context of host communities and resettlement communities drawing on information presented in the EIA (Kansai et al. 2012a; ERM 2014), SIA (Kansai et al 2012b; NNP1 2014a) and REDP (NNP1 2014b) and additional surveying completed by Earth Systems in May and July 2015 (Earth Systems 2015a; Earth Systems 2015b). An emphasis is placed on host communities who are expected to be primarily impacted by the establishment of the HSRA.

Key distinctions between the information provided in previous assessments and this IEE include:

- Ban Somseun has been included in this assessment and is referred to by the authors as a 'host community';
- Ban Thaheua, has been excluded from this assessment as no households from this village have been identified as using land within the HSRA; and
- Ban Hatsaykham has been identified as both a host community and a resettlement community. Due to its location and use of the proposed HSRA, socio-economic information for Hatsaykham is outlined in the section on 'host communities'.

### 6.1 Host Communities

#### 6.1.1 Location

The location and village boundaries of Ban Hat Gniun (including Ban Hatsaykham) and Ban Somseun in relation to the proposed HSRA are outlined in Figure 6-1.

- **Ban Hat Gniun** is located approximately 25 km from the district centre of Bolikhan. It comprises of two settlements: a) Hat Gniun settlement located on the left bank of the Nam Ngiep River about 7 km downstream of the main Project dam and about 3 km downstream of the re-regulation dam; and b) Hatsaykham settlement, also located on the left bank about 2.5 km downstream from the main dam site and before the regulation dam. The village land boundary extends across the Nam Ngiep River (refer to Figure 6-1) into the proposed HSRA.
- **Ban Somseun** is located about 11 km from the district centre of Bolikhan. The village consists of one (1) main settlement, located on the left bank of the Nam Ngiep about 31 km downstream of the main dam and 25 km downstream of the re-regulating dam. The village land boundary extends north from the settlement on both sides of the Nam Ngiep River into the proposed HSRA and approximately 30 households from Somseun have land within the HSRA.

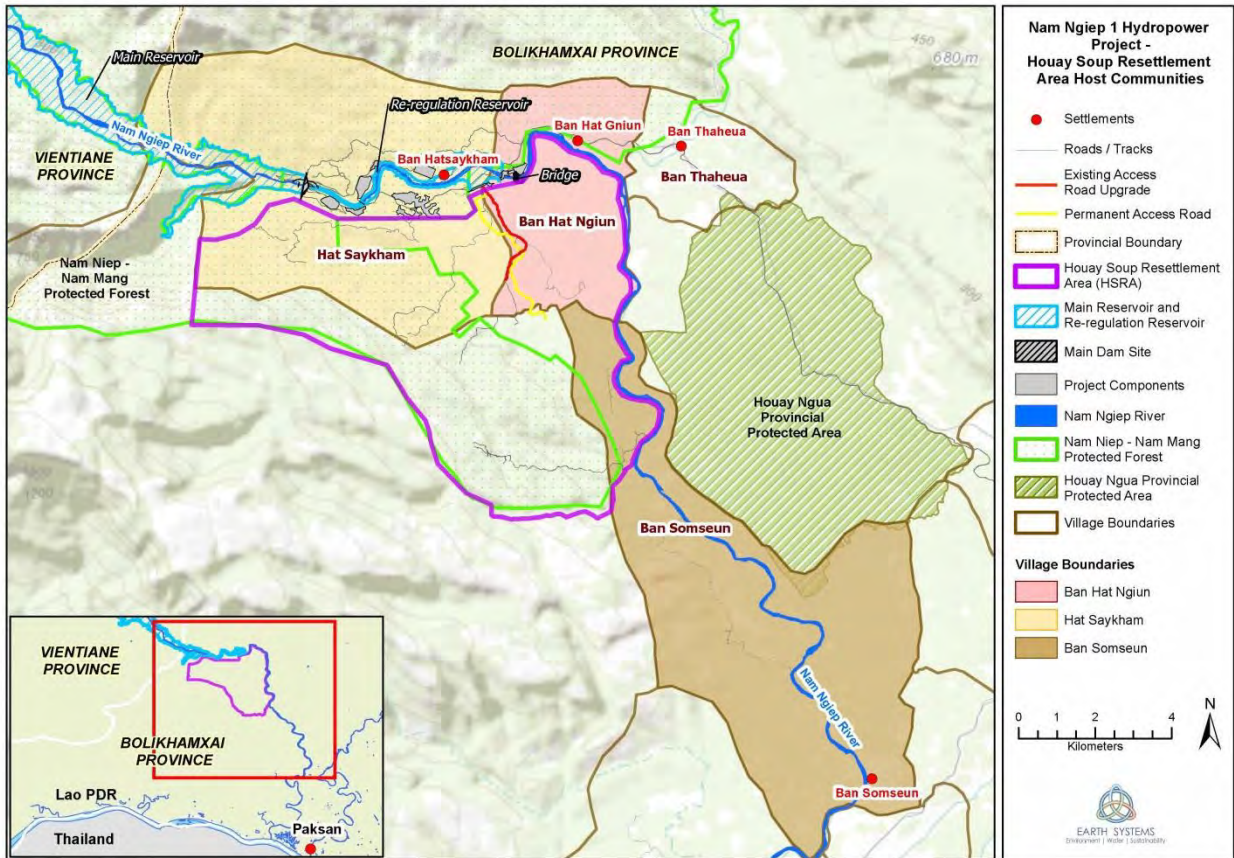


Figure 6-1 Location and Village Boundaries of Host Communities

Source: Earth Systems 2015

### 6.1.2 Demography and Population Changes

According to recent surveying (Earth Systems 2015b), the host communities have a total population of 1,927 living in 345 households with an average of 5.6 people per household. The gender ratio of men to women in these communities is 1.04. The official population in Ban Hat Ngiun and Ban Hatsaykham has increased by 15% since 2011 when the surveying for the EIA (Kansai et al 2012a) was conducted (refer to Table 6-1).

Table 6-1 Host Community Demographics

Village / Community	No. HHs	No. Families	No. People			HH Size	Gender Ratio (male to female)	Population change (%) since 2011
			Female	Male	Total			
Ban Hatsaykham (sub-village)	39	45	147	140	287	7.36	0.95	+24%
Ban Hat Ngiun	74	86	177	224	401	5.42	1.27	+7%
Ban Somseun	232	225	620	619	1239	5.34	1.00	-
<b>Total</b>	<b>345</b>	<b>356</b>	<b>944</b>	<b>983</b>	<b>1927</b>	<b>5.59</b>	<b>1.04</b>	

Source: Earth Systems 2015b; Kansai et al. 2012a



### 6.1.3 Ethnicity, Religion and History

Ban Hat Gniun consists of two distinct settlements. The Ban Gniun settlement is predominately comprised of people from the Lao-Tai language family (Tai Phouan ethnicity). These people mainly practice Theravada Buddhism. The majority of people living in Ban Hatsaykham are from the Mon-Khmer language family (Hmong-Lu Mien ethnicity) and practice animism. People in Ban Hatsaykham are reportedly related to upstream Hmong including the 'resettlement communities' in the lower reservoir area and moved to the current settlement in the early 1990s. The two settlements were administratively consolidated into one (1) village in the early 2000s.

The majority of people living in the Ban Somseun are from the Lao-Tai family (Tai Phouan ethnicity) and practice Theravada Buddhism. In the mid-1970s Ban Somseun and two former villages located in the proposed HSRA (Ban Hat Soup and Ban Thamdin) were merged to form the present day Ban Somseun.

### 6.1.4 Land Allocation and Ownership

All land in Lao PDR is ultimately owned by the State. The State, however, recognises both private and collective long term land tenure. The Government has a range of instruments with which it can allocate land rights and ownership of land and forests such as *Land Titles*, *Temporary Land Use Certificates*, *Land Lease Contracts*, *Village Land Map Sheet* and *Village Land and Forest Management Agreements*.

#### ***Village Land and Forest Allocation***

Since 1996 the GOL has implemented the Land and Forest Allocation Program (LFAP) with the aim of devolving most decisions about land use and land allocation to the village level. Government authorities liaise with villagers to decide on the allocation of land use for village land and they jointly develop a set of rules for the use of the land – outlined in Village Land and Forest Management Agreements.

Village land allocation exercises were reportedly last conducted in the Project area by the Land and Forest Allocation Program in the late 1990s and early 2000s. Original maps for Ban Hat Gniun and Ban Somseun are provided in Figure 6-2 and Figure 6-3. The information on village land allocation is summarised in Table 6-2, indicating total land areas for Ban Hat Gniun (16,848 ha) and Ban Somseun (13,000 ha). The maps also outline village land allocation and use rights within the HSRA. For Ban Hat Gniun (and Hatsaykham) (Figure 6-2) this includes protected forest, conservation forest, rehabilitation forest and agricultural land. For Ban Somseun map (Figure 6-3) this includes protected forest, conservation forest and rehabilitation forest.

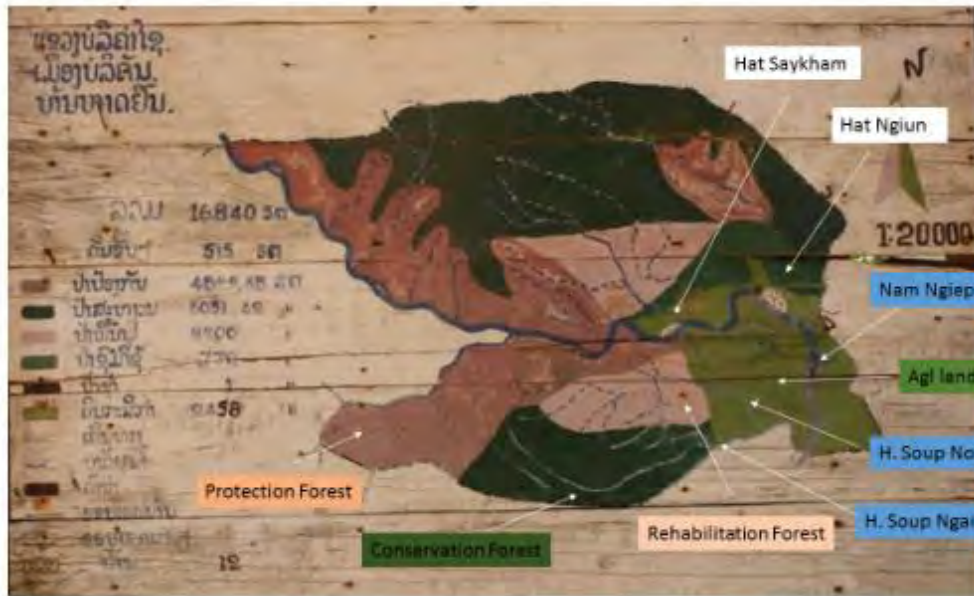


Figure 6-2 Ban Hat Gniun VLFA Map

Source: Earth Systems 2015

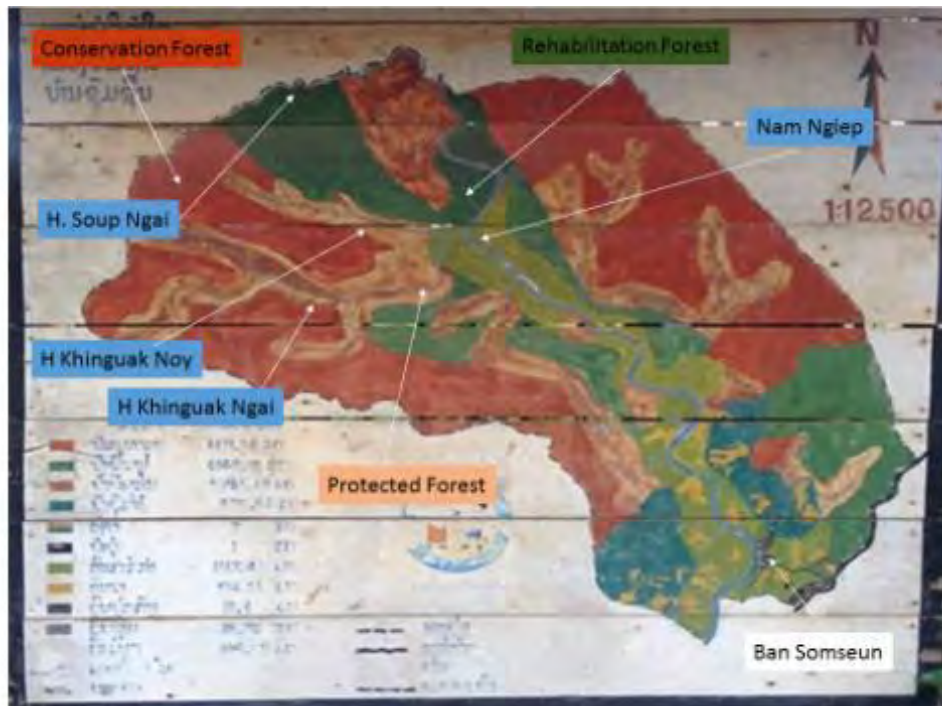


Figure 6-3 Ban Somseun VLFA Map

Source: Earth Systems 2015

Table 6-2 Village land allocation

Land Allocation Category	Ban Hat Gniun / Hatsaykham (Ha)	Ban Somseun (Ha)
Residential	12	34.3
Lowland agriculture	1167*	215.6
Upland agriculture		2,458

Land Allocation Category	Ban Hat Gniun / Hatsaykham (Ha)	Ban Somseun (Ha)
Production forest	770	873.9
Regeneration forest	2,200	2,148.1
Conservation forest	6,051.4	6,172.5
Protection forest	4,829.6	2,781.4
Cemetery / spirit forest	4	8
Concession land	-	-
Other	103	-
<b>TOTAL</b>	<b>16,840</b>	<b>13,000</b>

Source: VLFA maps (MAF 1999-2000)

GIS data on village land boundaries sourced from the Division of Land Management (PONRE – Bolikhamsay 2015) (refer to Table 6-3) provide a distinction between Ban Hat Gniun and Ban Hatsaykham and indicate a substantial reduction in total village land areas. It is understood that the reduction of village land is due to the establishment of the PFA in 2012 – essentially annexing land from these communities.

**Table 6-3 Village land allocation**

Village / Community	Village Land Area (ha)		
	Outside HSRA	Inside HSRA	Total
Ban Hatsaykham	3121.82	1852.08	4973.89
Ban Hat Gniun	817.72	1196.67	2014.40
Ban Somseun	4759.25	513.25	5272.50
<b>TOTAL</b>	<b>8698.78</b>	<b>3562.00</b>	<b>12260.79</b>

Source: GIS data (PONRE 2015)

### **Land Allocation and Ownership in the HSRA**

A number of surveying exercises have been completed in the proposed HSRA to identify existing land use. Each new survey has revealed more claimed use of the area than the last.

The REDP (NNP1 2014b) presents the results of land use surveying conducted in October 2012 – concluding that villagers from Ban Hat Gniun and Ban Hatsaykham currently use land within the HSRA.

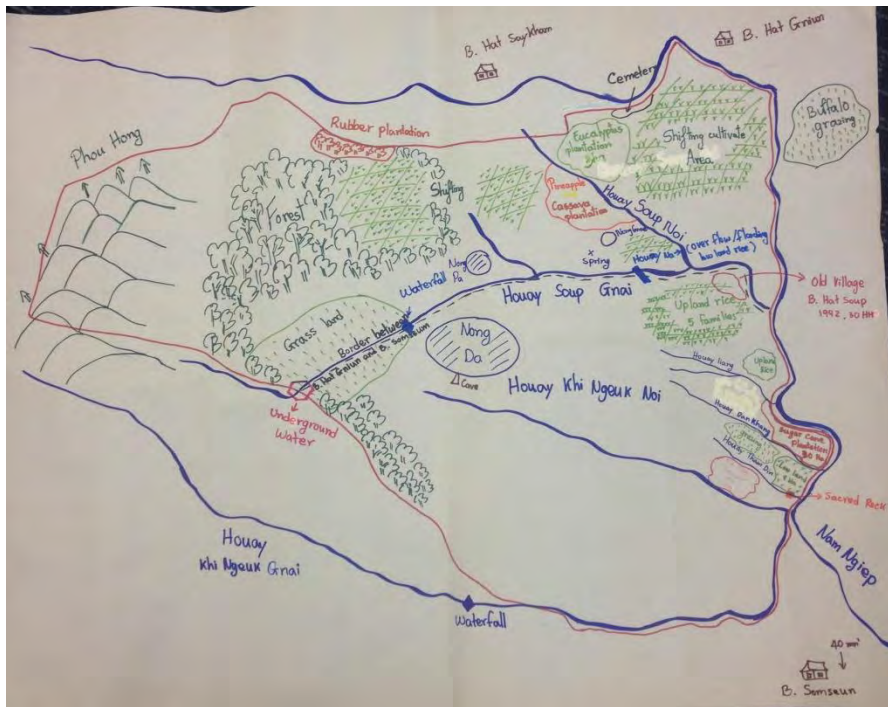
Participatory village mapping of the proposed HSRA was conducted by Earth Systems (July 2015) (refer to Figure 6-4). This exercise confirmed that three (3) host communities – Ban Hat Gniun, Ban Hatsaykham and Ban Somseun currently conduct agricultural activities in the proposed HSRA – consistent with VLFA maps and GIS data presented above.

Most villagers (80-90% of households) from Ban Hatsaykham reportedly utilise the north east and central area of the HSRA (above the Houay Soup Ngai) for upland / swidden agriculture. Each household prepares between three (3) to five (5) hectares each year. A small number of households have established commercial tree plantations<sup>2</sup>.

Similarly, all households from Ban Hat Gniun reportedly utilise the central and North West area of the HSRA (above the Houay Soup Ngai) for upland / swidden agriculture. Approximately five (5) households have established rain-fed lowland rice paddy fields and one (1) household has established a eucalypt plantation.

<sup>2</sup> The communities of Ban Hatsaykham, Ban Hat Gniun, and Ban Somseun will be consulted further during finalisation of the Resettlement Action Plan.

Approximately 45 households from Ban Somseun (the decedents of the previous occupants of Ban Thamdin and Ban Hatsoup) reportedly utilise a strip of land between the Houay Soup Ngai and Houay Khinguak and within 1-2 km of the Nam Ngiep river for upland / swidden agriculture. Five (5) of these households have also established rain-fed rice paddy fields.



**Figure 6-4 Consolidated Participatory Map, Proposed HSRA (Ban Hatsaykham, Ban Hat Gniun and Ban Somseun)**

Source: Earth Systems 2015

The findings of the participatory mapping exercise are supported by the preliminary results of detailed land and asset surveying of the area conducted by NNP1’s Social Management Office in late 2014 (refer to Figure 6-5 below). In addition to privately and commonly held land used by villagers in the three (3) host communities, a number of plots have been identified as concession areas owned by the GOL.



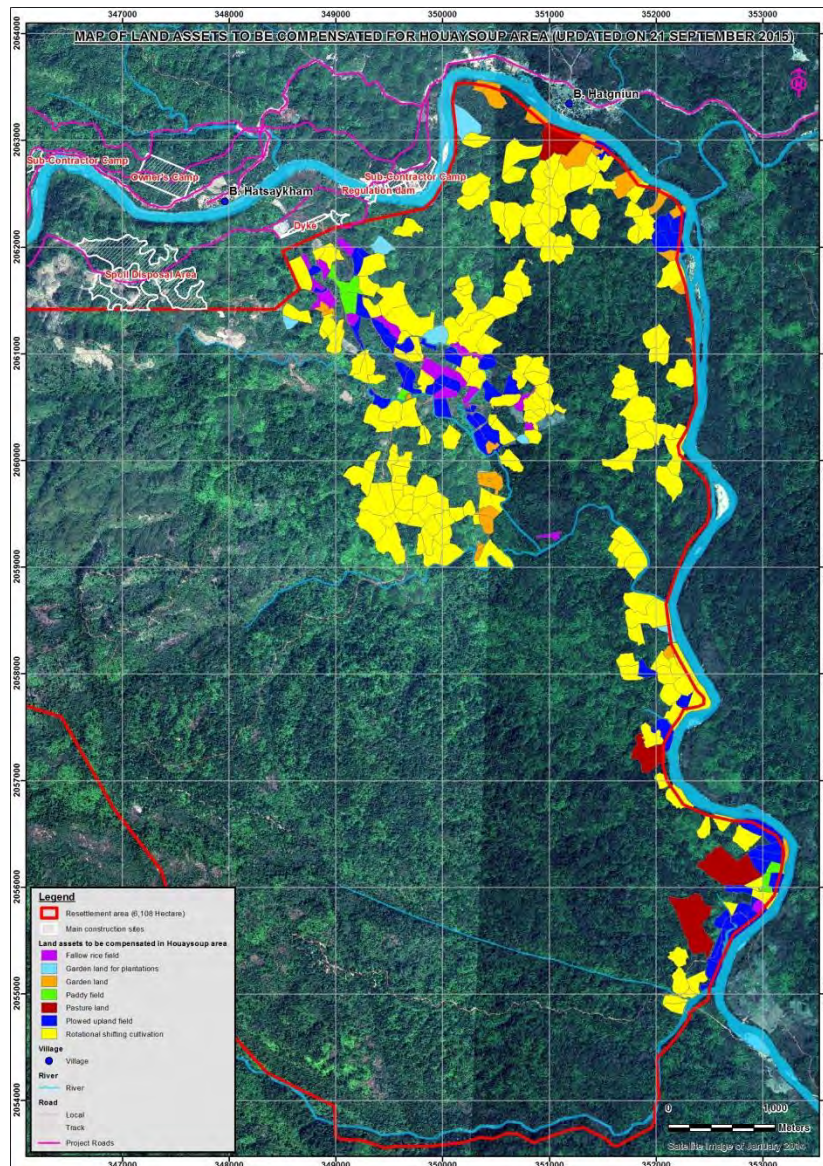


Figure 6-5 Individual land use within the HSRA from 2012 survey

Source: NNP1 2015

**Proof of ownership**

Individual ownership of permanent lowland and upland fields is most commonly verified by tax receipts and the village land log.

Individual ownership of upland agricultural areas is currently based on an informal system whereby each household recognises the general areas of each farm, and temporary borrowing and sharing of areas between households is common. Permanent land ownership is recorded in the village land log and verified with tax receipts. Some swidden cultivation plots are reported to the village chief annually for tax purposes, however the majority is not reported and therefore little documented proof of ownership of this land exists.

In recent years NNP1 SMO has defined individual land and allocation per household size for compensation purposes. District officials have also conducted ‘productive land’ assessments and issued letters to individuals outlining land under production and tax obligations.

## 6.1.5 Wealth and Poverty

### *Perceptions of Wealth and Poverty*

During village level surveying (Earth Systems 2015b) respondents were asked to group village households into four (4) categories: very well-off, sufficiently well-off, poor with land and poor with no land. The results of this exercise, provided in Table 6-4, indicate that Somseun is perceived as a wealthy village, while Ban Hat Gniun and Hatsaykham are perceived as fairly poor communities.

**Table 6-4 Perceptions of Wealth and Poverty in Host Communities**

	Ban Hat Gniun	Ban Hatsaykham	Ban Somseun
Very well off	-	26%	30%
Sufficiently well off	60%	51%	60%
Poor with some land	37%	23%	10%
Poor with no land	3%	-	0%

Source: Earth Systems 2015b

### *Income Sources and Expenditure*

According to previous assessments (SIA, NNP1 2014a) the main sources of cash income for villagers in Khum Hatsaykham comes from the sale of livestock and fish. Income from hunting and trade & service are secondary income sources. For Ban Hat Gniun the sale of livestock and agricultural products are reported as the primary sources of income. Secondary cash income sources are derived from the sale of surplus fish, NTFPs and handicrafts. Primary income for the residents in Ban Somseun derives from sales of livestock and agriculture products (i.e. sugarcane and cassava) while their secondary incomes are salaries for working with local Governments and local factories.

A recent income survey conducted by SMO in 2014 shows that people in Ban Hat Gniun and Ban Hatsaykham generate an average of 1.1 million kip per household per month. Earth Systems conducted village survey in June 2015 indicated that households in Ban Somseun earn an average income of 2.9 million kip per month.

Information on household expenditure is provided in the SIA (NNP1 2014a). The main expenditures for villagers in Hat Gniun and Hatsaykham are for clothing and contributions to social events such as marriages, funerals and celebrations for new-borns. Other important expenditures are on agricultural tools and supplies and costs for education and health. Villagers in Ban Somseun spend the majority of their money on food, social events (i.e. donations for temple and weddings) and utilities.

### *Vulnerability*

Information on vulnerable households in the three (3) host communities is outlined in Table 6-5. A total of 39 disadvantaged households were identified. Elderly and the disabled account for most of the vulnerable households in Ban Hat Gniun while in Ban Hatsaykham and Ban Somseun, widows are the chief reason for vulnerability, making up 57% and 74% of the vulnerable households respectively.

**Table 6-5 Vulnerable Households in the Host Communities**

Vulnerability Category	Ban Hat Gniun (HHs) <sup>^</sup>	Ban Hatsaykham (HHs) <sup>^</sup>	Ban Somseun (HHs) <sup>**</sup>
Female headed (Widow)	1	4	20
Elderly / Infirmed with no support	2	1	2
Disabled	2	0	1

Vulnerability Category	Ban Hat Gniun (HHs) <sup>^</sup>	Ban Hatsaykham (HHs) <sup>^</sup>	Ban Somseun (HHs) <sup>**</sup>
Absolutely poor	0	3	0
<b>Total</b>	<b>5</b>	<b>7</b>	<b>27</b>

Source: <sup>^</sup>NNP1 2014a (Vulnerability Report Access Road); <sup>\*</sup>Earth Systems 2014; <sup>\*\*</sup>Earth Systems 2015b

### ***Rice Security***

Rice security through self-production is a key indicator of household vulnerability in rural areas of Lao PDR. The SIA (NNP1, 2014a) reports that all households in Hat Gniun have enough rice to eat for 12 months round. In Ban Hatsaykham, 64 per cent of the villagers grow enough rice themselves to consume for more than 10 months a year. The remaining 36 per cent suffer from rice shortages for 1 to 8 months a year and mainly rely on food purchases or exchange in kin to address this deficit. All households in Ban Somseun have sufficient rice year round.

### **6.1.6 Local Economies and Livelihoods**

Local economies and livelihoods of the three (3) host communities are fairly typical of rural communities located in the transitional zone between mountainous and lowland areas in Lao PDR. The majority of villagers are still dependent on rice cultivation, animal husbandry, fishing in nearby streams, collection of non-timber forest products (NTFPs) and harvesting of timber forest products (TFPs). While the three (3) host communities share these commonalities, a number of clear differences are also present – influenced by the village size, settlement location, ethnicity of villagers and the history and connection to the local area. These aspects are discussed in the sections below.

#### ***Lowland rice cultivation***

Lowland rice cultivation is fairly limited in Ban Hat Gniun and Hatsaykham and more widespread in Ban Somseun.

Villagers in Ban Hatsaykham prefer the upland rice cultivation, a traditional staple livelihood for Hmong communities. They have reportedly established only a limited lowland rice cultivation area (10 ha planted every year and 7 ha planted biennially).

Villagers in Ban Hat Gniun reported having 20 ha of rain-fed lowland rice paddy fields on the right bank of the Nam Ngiep River and 17 ha within the HSRA. According to NNP1's SMO, these fields were established with the support of the Luxemburg government in 2004 and abandoned a few years later due to poor harvests. However villagers reported that these fields are still used and produce average annual yields of 4.6 tonnes / ha.

Villagers in Ban Somseun have developed approximately 96 ha of lowland rice paddy fields across the village lands. These fields are reportedly owned and used by approximately 40% of households. Approximately 2.9 ha of paddy fields held by five (5) households have been identified in the HSRA near the old Ban Tam Din settlement area (NNP1 SMO 2014) – considerably less than the 8 ha reported during village surveying (Earth Systems 2015b). Annual yield of these fields reportedly ranges from 2.8 to 5.4 tonnes / ha.

Common issues with lowland rice cultivation in the HSRA include drought (water availability), floods (destroying crops) and pests such as rats, beetle and termites that eat the roots of the rice after planting and as the rice grows.





**Plate 6-1 Lowland rice cultivation in Ban Hong in the HSRA**



**Plate 6-2 upland rice cultivation in the HSRA**

### ***Upland agriculture***

Upland agriculture, both permanent and shifting, is practiced by the majority of households in the three (3) host communities. In addition to upland rice, other crops such as maize, corn, sugar cane, cassava, pineapple and banana are grown. Mak keng (a small fruit) also grows naturally in upland fields.

Upland agriculture fields in Ban Hatsaykham and Hat Gniun are located on the right and left banks of the Nam Ngiep River - a large proportion within the proposed HSRA. According to ES village surveying (July 2015), 100% of households from both communities claim to practice upland agriculture within the HSRA – tending to between three (3) to (5) ha each per year. Villagers’ reported yields of upland rice in these areas varied considerably – ranging from 1 ton/ha up to 4 ton/ha. A number of factors reportedly affect rice yields including:

- Fallow cycles: Cycles range from 2 - 8 years with longer cycles producing greater yields. There is reportedly ample land for longer cycles, however limited access, transport and distance from settlements is a limiting factor;
- Intercropping: Villagers in Hat Gniun practice inter-cropping (rice with chili, cassava, eggplant and corn) while villagers in Hatsaykham reportedly separate rice from other crops; and
- Agricultural issues: Drought and pests (i.e. rats, beetles and termites) can cause significant damage to upland crops.

Upland agriculture fields in Ban Somseun are located on the right and left banks of the Nam Ngiep River. Original VLFA maps indicate this area (2,458 ha) extending from Houay Khinguak Noy down past the village settlement area, however recent village surveying has also confirmed upland agriculture cultivation (56 ha) on the old Tam Din village lands within the HSRA (refer to Figure 6-4). A total of 27 households reportedly practice both shifting (average of 2 ha per year per family) and permanent upland agriculture (average of 3 ha per year per family) in this area. Permanent agriculture fields are generally located in the most productive areas (i.e. good soils and near watercourses). Reported annual yields of upland rice in these areas range between 2.8 to 4.0 tonnes / ha. Shifting agriculture fields are generally located further away from the Nam Ngiep River. Annual yields reportedly range between 1.4 and 2.8 tonnes / ha. Drought and pest issues outlined above, can significantly affect yields.

### ***Gardens***

A number of households in Ban Hat Gniun and Somseun have established vegetable gardens around the homestead and along riverbanks particularly during dry season. Vegetables grown in these gardens include spring onion, eggplants, mint, chili, lemon, beans, legumes, and vegetables.



Villagers surround the vegetable plots with woven bamboo fences to demarcate use boundaries and to keep out animals. A number of these gardens have been identified in the proposed HSRA, located along the Nam Ngiep River and near the confluence of the Houay Soup Noi and Houay Soup Ngai (refer to Figure 6-4).

### **Tree Plantations**

The main household tree plantations in the three (3) host communities are fruit plantations, including mango, longan, coconut, and tamarind. The fruit trees are planted around village settlements and in upland agricultural areas and are mostly for domestic consumption. Over recent years a small number of households (~3) have planted commercial trees, such as eucalyptus and rubber. These plantations are in their initial stages of development. A small number of these commercial tree plantations have been identified in the HSRA area including 3 ha of eucalyptus plantation in Ban Hat Gniun, 1 ha of rubber plantation in Ban Somseun, and 5 ha of rubber owned by 4 households in Ban Hatsaykham.

### **Livestock**

Households from all three (3) host communities raise a variety of animals for domestic consumption and for sale. Chickens, ducks and pigs roam around the houses. Some larger pigs are kept in pens. Other large animals such as water buffaloes, cows and goats are usually left to roam or are herded during the day before being brought back to stay near the house at night. Livestock holdings for host communities are presented in Table 6-6.

**Table 6-6 Livestock Holdings in Host Communities**

Village / Community	Households (2015)	2013*					2015^				
		Buffalo	Cow	Goat	Pig	Poultry	Buffalo	Cow	Goat	Pig	Poultry
Ban Hat Gniun	39	184	289	6	84	1,200	250	200	0	50	1,500
Ban Hatsaykham	74	166	155	20	248	755	75	150	14	120	800
Ban Somseun	232	100	350	100	350	4,500	150	400	150	400	5,000

Source: \*NNP1 2014b; ^Earth Systems 2015b

The HSRA is commonly used by all three (3) host communities for cattle rearing (ES July 2015):

- Approximately 25 households from Hatsaykham raise between 4-5 head of cattle in the HSRA. Key grazing areas include grasslands in the upper Houay Soup Ngai catchment (near Nong Da) and lower Houay Soup Noi catchment. Streams throughout these areas are used as a water source;
- Typically, the residents of Ban Hat Gniun do not raise cattle in the HSRA during the rainy season as this area is used for cultivation activities. Nonetheless, there are about 7 households that graze their animals in the HSRA during the dry season; and
- Approximately nine (9) households from Ban Somseun raise an average of 5-6 head of cattle in the HSRA. Cattle reportedly graze in young fallow areas and source drinking water from nearby waterways.



**Plate 6-3 Pigs at Ban Hatsaykham**



**Plate 6-4 Cattle grazing in the HSRA**

**Forest Resource Use**

Most villagers in the Ban Hat Gniun, Ban Hatsaykham and (to a lesser extent) Ban Somseun still rely on forest resources including Non-Timber Forest Products (NTFPs), Timber Forest Products (TFP) and wildlife for subsistence and as a source of livelihood. These resources are mainly sourced from allocated village forests (production, conservation and regeneration). The HSRA was identified as a key source of forest resources in all three (3) communities. The HSRA is characterised by a mosaic of upland agriculture / fallow forest and upper mixed deciduous areas. While resources in fallow areas are utilised (mainly for NTFPs) other more intact forest areas (i.e. within the PFA) are the main sources of TFPs and wildlife.

Earth Systems surveying for this study indicates that villagers collect and use 12 timber forest product (TFP) plant species and 21 non-timber forest product (NTFP) plant species (Appendix D). A few species were used for both timber and non-timber products, totalling 30 species used by villagers for subsistence and trade. Nearly all NTFPs are reportedly collected from fallow forest/land. Since most of the larger trees usually occur within upper mixed deciduous (UMD) forest, the most common habitat for collection of TFPs from these species was in UMD. According to the LKS, the villagers reported that there are 28 mammal species, 33 bird species and 33 reptile species in fallow and UMD forest areas of the HSRA. Most of these wild animals were reported as being seen only. However, the ES survey team witnessed hunting activities and wildlife captured including wild pigs (*Sus scrofa*), black Crested Bulbul (*Pycnonotus melanocyterus*) and squirrels (*Callociurus* sp.) that were captured by villagers from Ban Somseun and Ban Hat Gniun.

Men and women typically shared the collection duties of TFPs and NTFPs. However, it appears that timber from some of the larger trees (e.g. Dipterocarpaceae) were only collected by men from Hat Gniun and Somseun. Wildlife hunting was mostly reported as the men’s activity in the three host communities as they are more skilful at making and using artisan hunting tools such as traps and homemade guns.

Use of plants included food, medicine and sale for income. Timber products were normally used within the village, with the exception of some Dipterocarps from Somseun that were also sold. Similarly most NTFPs and wild animals were consumed within the village for food, as well as being used within traditional medicine. Wildlife meat is a supplementary source of animal protein for the villagers.



**Plate 6-5 Hunting Equipment, HSRA**



**Plate 6-6 Squirrels, HSRA**



**Plate 6-7 Edible mushroom Gathering, HSRA**



**Plate 6-8 Small-scale logging, HSRA**

**Fishing and Aquatic Resource Use**

Fish and other aquatic resources are an important source of protein for people in rural Lao PDR and villagers of Ban Hat Gniun, Ban Hatsaykham and Ban Somseun are no exception. During focus group discussions / Local Knowledge surveys, villagers estimated that 100%, 80%, and 95% (for Ban Hat Gniun, Ban Hatsaykham and Ban Somseun, respectively) of households include a family member that fishes regularly. Most of the resources are consumed locally (85 – 90%, including 10% that is fermented or dried for later consumption). Fish are considered an essential element of nutrition for local people, who even in low fishing season consume fish several days per week (NNP1 2014a). Approximately 10 – 15% of fish caught are sold at markets, to restaurants, or to individuals in Ban Houay Khoun, Ban Somseun, Ban Hat Gniun, and Paksan. The money earned from fish sales depends on the size of the fish and species (refer to Table 6-7).

**Table 6-7 Prices earned for fish sales**

	> 3 kg	<3 kg
Catfish species	50,000 – 80,000 Kip / kg	30,000 – 40,000 Kip / kg
All other species	30,000 – 50,000 Kip / kg	20,000 – 30,000 Kip / kg

Source: Earth Systems 2015b

Households that fish generally have at least one member of the household fishing for 6-7 days per week during the dry and rainy seasons. Representatives from all three communities indicated that of the regional



fisheries, the Nam Ngiep River is the best (particularly during the dry season), both for the number of fish caught and the average size of the fish. All three communities are increasingly fishing tributaries of the river (most often HSRA streams) for 10 – 30% of their fishing. The primary reason for this is the increased number of people that fish the Nam Ngiep consistently, including a significant rise in the number of people that fish commercially (whereas fishing was traditionally for consumption only).

The HSRA is fished somewhat regularly by villagers from Ban Hatsaykham, Ban Hat Gniun, Ban Songkhone, Ban Nampa, and Ban Houay Khoun, primarily during the rainy season. HSRA streams are more commonly fished during the rainy season to coincide with the fish migration pattern (fish move up the Nam Ngiep in ~June and back out in ~October) and because their boats can reach further upstream with higher flows. Each community indicated that the best fisheries (in the HSRA) are Houay Soup Noy / Ngai near their confluence (lower to middle reaches) and the lower reach of Houay Khinguak Ngai, though each of the perennial streams are fished at least occasionally. In addition, aquatic biota are collected from seasonal and perennial wetlands in the HSRA (Nong Pa, Nong Da (also referred to as Honda)), with frogs and crustaceans comprising the majority of harvest.

Villagers from Hatsaykham, Hat Gniun, and Somseun reported catching an average of 20-30 kg, 5-6 kg, and 2 - 3 kg per day in general, and approximately half this much in HSRA streams (villagers of Ban Hatsaykham were asked numerous times to confirm this high number and insisted that this is accurate). During LKS, representatives from each community reported that the fisheries are in decline for the Nam Ngiep River and its tributaries. Reportedly, 40 – 80% less fish are caught on the Nam Ngiep when compared to five (5) years ago and 50 – 70% less fish (weight) are caught in HSRA streams when compared to five (5) years ago. The primary reasons cited for declining fisheries included:

- Number of people fishing;
- Turbidity in the Nam Ngiep River;
- Increase in commercial fishing / transition from consumption to consumption and commercial; and
- Change in fishing methods (each community indicated knowledge of people using electrofishing and spearfishing).

Men and women from each community fish, with approximately 70 – 80% of fishing dominated by men. Villagers indicated that men practice traditional fishing for large fish in the rivers and streams, while women usually use scoop nets and other techniques to collect smaller fish as well as frogs, crab, shrimp, eel, snails, and aquatic insects.

The most common fishing techniques include:

- Mong (gill net);
- Hae (cast net);
- Hook and lines;
- Handle scoop nets; and
- Sai (horizontal cylinder traps).

Each community also occasionally use Toun (upright basket traps), life nets, bamboo trap, scoop baskets, and filtering traps. As above, representatives from each community reported knowing of others who are using electrofishing gear and spearfishing.



	
<p><b>Plate 6-9 Fishing, Nam Ngiep River</b></p>	<p><b>Plate 6-10 Frog, HSRA</b></p>

**Aquaculture**

NNP1 has supported the development of household aquaculture ponds in Ban Hat Gniun and Ban Hatsaykham.

In Ban Somseun thirty (30) families share an aquaculture pond and fish resources. A small stream enters the pond, capturing native fish. The villagers also capture smaller live fish from the Nam Ngiep River and transplant them to the pond for raising to an adequate size for consumption.

**Non-Agriculture livelihood activities**

A few households in Ban Hat Gniun run small-scale trading including groceries and restaurants. This activity is their primary household income. In addition, few people are working for the Government in Bolikhan district. A number of villagers are also casually employed by NNP1’s sub-contractors such as cleaning and construction works. About one-third of total households in Ban Somseun casually work for nearby sawmills. The village authorities also reported that there are 60 - 70 people who work for the government as teachers, soldiers and Forestry Department staff. A few villagers provide local transport services from the village to Paksan and school transport services.

It was reported that about 20% of total households in Ban Hatsaykham make handicraft products both for sale and domestic use. The villagers have been employed casually by sub-contractors to work in the NNP1’s related construction and UXO clearance activities. One villager was recently recruited as full-time staff of NNP1.

**6.1.7 Water Resource Use**

The three (3) host communities are situated within the Nam Ngiep River Basin. Each settlement is located on the left bank of the Nam Ngiep River. The river and left bank tributaries supply domestic water to these settlements and agriculture water to left bank agriculture fields.

Information on key water resources on the right bank of the Nam Ngiep River and in the proposed HSRA is provided in Section 4.5. The most significant streams in the HSRA include the Houay Soup Noi, Houay Soup Ngai, Houay Khinguak Noi and Houay Khinguak Ngai (from north to south). All these streams are perennial – the former two (2) spring-fed. A number of smaller ephemeral streams located in the East of the proposed HSRA drain directly into the Nam Ngiep river and include (from north to south), the Houay Liang, Houay Dhakong and Houay Thamdin. A number of grassy wetlands including the Nong Hong Da and Nong Pa were identified in the upper areas of the Houay Soup Noi and Ngai catchments.

These water resources are used by villagers from the three (3) host communities primarily for fishing (refer to Section 7.3) and to a lesser extent agriculture (i.e. livestock drinking water and rain-fed paddy fields). Streams in the area are also used by villagers as a source of drinking water and bathing whilst they are working in the area. Water is reportedly not boiled before drinking. According to villagers in Ban Hat Gniun and Ban Hatsaykham, grassy wetlands Nong Hong Da and Nong Pa are used for small-scale aquaculture (i.e. frog breeding) and as a source of drinking water for livestock. In addition to the water use described above, Ban Hatsaykham utilises three (3) boreholes with hand pumps installed by NNP1. Ban Hat Gniun has a gravity fed system (GFS) and they have a larger water supply system under construction. Ban Somseun has a town water supply system fitted with water meters which is currently struggling to meet demand. NNP1 is working with Ban Somseun to upgrade this system. All communities capture and store rainwater for use during the rainy season.

### **6.1.8 Local Infrastructure and Services**

This section provides a summary of local infrastructure and services in the three (3) host communities. More detailed information is provided in the SIA (NNP1 2014a). The majority of village infrastructure is located in and around the settlement areas of the three (3) host communities and not within the proposed HSRA – with the exception of agricultural and logging access tracks (see below).

#### ***Proximity and access to district / provincial services***

All three (3) host communities have relatively good access to district and provincial services (i.e. health, education and economic etc.). Ban Hatsaykham and Ban Hat Gniun are located approximately 21 km from the district capital of Bolikhan and 36 km from the provincial capital of Paksan. Access to these communities was improved substantially in 2014 after the completion of the main NN1HP access road. Ban Somseun is located within 3km of the provincial capital of Paksan via a sealed road.

#### ***Electricity and Energy***

All three (3) host communities have access to the national electricity grid. Most households in Ban Somseun utilise this electricity for lighting, operation of small appliances and cooking. Ban Hat Gniun and Hatsaykham were only recently connected in 2014 (with the support from NNP1). Most households still use firewood as their primary source of cooking fuel although some households have started to use electricity. A small number of households from these communities used small river-powered generators prior to the connection to the grid (NNP1 2014a).

#### ***Health***

All three (3) host communities have a village medicine box and an appointed village health representative. All three (3) communities have relatively good access to district and provincial health services and receive regular visits from district health programs (i.e. immunization and other health support services).

#### ***Water and Sanitation***

Domestic water in the three (3) host communities is sourced from nearby waterways or wells. Villagers in Ban Hatsaykham source their domestic water from three (3) bore holes and supplement this supply with water from the Nam Ngiep – only 60% of households boil this water prior to drinking. Villagers in Ban Hat Gniun use a gravity fed system (GFS) and Ban Somseun source drinking water from town supplies as well as village wells (all boiling before use) and bottled water. Households in these communities also use water from the Nam Ngiep, and rainwater harvesting during the rainy season, for domestic use. All households in Ban Somseun and Ban Hat Gniun and 26% of households in Ban Hatsaykham reportedly have access to private sanitation infrastructure, including latrines and closed septic tanks in each household.

## **Education**

Each of the host communities have primary schools – although the school in Hatsaykham only provides grades one (1) to three (3). NNP1 currently provides support for a school bus to take students from Hatsaykham to Hat Gniun. Villagers in Ban Hat Gniun and Ban Hatsaykham do not commonly go to secondary school as there are no secondary schools located within close proximity of the settlements. Villagers in Ban Somseun go to upper and lower secondary school that is available in Ban Houay Khoun, 3 km from Ban Somseun. The College of Forestry is also located in in Houay Khoun.

## **Irrigation**

There are currently no irrigation systems present in the three (3) host communities.

### **6.1.9 Village Access to the HSRA**

Villagers from the three (3) host communities mainly access the HSRA via boat. A rope pull barge (provided by NNP1) has also recently been installed at Ban Hatsaykham. Villagers from Hatsaykham and Ban Hat Gniun use the barge. There are a number of agricultural and logging access tracks throughout the HSRA providing villagers from all three (3) of the host communities with access to most areas via foot or small vehicle (i.e. toktok and motorbike).

Proposed resettlement communities include Ban Hatsaykham settlement located in the regulation reservoir area (see above) and Ban Houaypamom, Ban Sopphuane, Ban Sopyouak and Ban Namyouak located in the main reservoir area (2LR villages).

Baseline information for these communities is documented in the main Project's SIA (NNP1 2014a) and REDP (NNP1 2014b). The following sections provide a summary of key information on 2LR villages from these reports.

## **6.2 Resettlement Communities**

Proposed resettlement communities include Ban Hatsaykham settlement located in the regulation reservoir area (see above) and Ban Houaypamom, Ban Sopphuane, Ban Sopyouak and Ban Namyouak located in the main reservoir area (2LR villages).

Baseline information for these villages is documented in the main Project's SIA (NNP1 2014a) and REDP (NNP1 2014b). The following sections provide a summary of key information on 2LR villages from these reports.

### **6.2.1 Location**

The 2LR villages are located in Hom District of Xaysomboune Province about 12 to 25 km upstream from the dam site, which is located in Bolikhan District of Bolikhamxay Province. Through the inundation of the reservoir, all four (4) villages will require resettlement and lose productive land, and will require relocation to the selected resettlement sites.

### **6.2.2 Demography and Population Changes**

The 2LR villages have a total 481 households with 3,231 people (Earth Systems 2015b). The average household has 6.7 people. The ratio of males to females is 1.1. The total population in these villages has increased 4% over the last four (4) years.

### 6.2.3 Ethnicity, Religion and History

Almost 100% of the population in these villages are Hmong with the exception of a few Lao Loum households in Ban Sopyouak. The main religion is Animism. All four (4) villages have a long history with the local area. Present village locations were established between 1984 and 1996.

### 6.2.4 Land Allocation and Ownership

Average village land for these villages is 1900 ha, ranging from 850 ha (Ban Houaypamom) to 2880 ha (Ban Sopyouak). Land use in all villages includes a mixture of lowland agriculture, upland agriculture, commercial plantations, and grazing land and village forests. Privately held lands account for 36.4 % of the total land area of the communities. Over half of the total village forest land across the four communities is classified as community managed production forest.

### 6.2.5 Local Economies and Livelihoods

All four (4) 2LR villages have agricultural based economies. The residents of these communities have traditionally had a mixed economy of cultivating rice and food crops, fishing, raising livestock, hunting for meat and gathering NTFPs – all primarily for household use. Households in these villages practice lowland rice cultivation and upland rice cultivation. Livestock raising and collection of NTFP's are both important sources of cash income within 2LR villages.

### 6.2.6 Wealth and Poverty

The average annual cash income of households in 2LR villages is 7.6 million ranging from 3.8 million in Ban Soppouane to 10.6 million in Ban Sopyouak. Rice sufficiency was used to assess poverty in these villages. The majority of households in 2LR villages (90%) were found to be rice sufficient year round with the remainder experiencing shortfalls of rice for up to 2 to 4 months of the year. Those households either buy or exchange goods and services in kind to obtain the additional rice they need.

### 6.2.7 Water Resource Use

All villages use the Nam Ngiep as a key water resource for domestic use, as well as other activities such as fishing and generation of electricity through pico hydro-electric systems. Drinking water comes from simple gravity flow water systems from mountain streams or from wells. Water for other domestic uses is from the Nam Ngiep or its tributaries (with associated water quality issues), or from wells. Sufficient water is not available throughout the year.

### 6.2.8 Local Infrastructure and Services

Access to 2LR villages is via a road from Hom District via Ban Phalavaek which is not always passable during the rainy season. Villages are accessible by boat on the Nam Ngiep River, though parts of the river are difficult to travel due to rapids and rock outcrops. None are served by the national electricity grid, but individual electricity production via pico-hydro or solar power is present; the latter supported by the Project.

Three of the four villages (excluding Ban Houaypamom) have primary schools and Ban Namyouak also has a lower secondary school. Ban Sopyouak has a health centre which is fairly easily accessed by the people of Ban Namyouak as well. None of the communities have temples or pharmacies.

All four communities have small grocery shops which are small rooms or add-ons at people's houses where they sell soaps, shampoos and detergents, toothpaste, and a variety of packaged and canned goods.



## 6.3 Cultural Components

### 6.3.1 Cultural Practices

The majority of people in the host communities of Ban Hat Gniun and Ban Somseun are Lao Loum. These populations are well integrated into the wider Lao society and economy and have a history of good relations with other ethnic groups in the area (NNP1 2014b).

The majority of people in the resettlement communities are Hmong. Although Hmong are traditionally highland residents, these communities live in the river valley and have adopted livelihood activities more typically associated with sedentary agriculture of the Lao. Their settlements are quite recent, with the oldest of the four communities established about 30 years ago. The lands were given to these villagers after the civil war, in gratitude for their support for the Pathet Lao. Many of the villagers moved from higher, mountainous areas, the traditional area where Hmong live, with some having moved from the Phu Katha region (NNP1 2014b).

The Project has assessed these Hmong communities as fulfilling the ADB's criteria for classification as indigenous people (NNP1 2014b).

### 6.3.2 Cultural Heritage

Village surveys (Earth Systems 2015) conducted in Ban Hat Gniun, Ban Hatsaykham, and Ban Somseun indicated there are no archaeological and culturally significant sites of national and regional importance within the HSRA (Kansai et al 2012b; Earth Systems, 2015b).

One local culturally significant site was identified within the HSRA: a sacred rock near Houay Thamdin. Anecdotal evidence indicates that the site is considered an important place respected by local villagers as it was believed a hermit monk meditated in a small cave called Thamdin (Din cave). The cave has collapsed long ago and only sacred rocks remain.

One cemetery in Ban Hat Gniun was identified in the north east corner of the HSRA, however, this cemetery is located outside the HSRA.

Other cultural sites and artefacts identified in the vicinity of the HSRA include (Kansai et al 2012b; Earth Systems, 2015b):

- A polished shouldered axe/adze in stone found in the Nam Ngiep River during fishing in 2006, which provides evidence of Neolithic human occupation during the late stone age; and
- An ancient Buddhist temple cave located approximately 6 km from Ban Hatsaykham, upstream and on the right bank of the Nam Ngiep. The cave is approximately 200 m further inland, at the foothill of Phu Hong, a mount that belongs to the Phu Kata range. Three bronze statues survived looting and have been moved to the Buddhist temple in Ban Gniun (10 km away) for improved security

In addition, other physical resources of archaeological and cultural significance have been identified in Thaheua village, including a bronze Buddha image found in the ruins of an ancient Buddhist temple located on the opposite bank of the Ban Thaheua village (dated from Late Lane Xang Period, c. 19 AD, and now kept at the Buddhist temple in the village) and Neolithic remains at a tributary downstream of the Main Dam. The findings of Neolithic remains by villagers are currently under investigation by NNP1's Environmental Management Office to assess the sources and the significance of these findings (NNP1 2014b). The presence of numerous locally collected polished stone tools found in the wider area indicates that human occupation occurred between 4,000 and 12,000 years ago (Kansai et al. 2012a).

Intangible cultural heritage values found within the local area include traditional practices by local villagers, such as hunting, gathering, fishing, collection and use of medicinal plants and TFPs (e.g. firewood, bamboo used by both Lao and Hmong people to make animist symbols to ward off evil spirits).

### 6.3.3 Natural Heritage

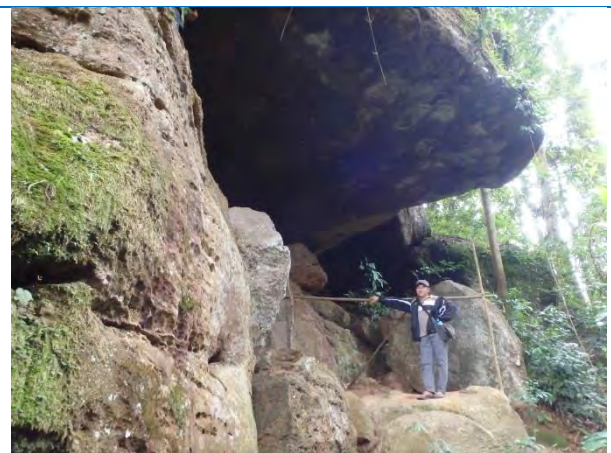
Natural heritage is strongly linked to physical and biological features of the natural environment which are of significance from a scenic, aesthetic, scientific or ecological perspective, such as conservation forests and biodiversity protected areas, mountains, waterfalls, caves, waterbodies, and wetlands.

There are no natural sites of international or national significance in the HSRA. However, during field and village surveys (Earth Systems 2015b), the following natural sites of local significance or aesthetic value were identified:

- Major streams including Houay Soup Noi, Houay Soup Ngai, Houay Khinguak Noi, and Houay Khinguak Ngai (which all occur within the HSRA);
- A number of lakes and wetlands, including Nong Da (seasonal wetland) in the south west of the HSRA (refer to Plate 6-1), and Nong Pa / Nong Gnae (with natural perennial spring) located in between Houay Soup Ngai and Houay Soup Noi in the western part of the HSRA. The perennial spring provides a good source of drinking water;
- A historical Tham Nong Da (Nong Da Cave) or Mr. Xeng’s Cave (refer to Plate 6-2), located on the south-west border of the HSRA. Mr. Xeng, who was a local revolutionary movement leader, used this cave as a stronghold site during the Vietnam War. Currently, local residents still use the cave as a sleeping camp during hunting and collection of NTFPs;
- A seasonal waterfall on Houay Khinguak Ngai along the border of the HSRA. The waterfall is located about 3 km upstream from its confluence to Nam Ngiep River. The waterfall is 8 - 10 m in height with water flowing from July to October;
- An important mountain peak, which has natural caves and waterfalls located along the HSRA western boundary, approximately 1 km towards the boundary; and
- Pu Hong (referred locally as the ‘Palace Mountain’) and Phu Kata (referred locally as the ‘Pan Shaped Mountain’) near Ban Hatsaykham, which have been named after the famous ‘Sinxay Epic’, a masterpiece of Lao classic literature because they were believed to be the real places from that story.



**Plate 6-11 Nong Da (seasonal wetland) in the south west of the HSRA**



**Plate 6-12 Tham Nong Da (Nong Da Cave) located on the south-west border of the HSRA**

## 7 IMPACT ASSESSMENT AND MITIGATION MEASURES

Section 7 of this *Initial Environmental Examination* provides a more detailed assessment of the potential impacts and management / mitigation measures specific to the HSRA construction and post-construction phases. These phases are defined as follows:

- The construction phase will be initiated in approximately November 2015 and will extend to late 2018. Residents from Ban Hatsaykham will be relocated to the HSRA in approximately April 2016, bringing potentially sensitive receptors to within close proximity of construction activities. Therefore the potential for impacts and / or the severity of impacts will change at this time for certain aspects (e.g. dust and noise). The rigour of management / mitigation will vary according.
- The post construction phase for the HSRA is divided into two distinct stages:
  - » HSRA Stabilization Period (as per the REDP, Livelihood Restoration and Income Plan) - NNP1 involvement in livelihood restoration activities for PAPs will continue for 10 years following the pre-construction period of the Main Project (December 2013) and for up to five (5) years during a stabilisation phase after NN1HPP COD.
  - » Operations and Maintenance - NNP1 involvement in post-construction maintenance and operation of the resettlement infrastructure will commence in 2018 (or when infrastructure is completed). Operational responsibility for village infrastructure will be allocated to the village and / or GOL following the official transfer of the HSRA to the village / GOL after MONRE is satisfied that CA requirements have been met.

The management and mitigation measures specified in this Section (and monitoring framework in Section 8.3) will be incorporated into contractor' *Site Specific Environmental and Social Management and Monitoring Plans* (SS-ESMMP) to clearly demonstrate contractor requirements (and contractual obligations) and best management practices across the infrastructure development area. The Nam Ngiep Hydropower Project *Environmental and Social Management and Monitoring Plan* (ESMMP-CP) (ERM, 2012) specifies overarching Project requirements for management, mitigation, monitoring and reporting during the Project construction phase, which includes construction of the HSRA. Additional measures from applicable sub-plans of the ESMMP-CP (Appendix H to this report) should be considered for inclusion in SS-ESMMP, where appropriate.

It is anticipated that post construction management, mitigation, and monitoring measures identified in this IEE will be incorporated into the NN1HPP ESMMP – Operations Phase (ESMMP-OP).

### 7.1 Physical Impacts and Mitigation Measures

#### 7.1.1 Project Footprint

##### ***Issues and Findings***

Development of the HSRA will impact approximately 2,394 ha of landform morphology and soil / subsoil during construction of the RDS infrastructure (i.e. housing, community infrastructure, utilities, roads, etc. – permanently impacted areas) and during operations (paddy fields, upland agricultural areas, etc.). The construction of Project infrastructure, agricultural plots, and livestock grazing will not require extensive earthmoving operations and the morphology of the area will not be significantly altered. Development of the paddy fields will require some reshaping of the landscape, though the Nam Ngiep floodplains are relatively flat and thus earthworks will be moderate in scope.

The HSRA has also largely been positioned in heavily disturbed vegetation / habitat, minimising potential impacts to terrestrial biodiversity (refer to Section 7.2.1).

### Construction

The majority of development will occur during Project construction. The first phase of facilities' construction (site preparation) will include vegetation clearing and grubbing, earthworks, and topsoil compaction. Table 7-1 summarises the general impacts of site preparation, which are discussed in detail in applicable Sections of this chapter.

Primary earthworks / physical impacts will occur for housing / community infrastructure (levelling and compaction) and for rice paddy fields (levelling, creating Irrigation Reservoir and canals, etc.).

**Table 7-1 Summary of potential physical impacts related to site preparation during construction**

Impacts	Assessment	Reference Section
Erosion and Sedimentation	Clearing and grubbing of vegetation, major earthworks, soil stockpiling, soil compaction will increase the likelihood of soil erosion from water and wind with subsequent sediment transport	Section 7.1.4
Soil Compaction	Heavy earthmoving equipment and pad / road preparation will compact surface soils	Section 7.1.5
Water Quality	Diesel powered vehicles / equipment provide potential sources of hydrocarbons to surface and groundwater and accommodation camps a potential source of nutrients and pathogens	Section 7.1.3
Hydrology	Surface water from seasonal drainages will be diverted around disturbance areas.  The flow regime of Houay Soup Noi and Houay Soup Ngai will be permanently altered with the construction of domestic and irrigation water supply intake and storage reservoirs.	Section 7.1.2
Air Quality	Particulate matter (dust) will be generated from clearing and grubbing, topsoil stockpiling, vehicle transit on unsealed road networks, etc.  Exhaust emissions (e.g. CO, NOx, SO <sub>2</sub> , VOCs) will be generated from diesel powered vehicles / equipment	Section 7.3.9
Noise	Vehicles / Equipment will be a source of noise emissions during site preparation.	Section 7.3.8
Vibration	Vehicle / equipment utilisation will be a minor source of vibration during site preparation.	Section 7.3.8

Source: Earth Systems 2015

### Post-construction

Landforms that will support upland agriculture / cash crops and tree plantations will primarily be developed following construction of primary HSRA infrastructure. The HSRA footprint will expand during site preparation (e.g. clearing of vegetation and earthworks) and the majority of potential impacts will be indirect (e.g. water quality, air quality, erosion and sediment transport, etc.), as per the construction phase. Management and mitigation measures for associated indirect impacts are specified in applicable sections below.

Site preparation activities for upland and lowland cultivation sites will occur annually and periodically for tree plantation areas (pending rotation cycle). Annual and periodic site preparation of these areas may lead to additional physical disturbance to landforms (primarily surface soils) that will subsequently require annual / periodic management for indirect impacts listed in Table 7-1.



## **Management and Mitigation**

### **Construction**

The Project has been designed to minimise the physical impacts to the natural landscape by siting the majority of the Project footprint in highly degraded vegetative communities (i.e. old and young fallow). To ensure potential impacts on landforms are managed and mitigated for the Project, the following measures will be implemented by NNP1 / contractors for the construction phase:

- Areas requiring earthworks will be surveyed and delineated, with the maximum extent (area) of earthworks demarcated for each Project component. Vegetation clearance will be restricted to the minimum area required;
- Where feasible, landforms will be progressively rehabilitated throughout construction or immediately following construction for temporarily impacted areas that will not be required during operations. Buffer areas required for construction equipment (e.g. road embankments, access for construction equipment, vehicle laydown areas, etc.), temporary access roads, etc. will be ripped, graded to contour and planted with native vegetation;
- Areas disturbed by construction will be contoured to restore suitable drainage paths. Disturbed areas surrounding infrastructure will be rehabilitated and revegetated with native plants; and
- Management and mitigation measures provided in Section 7.2.1 will be applied for vegetation clearance.

### **Post-Construction**

Landform disturbance post construction will be limited to site preparation of agricultural areas / plantations. Management and mitigation measures are provided in applicable sections below (and in the INRMP, Appendix A) for the indirect impacts anticipated.

### **Assessment of Impacts**

The HSRA footprint is commensurate with the infrastructure, agricultural / livestock grazing area requirements of the resettled people. By minimising the footprint (and associated site preparation) to that needed for development of the HSRA, the impacts to the morphology of the area will be minimised.

Vegetation clearance and site preparation will lead to indirect impacts (e.g. erosion and sedimentation, noise, dust) that will require management measures identified in the Sections below.

## **7.1.2 Hydrology**

### **Issues and Findings**

**Flooding:** Preliminary modelling indicates that peak storm events may flood some of the proposed HSRA road network. Further modelling (including field measurement of flow for calibration) is required to clearly identify whether HSRA infrastructure (e.g. portions of the residential area) are above potential flood waters from major events (e.g. 1:100 – 1:1000 ARI).

It is anticipated that Phase 1 of relocation may easily be constructed above potential flood zones (with the potential exception of a portion of the access road). The phased approach to resettlement, with Ban Hatsaykham residents relocated in April 2016 and the remainder of resettlement occurring in the following 1 – 2 years, will allow for realignment of the residential infrastructure (e.g. to higher ground in the RDS Annex) to avoid potential flood zones, if further flood modelling indicates a risk to any of the remainder of the HSRA infrastructure.

**Stream flow reduction:** Construction of the Irrigation Reservoir on the Houay Soup Noi and abstraction of water from Houay Soup Ngai will significantly reduce surface water flow in these streams, particularly during the dry season. During the filling phase of the reservoir, the natural flow will cease below the dam wall as

it is captured in the reservoir. Temporary elimination of flow to the Houay Soup Noi may have serious long-term consequences for downstream aquatic biology.

According to preliminary design for the irrigation dam and domestic water supply intake, downstream dry season flow will be eliminated (if unmitigated) for these perennial streams during operations as well (given tributaries are ephemeral), with significant impacts for aquatic biota in the Houay Soup Noi and Houay Soup Ngai below the infrastructure.

Flow will also be decreased during the rainy season. Some aquatic biota likely require elevated rainy season flows during the rainy season. For example, migratory aquatic species likely require elevated rainy season flows to move upstream to suitable spawning areas and some macro-invertebrate species require flood waters to stimulate life cycle and reproductive processes. Thus, impacted rainy season hydrology may also indirectly denigrate aquatic habitat.

An environmental flow regime is required (continuous release of water) through the Irrigation Reservoir Dam and past the domestic water supply intake to preserve aquatic species habitat throughout the dry season.

### ***Management and Mitigation***

**Flooding:** Robust flood modelling should be conducted for the HSRA settlement area to determine reliable flood zone estimates. It cannot yet be determined whether the current siting of HSRA infrastructure avoids the flood zone for the 1:100 – 1:1000 year ARI peak storm events, whether current design constitutes a safety risk or temporary isolation risk for the resettled community, and whether flooding will necessitate ongoing maintenance of site infrastructure following flood events.

The following are recommended to manage / mitigate for potential flooding following significant storm events:

- Refine the flood model to accurately capture the extent of Houay Soup Noi and Houay Soup Ngai flood zones for annual, 1:100 and 1:1000 ARI peak storm events; and
- Identify suitable alternatives for housing and roads (in the Resettlement Development Site annex) that sit well above the flood zone.

**Flow reduction:** The following are recommended to ensure sustained populations of aquatic biology / habitat downstream of the irrigation dam and domestic water intake on the Houay Soup Noi and Houay Soup Ngai, respectively:

- A continuous environmental flow (i.e. 365 days / year and 24 hours / day) should be released to maintain a minimum of baseflow during the dry season and some retention of peak flow behaviour in the Houay Soup Noi below the Irrigation Dam; and
- Baseflow (currently estimated at 0.25 and 0.006 m<sup>3</sup> / s for Houay Soup Noi and Houay Soup Ngai, respectively) should be accurately determined via stream flow gauging.

### ***Irrigation Dam***

During the filling phase of the Irrigation Reservoir it is recommended that:

- Flow from the Re-regulation Dam should be diverted to the Irrigation Supply Reservoir until it is full. The environmental flow mechanism (e.g. culvert through the dam wall) should be in-place upon reservoir filling.

Once the Irrigation Reservoir is full it is recommended that:

- The water conveyance regime from the Re-regulation Reservoir should continue during the rainy season (excluding peak flow events that may lead to flooding) to provide an adequate volume of water to preserve the natural hydrology of the rainy season (to the extent practicable); and
- The environmental flow conduit should be suitable for fish passage.

### *Domestic Water Supply*

NNP1 is considering Option 2 for supplementary domestic water supply infrastructure (i.e. pumping from the Irrigation Reservoir during the dry season to supplement water supply from Houay Soup Ngai). The following is recommended to maintain and environmental flow in the stream, protecting aquatic habitat and species downstream of the domestic water supply intake:

- Construct and operate Option 2 to allow for an environmental flow release. Baseflow (~6 L / s) should bypass the intake to provide adequate water for fish in this perennial stream; and
- Consider constructing a larger holding tank for domestic water supply to provide adequate flow for domestic water supply during the rainy season, allowing for continuous discharge of 6 L / s throughout the year.

### **Assessment of Impact**

Preliminary flood modelling indicates that some infrastructure may reside within the flood zone for the 1:100 - 1:1000 ARI peak storm event. Some of the HSRA infrastructure may be flooded following large storm events. Only a fraction of the settlement area may occur within the flood zone. Therefore Phase 1 of relocation (Ban Hatsaykham) may commence without risk to settlement infrastructure. Further flood modelling will allow for either (a) construction of the remainder of the residential area if modelling indicates no flood risk, or (b) realignment of the remainder of the residential area and road network to avoid flood zones (likely into higher ground in the RDS annex).

With implementation of management measures, specifically (a) environmental flow regimes for the Houay Soup Ngai and Houay Soup Noy; (b) development of Option 2 for domestic water supply (pumping from the Irrigation Reservoir; and (c) provision of upstream / downstream migration conduits passed Project infrastructure, the habitat and ongoing existence of aquatic biology in the streams will not be significantly impacted by altered hydrology.

## **7.1.3 Water Quality**

### **Issues and Findings**

With the implementation of water treatment facilities, and isolation of domestic water facilities and catchments from livestock, water quality for HSRA residents should improve considerably.

There is potential for construction / post-construction impacts to downstream surface water quality and groundwater, including erosion and sediment transport (assessed independently in Section 7.1.4), hazardous and non-hazardous wastes, nutrients, and pathogens.

### **Construction**

Impacts to surface water from HSRA construction will likely be similar to that anticipated for NN1HP Construction during construction, potentially including:

- **Hazardous materials / waste:** Diesel fuel (and other hazardous materials and waste) for vehicles and equipment will be transported and stored / handled on-site providing potential for spillage and subsequent impacts to surface and groundwater;
- **Non-hazardous waste:** General refuse will be generated during construction (e.g. food packaging, plastic water bottles, construction packaging) and excess construction materials may pollute surface water during storm events (refer to Section 7.1.6); and
- **Nutrients and Pathogens:** A small workforce accommodation will be constructed in the HSRA (refer to HSRA Preliminary Construction IEE). Waste water from the accommodation / construction facilities will comprise a potential source of nutrients and pathogens that may be released into receiving waters via grey-water or septic systems.

Temporary toilet facilities may be required in construction areas as well, providing an additional potential source of nutrients and pathogens.

### **Post-Construction**

- **Hydrocarbons:** The irrigation pumps for the southern paddy fields will require diesel fuel storage and handling providing potential for spillage and subsequent impacts to surface and groundwater;
- **Non-hazardous waste:** General refuse (rubbish) derived from up to 750 households inhabiting the HSRA (e.g. food / resource packaging) may pollute surface waters if improperly disposed of or improperly handled following collection. Waste disposed of at the landfill poses a potential threat to groundwater quality;
- **Arsenic:** Two data points indicated the presence of arsenic in HSRA groundwater and 0.046 mg / L of arsenic was detected in a single July 2015 sample from Houay Soup (NNP1 water quality sampling team and associated laboratory). It is considered likely that this reading resulted from laboratory error. However, because dry season surface water in Houay Soup Ngai is spring fed (and groundwater contamination with arsenic a remote possibility), the possible existence of arsenic in HSRA streams should be investigated further;
- **Pathogens:** The HSRA may accommodate up to 750 households (4,500 individuals if 6 people per household is assumed). Waste water (grey water or septic system discharge) will comprise a potential source of pathogens to receiving surface or groundwater.

Solid waste landfills may provide an additional source of pathogens to surface or groundwater if they are not effectively isolated.

Baseline total and faecal coliform levels are elevated above Project drinking water guidelines in the Houay Soup, including the Houay Soup Ngai above the Project intake for drinking water. Added populations of domestic livestock in the HSRA may contribute to increasingly higher concentrations of pathogens;

- **Nutrients:** Nutrient input to the Houay Soup Noi, Houay Soup Ngai, Houay Soup and downstream receiving waters (Nam Ngiep River) may increase significantly as a result of Project operations. The most significant nutrient inputs would likely be derived from over-fertilisation of agricultural plots, livestock in the HSRA, and from aquaculture in the Houay Soup Noi Irrigation Reservoir.

Additional nutrient input may occur from septic facilities that are not suitably designed and / or maintained, from grey water discharge from kitchen facilities, and from solid waste disposal areas if not effectively isolated.

Nutrient input to Houay Soup and downstream receiving waters may increase as a result of food application to the reservoir to increase productivity of the aquaculture that will be undertaken in the Project irrigation pond. Studies have found that less than 30% of the nitrogen and phosphorous added in feed is recovered with fish harvest (SRAC 1999). Monitoring of effluent from catfish farming in the south-eastern United States found water quality was poorest (highest concentrations of solids, organic matter, total phosphorous, and total nitrogen) in the warm season when fish feeding rates and water temperatures are highest (SRAC 1999).

Nutrient concentrations in the Houay Soup Noi, Houay Soup Ngai, and small first order ephemeral tributaries of the Nam Ngiep River may increase as a result of livestock rearing adjacent to these streams; and

- **Dissolved Oxygen:** As the Irrigation Reservoir will be supplied with water from the Nam Ngiep HPP Re-regulation Dam, the dissolved oxygen (DO) concentration may be low (as a result of oxygen consumption during the breakdown process of organic matter in the Project's Main Reservoir), particularly during the initial years following impoundment.



The predicted range of DO in the main reservoir outflow discharge varies from 3.5 mg / L to 7.9 mg / L through the year (ERM 2014). Due to oxygenation and dilution in the Re-regulation Dam reservoir, the DO concentration is expected to increase as the water flows downstream to the Re-regulation Dam. DO concentration of discharge water from the re-regulating dam is expected to be greater than 6 mg/L for most of the year.

## **Management and Mitigation**

### **Construction**

Management and mitigation measures to minimise impacts to downstream surface water and down-hydraulic gradient groundwater from significant impacts during construction include the following:

- Provide drinking water of suitable quality to HSRA residents and construction workers and contractors working in the HSRA (according to applicable Project water quality standards);
- Implement erosion and sediment control measures (as per Section 7.1.4);
- Identify the volume of spoil and location of spoil disposal sites prior to construction commencing, and account for site capacity, surface drainage, stabilisation, and erosion and sediment control requirements;
- Place and secure construction materials and chemicals above flood levels during rainy season;
- Effectively isolate the solid waste disposal facilities, septic systems, and grey water discharge from surface and groundwater by ensuring design of facilities suitable for the anticipated population of the HSRA and estimate solid waste / grey water / black water generation;
- Implement hazardous and non-hazardous management measures (refer to Section 7.1.6). Ensure all hazardous and non-hazardous waste facilities have primary containment (bunding, are covered to prohibit rain infiltration) and secondary containment. Provide hazardous materials spill kits (e.g. Sorbex) in readily accessible locations). Train staff (and ensure contractors are adequately trained) in hazardous and non-hazardous storage, handling, and emergency and preparedness planning;
- Service vehicles in the NN1HP laydown areas to the extent feasible. Minimise potential for effluent in the HSRA;
- Implement an auditing and reporting system to ensure that management and mitigation measures are effectively implemented (i.e. water quality monitoring, construction monitoring);
- Develop adaptive management strategies, where required, if management and mitigation measures are proven inadequate in protecting surface and groundwater quality;
- Monitor water quality during construction (upstream / downstream) to ensure ambient water quality and effluent discharge standards are maintained (refer to Section 8.3); and
- Ensure the SS-ESMMP for the HSRA provides detailed specifications for greywater treatment and sewage containment (and treatment / removal). Treatment and disposal should ensure effluent meets Project discharge guidelines and receiving waters meet ambient water quality guidelines for nutrients and pathogens. Septic systems shall be designed to account for or prohibit overflow.

The Project ESMMP-CP provides further detail regarding the measures above (e.g. SP01: Erosion and Sediment Control, SP02: Water Availability and Pollution Control; SP05: Waste Management, SP06: Hazardous Material Management, SP10: Spoil Disposal; and SP15 Training and Awareness. ESMMP-CP sub-plans (Appendix H) should be reviewed for incorporation into SS-ESSMPs, where applicable. These sub-plans are provided in Appendix H.

Contractors will be contractually obligated to the management, mitigation, monitoring and reporting requirements of the SS-ESMMP.

## **Post-Construction**

### *Hydrocarbons*

All hydrocarbons (fuels and lubricants, etc.) for irrigation pumps and additional requirements will be stored in fully bunded areas. Bunded areas will be covered to prohibit rain infiltration. Bunds will have sufficient capacity to contain at least 120% of the tanks' maximum capacity.

### *Nutrients and Pathogens*

- Effectively isolate the solid waste disposal facilities, septic systems, and grey water discharge from surface and groundwater by ensuring design of facilities and treatment measures are suitable for the anticipated population of the HSRA and estimate solid waste / grey water / black water generation. Septic system design and treatment methodology will have to prohibit the chance for overflow;
- Use high quality feeds and efficient feeding practices for aquaculture in the irrigation pond;
- Ensure adequate aeration and circulation of irrigation water to maintaining high DO, enhancing the appetite of fish encouraging feed conversion; and
- Consider diverting the Houay Soup Noi around the irrigation pond (relying on Re-regulation Reservoir water entirely for the Irrigation Reservoir / aquaculture facility). This would allow discharge of water from the reservoir that may have high concentrations of nitrogen and phosphorous for paddy field irrigation, enhancing fertilisation of paddy fields while avoiding discharge of nutrients to the Houay Soup Noi. This option would simultaneously benefit the environmental flow regime (refer to Section 7.1.2).

### *Drinking water infrastructure*

The implementation of roughing filters for pre-treatment of water for domestic supply will require development of a maintenance program that should be implemented by NNP1 while the HSRA villagers and the Company collaborate on the resettlement area maintenance program.

Organic matter build-up in the media will require periodic replacement or treatment of the media to ensure its ongoing effectiveness in removing suspended solids and associated parameters of interest.

- To protect water quality (pathogens) in the Irrigation Reservoir / water supply ponds, livestock will be prohibited by fencing (final design yet to be completed). NNP1 will install fences, which will be maintained by the community; and
- According to The NNP1 REDP, livestock will be prohibited from entering the watershed areas for water supply ponds as well (with Project installed fencing). This will require erection of a long fence and considerable maintenance. Detailed design has not yet been provided.

The domestic water supply should be regularly monitored for comparison with Project drinking water and ambient water quality guidelines (refer to Section 8.3).

## **Assessment of Impact**

The quality of domestic water supply is expected to be improved, both in comparison to pre-resettlement domestic water supply and in comparison to current HSRA stream water due to water treatment and isolation of water supply facilities from livestock. The domestic water supply treatment plant will require ongoing maintenance to remain effective.

Nutrients and pathogens in downstream receiving waters are expected to increase post-construction. Management of the Irrigation Pond effluent and application of appropriate volumes of fertilisers (and correct timing of application) should minimise impacts to less than significant for receiving waters.

Design, construction, and maintenance of key HSRA facilities, including septic systems, landfills, temporary waste holding facilities, etc. is expected to reduce post-construction water quality impacts to less than

significant. Erosion and sediment transport is expected to be the most significant water quality impact during construction (refer to below).

### **7.1.4 Erosion and Sediment Transport**

The Acrisol soil groups that dominate the Project Development Site are highly dispersible, and will be prone to erosion and sediment transport during the rainy season. Erosion may lead to degradation of topsoil quality (soil character and fertility) and sediment transport impairs downstream surface water quality with associated impacts for aquatic species, aquatic habitat, and downstream water users.

The potential for erosion and sediment transport issue will be particularly significant during the first 1 – 2 rainy seasons during and following construction, prior to establishment of vegetation via natural regeneration and Project planting.

#### ***Issues and Findings***

##### ***Construction***

The majority of erosion and sediment transport will result from water erosion of disturbed areas during the rainy season. The primary impacts will include:

- Impaired surface water quality during construction due to suspended sediments generated from land clearing / earthworks, instream construction, sand / gravel extraction from borrow areas, and road construction / unsealed road surfaces; and
- Loss of topsoil and subsequent impacts to soil quality due to erosion of cleared landforms following site preparation for upland agricultural areas / plantation areas.

The design and construction of access road / road infrastructure will be particularly important in controlling sediment-laden runoff from the Project site. Roads intercept, concentrate and direct water on compacted surfaces to receiving waters.

Land clearance associated with site preparation will provide the following respective areas of disturbance that will be susceptible to erosion and sediment transport:

- Housing, roads, and community infrastructure (255 ha);
- Upland cultivation areas (427 ha);
- Plantation areas (191 ha); and
- Riparian areas adjacent domestic and irrigation water infrastructure (38 ha).

##### ***Post-Construction***

Following HSRA construction, it is anticipated that erosion sediment transport will be less extensive than during constructions as natural revegetation / planting of temporarily disturbed areas will stabilise topsoil.

However, annual or periodic clearing of vegetation in upland cropping areas and plantation areas will provide significant areas of disturbed areas prone to erosion and sediment transport. In addition, the ongoing existence of an unsealed road network will provide further area susceptible to erosion and pathways for sediment transport to watercourses.

#### ***Management and Mitigation***

##### ***Construction***

Application of suitable stormwater management measures and erosion / sediment control will be required during construction to avoid and minimise erosion and sediment transport. The following measures will be implemented:

- Where feasible, major earthworks and grading operations will be scheduled for early in the dry season;
- Surface water management infrastructure (e.g. cut-off / diversion drains, velocity dissipation devices, culverts) will be installed in appropriate locations to minimise and control surface water flow over disturbed areas and water will be diverted to appropriately size sediment basins for settling of suspended sediment prior to water discharge. All designed drainage works will be surveyed, pegged, and approved by NNP1 Site Manager prior to implementation. Site drainage will be implemented prior to vegetation clearance / earthworks;
- Major control measures such as sediment basins will be installed prior to vegetation clearance / earthworks. Major control measures will be surveyed and pegged. The contractor will require approval from the NNP1 Site Manager prior to constructing each measure;
- Appropriate sediment controls will be implemented (e.g. sediment traps and basins, silt fences, riprap, etc.) depending on the size of the disturbed area and the upslope catchment area. Discharged water from excavation / earthworks areas will not be allowed to discharge directly to natural water bodies. Sediment basins will be designed, installed and maintained to efficiently remove suspended solids from water and will be routinely inspected by the contractor and NNP1 EMO.
- Vegetation on steep slopes and riparian corridors will be preserved where possible. A minimum of 25 m of riparian vegetation will be left intact on each side of perennial streams and 10 m on each side of ephemeral streams, with the exception of in-stream works areas (e.g. water intakes and Irrigation Reservoir). A vegetative buffer of 25 m width will be left intact on the border of the Nam Ngiiep River (e.g. between rice paddy and river);
- Vegetation clearing will be restricted to the minimum area possible and vegetation will be preserved in areas where construction will occur at a later date. Areas scheduled for vegetation clearance will be clearly demarcated and personnel will be informed of the maximum extent of clearance and the requirement to prohibit heavy equipment from straying beyond demarcated zones;
- Erodible construction material will be stockpiled on relatively flat areas, at least 20m from drainage lines and steep slopes, and in locations approved by the NNP1 Site Manager;
- Disturbed land areas will be progressively rehabilitated where feasible, with priority rehabilitation and revegetation undertaken in high risk areas such as steep slopes and sites close to rivers and creeks; and
- As earthworks are expected to extend into the wet season, sediment control dams, drainage structures, and additional erosion and sediment control facilities should be completed prior to the onset of the wet season.

The following management and mitigation measures should be implemented to minimise erosion and suspended sediment input to receiving waters from road infrastructure:

- Roads will be constructed during the dry season to the extent possible. Erosion and sediment control facilities for unsealed roads will be completed before the onset of the wet season;
- The road design will include a drainage system to channel water from the road surfaces to outlets with erosion and sediment control facilities, including rip-rap at inlets and outlets of culverts and channels and sediment control basins constructed for larger catchment areas;
- Roads will be constructed with cross-fall slopes of (maximum 3%) to promote rapid drainage from unsealed road surfaces to avoid scouring. Where cross-fall is insufficient, water bars will be constructed to direct water to road discharge channels that will be outfitted with velocity dissipaters and sediment control (e.g. rip-rap, sumps and/or silt fencing);
- Drainage from upslope of road surfaces will be diverted via roadside drainage channels to culverts with velocity dissipaters and sediment control at outlets;



- Culverts will be installed at drainage crossings, perpendicular to the road alignment and implemented with appropriate slopes to facilitate water and sediment movement with deposition and consequent culvert blockages;
- Permanent structures should be designed using an average peak storm recurrence interval of 50 years, and temporary structures should be designed using an average recurrence interval of two years (24 hour storm events);
- Batter slope angles will be minimised to the extent feasible;
- Soil will not be side-cast (pushed) over the crest of the low side of the road. Excess soil will be transported to the topsoil stockpile or temporary stockpiles, with stockpile locations identified prior to the onset of construction; and
- Where feasible, vegetation will be left intact on road verges and roadside batters to reduce surface flow velocity and erosive potential.

Erosion and sediment control facilities will require routine inspection and maintenance, as well as adaptive management if facilities are deemed inadequate or ineffective during monitoring.

Refer to Appendix H for a comprehensive list erosion and sediment control requirements for the Project as well as monitoring requirements (methods, location, and frequency) that should be considered for incorporation into the SS-ESMMP for HSRA Construction.

### ***Post-Construction***

Management and mitigation post-construction should focus on completion and maintenance of erosion and sediment control facilities implemented or initiated during construction. The following maintenance activities should be prioritised:

- Monitoring of road-side drainage channels and additional water conveyance facilities (e.g. irrigation ditches) for erosion. Eroding channels should have additional measures implemented (i.e. velocity dissipation, rock armouring, or similar);
- Monitoring of unsealed road network, and corrective actions as applies (i.e. additional water bars on steep slopes, facilities to move water from road surfaces where erosion is evident, etc.); and
- Conduct ongoing monitoring of road network, stormwater conveyance channels, erosion and sediment control devices, and additional areas prone to erosion to identify maintenance requirements and determine where more robust facilities should be implemented.

Annual and periodic clearing of vegetation for agricultural plots / plantations will provide disturbed areas prone to erosion. This will require ongoing stormwater management, erosion and sediment control similar to construction phase management. The following are specific to agricultural areas / plantations operations:

- Consider planting rows to parallel to topographic contours, which minimises erosion and allows rows to act as surface water filters (sediment control);
- Restrict vegetation clearance / timber harvest to the dry season and ensure that erosion and sediment control facilities have been implemented prior to the onset of the rainy season;
- Maintain vegetated buffer strips at the downslope side of agricultural plots, and enforce 5 m riparian buffer zones either side of ephemeral and seasonal streams;
- Consider agroforestry models for plantation with wide spacing between rows (e.g. 10 m) to provide adequate space and light for intercropping (and thus establishing plants throughout clearance area); and
- Implement erosion and sediment control provided in the ESMMP-CP SP01 and those listed above for construction (e.g. vegetative buffers along stream channels, diversion of water around disturbance areas, etc.).

## ***Assessment of Impacts***

Vegetation clearance and land disturbing activity during construction and site preparation for agricultural plots will promote erosion and contribute suspended sediment to the HSRA streams and Nam Ngiep River. Impacts will be below domestic water intakes / irrigation water supply infrastructure, thus impacts to HSRA villagers should be limited to the need for maintenance of unsealed roads and additional cleared areas.

Diligent application of management and mitigation measures identified above will minimise the impacts of sediment loading in receiving waters to moderate.

### **7.1.5 Soil Quality**

According to ISRIC World Soil Information database (2015), agricultural productivity on Acrisol soil types is limited by acidity (and corresponding aluminium toxicity and phosphorous sorption), and often poor fertility. Assessment of soil samples from 16 sampling sites in the HSRA (2011 and 2015) confirmed that the physio-chemical makeup of the soils in the HSRA will not be very productive without implementation of a soil improvement program. HSRA soils were uniformly (across all sampling sites) acidic (e.g. pH 4.0 – 4.7); low in plant available nutrients (particularly phosphorous, potassium, magnesium, and calcium); with moderately low cation exchange capacity (CEC) and organic matter. Some areas exhibit signs of poor drainage and aeration, though soil texture is generally conducive to crop production with soil improvement.

Project construction and operations will not impair soil fertility and the capacity of the soil to produce crops (outside of permanent infrastructure areas). Rather, HSRA implementation provides an opportunity to enhance soil fertility to facilitate greater crop / plantation yields during operations. The assessment below therefore considers potential negative impacts during construction and site preparation during operations but focuses on potential soil improvement techniques that will promote more viable agricultural production / livestock grazing areas.

## ***Issues and Findings***

### ***Construction***

Site preparation may impact soil physical properties in the following respects:

- Implementation of housing, community infrastructure, road networks, etc. will compact soil surfaces. However, by minimising vehicular access to the permanent infrastructure areas to the extent possible, compaction will be primarily limited to areas not intended for future plant growth; and
- Construction of lowland paddy fields and upland agriculture areas will provide opportunity for physio-chemical enhancement of soil properties in the HSRA.

### ***Post-Construction***

- Annual and periodic site preparation for agricultural plots and plantations will provide opportunity for soil enhancement throughout inhabitation of the HSRA, as per livelihood restoration requirements of the REDP.

## ***Management and Mitigation***

A pilot demonstration farm and soil improvement program has been established within the HSRA since 2014, and experiments have indicated that harvests can be improved through a soil improvement program. The soil improvement program was specifically developed to be implemented in rice paddy field areas prior to resettlement, and included some of the recommendations provided below.

### ***Construction***

- Excessive soil compaction will be ameliorated by surveying, delineating, and marking construction area boundaries and limiting vehicular access to within construction area boundaries. Temporary

access roads and additional temporarily disturbed areas will be ripped to reduce soil compaction and revegetated with native plant species. Topsoils will be protected from erosion and sedimentation according to Section 7.1.4 of this report.

The following should be considered during HSRA construction:

- Demarcating the area identified for the irrigated paddy fields in consultation with current land users as all well as PAPs from the five resettlement communities;
- Levelling of the land to form fields that can be easily irrigated. Careful topsoil management will be required during this process to ensure topsoils are not lost and the upper fertile soil layers are maintained;
- Application of dolomitic limestone to raise pH levels in paddy field topsoil to target levels (refer to Table 7-2), minimising aluminium toxicity (< pH 4.5) and providing substrate more amenable to nutrient uptake. Dolomite is recommended as it provides magnesium and calcium fertilisation along with raising pH (as opposed to calcium carbonate which will not provide Mg<sup>2+</sup>). Annual or bi-annual soil sampling and laboratory test work should be undertaken to determine the frequency of dolomite application requirements;
- Planting of a nitrogen fixing crops (e.g. legumes) during construction will increase plant available nitrogen with minimal cost, effort, and readily accessible inputs (NNP1 2014b);
- Trialling of different crop rotation methods, including a double crop cycle whereby an initial nitrogen fixing crop is planted and subsequently ploughed back into the soil, and then a second crop is planted and left standing until first rice planting for the wet season;
- Fencing of the areas via a standard agricultural electric wire fence to prevent livestock from feeding on the crops. When the crop has reached an optimum level of nitrogen fixation, cattle may be allowed to graze depending on the crop selected, to actively attract livestock to forage and additionally fertilise the land; and
- Nutrient analysis of paddy field soils prior to planting the first rotation to determine inorganic fertiliser requirements (likely NPK, with micro-nutrients as required).

### Post-Construction

Soil improvement will be required (as per the REDP) to ensure adequate and sustainable upland agriculture / plantation yields as well has paddy fields (as above). The chemical properties of the soil should be considered during crop selection. Crops / trees more tolerant of acidity will reduce the required application rates of dolomite / lime, and potentially fertilisation rates. For example, rice, rubber trees, and certain fruiting trees / plants (e.g. pineapple, cashew, and palm) may be productive in more acidic soils, however the desired crops of villagers is expected to largely dictate crop selection.

NAFRI (2011) identified target values for key chemical properties paddy rice, upland farming, and fruit tree plantations (refer to Table 7-2).

**Table 7-2 Target value of soil improvement**

Item	Paddy field	Upland Agriculture	Fruit farm
pH (H <sub>2</sub> O)	5.5-6.0	6.0-6.5	5.5-6.0
pH (KCl)	5.0-5.5	5.5-6.0	5.0-5.5
Effective phosphoric acid (mg/100 g)	More than 10	More than 20	More than 20
CaO (mg/100 g)	More than 200	200-300	100-200
MgO (mg/100 g)	More than 25	20-40	25

Item	Paddy field	Upland Agriculture	Fruit farm
K <sub>2</sub> O (mg/100 g)	More than 15	15-30	15-25
CEC (me / 100 g)	More than 20	More than 20	More than 20
CaO / MgO	Less than 6	Less than 6	Less than 6
MgO / K <sub>2</sub> O	More than 2	More than 2	More than 2
Base saturation (%)	60-80	80	40-60

Source: NNP1 2014

The following should be considered to enhance soil productivity in lowland and upland agricultural areas and plantation areas (though management will differ in some respects per activity):

- Dolomite application to raise pH to target levels (as above) and annual or periodic soil sampling and laboratory test work undertaken to determine the application rate frequency of dolomite application requirements for paddy / upland agriculture / plantations, respectively;
- Annual or periodic analysis of soil fertility will be required (pending duration of crop cycling) to determine effective inorganic fertiliser application rates / frequency of application. Broad-scale applications of manure and other types of organic fertilisers should be avoided to prevent potential surface water pollution in the nearby Nam Ngiep River and its tributaries;
- Incorporation of further soil improvement techniques should be considered for the soil improvement program, including the application of either:
  - » Biochar produced from agricultural and food wastes as well as thinned wood after charring. Soil mixed with biochar becomes soft, porous, permeable and then suitable for plants to grow well. Moreover, it improves biological activity (i.e. microbes) due to its porous medium, which then supply plant nutrients such as nitrogen, potassium, phosphorus. The Project is exploring the option of biochar development with a research institute based in Chiang Mai, Thailand (NNP1 2014b); and / or
  - » Effective microorganisms (EM), which are predominantly anaerobic organisms such as lactic acid and fermenting bacteria. Research at the Houay Soup pilot farm has shown environmental destruction caused by symptomatic treatment, e.g. agrichemicals for plants damaged by blight, insects, and antibiotics for farm animals, in which microbes so called 'good bacteria' participate and decay organic matter. When EM is applied into the above conditions, various anti-oxidation materials and nutrients are produced, moreover it will stop organic matter from decaying, which creates suitable conditions for plants and animals (NNP12014b).
- Villagers will be informed of appropriate application rates for nutrients / dolomite through the NNP1 Livelihoods Support Program training. This training should be conducted annually for the initial years following agricultural plot establishment, as soil fertility will change over time and it is expected that ongoing monitoring of crop yield vs. nutrient application rates will refine the soil improvement program.

### **Assessment of Impacts**

The soil improvement programs is expected to enhance crop yields / plantation growth to levels currently not achievable in the HSRA. A robust program should provide yields that are greater than proposed resettled villagers currently achieve and may preclude the need for swidden agriculture in the area.

Nutrient loading in receiving waters should be avoided with diligent application of fertilisers during appropriate seasons and avoiding excessive fertiliser application via annual soil analysis for maximum soil enhancement requirements.



## 7.1.6 Hazardous and Non-hazardous Waste

### *Issues and Findings*

The following assessment of potential impacts from hazardous and non-hazardous waste considers construction and operations collectively, as the potential impacts are expected to be similar throughout. Management regimes consider construction and operations separately, as temporary vs. long-term management regimes will be implemented, respectively.

#### *Non-hazardous waste*

General waste materials generated from HSRA construction and operations, workforce accommodation, and administrative facilities may physically impact the environment (with potential biological / social implications), including contamination of receiving surface and groundwater and soil substrate for improperly stored or untreated wastes (refer to Section 7.1.3); increased populations of wildlife due to food wastes, including rates and other potential vectors for disease; and impaired visual amenity.

Soil amendments may impact the receiving environment if not properly stored, handled, or applied.

Detailed design for long-term (post-construction) waste facilities have not yet been completed. Non-hazardous waste disposal (landfill) and temporary waste storage and separation facilities near the market (separation of recycling, waste for landfill, and storage areas) are expected to minimise the risk for potential impacts from non-hazardous waste.

#### *Hazardous Waste*

Hydrocarbons and hydrocarbon waste may contaminate soils, groundwater, or surface water if improperly stored or handled. Hydrocarbons will be required during construction for vehicles / equipment and to run irrigation pumps and the water treatment plant during operations.

While pesticides / herbicides applications are not considered for HSRA construction, there is potential that either may be utilised by residents of the HSRA during agricultural site preparation and / or following an outbreak of a pest that threatens crops / plantations. Pesticides / herbicides vary considerably with respect to potential environmental and health risks.

The following hazardous substances may be used in construction activities:

- Paint and solvents;
- Petroleum products such as oils, fuels, and grease;
- Herbicides, Pesticides;
- Acids for cleaning masonry;
- Concrete curing and repair compounds;
- Contaminate waste materials;
- Concrete admixture;
- Flocculants;
- Adhesive;
- Release agent;
- Medical waste; and
- Effluent from work camps.

## ***Management and Mitigation***

NNP1 shall design facilities to ensure residents of the HSRA are able to properly store, handle and dispose of hazardous and non-hazardous wastes. NNP1 will train applicable HSRA residents in hazardous and non-hazardous waste containment, clean-up, disposal, and emergency preparedness and response. NNP1 will regularly audit contractors to ensure that contractor SS-ESMMP requirements for hazardous and non-hazardous waste are met during construction.

### ***Construction***

Waste management during construction will require several facilities (e.g. storage and separation area for recyclables, residue waste landfill for non-recyclables and non-hazardous materials, and / or a method of waste removal for disposal at primary NNP1 HPP landfill facilities. The management measures listed below and applicable measures from SP05 and SP06 (Appendix H) will be incorporated into SS-ESMMPs for HSRA construction.

#### ***Non-Hazardous Waste***

Waste management should be based on the following hierarchy (in decreasing order of preference):

1. Minimise the production of waste.
2. Maximise waste recycling and reuse.
3. Treatment of waste.
4. Ensure safe waste disposal.

The first priority for the management of non-hazardous wastes generated by the Project will be to reduce the volume of waste generated, which will be achieved by:

- Procuring supplies that produce less waste by virtue of the way they are produced, packaged or consumed;
- Procuring supplies that have been produced from recycled materials, if possible; and
- Maximising the efficiency of all on site production processes.

To maximise recycling and reuse, waste should be segregated accordingly at the location where they are generated:

- Biodegradable materials – vegetation and food scraps;
- Recyclable materials – processed timber; hard plastic; glass; metal; paper and cardboard; and tyres. Waste will be further segregated within this category, depending on the requirements of recycling contractors; and
- Non-hazardous residue waste.

Any non-hazardous residue waste that cannot be reused or recycled will be deposited in clearly marked, general litter bins located around the Project site. The Company will implement an education campaign for staff and contractors to minimise the generation of litter associated with Project activities. The following management measures will be incorporated into SS-ESMMPs for HSRA construction:

- Appropriate facilities and procedures for collecting, separating, storing and disposing of wastes will be provided prior to the commencement of site preparation and waste generation. Waste facilities will be inspected in advance of construction by the nominated Owner Environment Officer to ensure they are in accordance with Project requirements;
- Dedicated waste bins will be provided around the Project site in different colours according to waste/recycling type for separation and sorting of waste at source. Containers for hazardous waste and non-hazardous waste will be clearly marked to avoid confusion. Bins will be clearly visible, impervious to rain, and regularly checked to ensure waste removal is frequent enough. Regular

collection and disposal of wastes (by approved waste contractors) will be carried out to avoid overflowing of waste containers and storage facilities;

- Bins containing food waste will be secured with lids to prevent scavenging by birds and animals;
- The dumping of wastes into the natural environment will be strictly prohibited;
- NNP1 will ban burning of waste during construction;
- NNP1 will ensure designated waste disposal areas are regularly covered by soil to reduce potential for pollution and animal encroachment; and
- The landfill will be utilised for non-hazardous waste only.

#### *Hazardous Waste*

Project requirements for management, mitigation, monitoring and reporting (refer to Appendix H) will be implemented by NNP1 and its contractors, including:

- All chemicals and waste considered potentially hazardous materials will be registered (type, quantities stored, quantities used or generated, quantities moved from storage and to waste disposal) and the information logged in a register;
- Containers of hazardous materials or waste must be labelled accordingly, with date of storage / waste accumulation; the name of the material and its physical state (solid or liquid); the hazard characteristics of the waste (ignitable, corrosive, toxic, reactive); main danger for user (poison, burning, dangerous for eyes, skin, lungs, etc.), with MSDS posted on-site;
- Safety procedures applicable to the handling and use of hazardous materials will be established and become a part of the training program. Safety rules will be translated in Lao languages and printed on posters to be posted on the walls of the dedicated buildings where hazardous materials are to be used. Personal protective equipment (PPE) will be provided to concerned workers and the use of such equipment will be enforced;
- All refuelling of heavy equipment and machinery will be undertaken by a service vehicle, with appropriate safeguards and protection measures to prevent any spillage or contamination by chemical wastes or maintenance oils, lubricants etc. Safety procedures regarding fire and accidental spill management will be posted;
- Pesticides for vector control (mosquitoes) and for vegetation control will be utilized in accordance with: authorized pesticides, in accordance with the list approved by EMO (and Lao PDR decree); labelling and storage of pesticides will satisfy measures listed above; the translation of all information related to toxicity of pesticides, including user instructions, to commonly used Lao language(s); safe handling of pesticides will rely on training users; specific training programs and supporting communication materials will be supplied for this purpose;
- All the fuel and hazardous material storage will be adequately banded to prevent any spillage problem (refer to below). Maintenance shops, fuel and oil depot will be provided with impermeable flooring or sheets with sump where wash water and sludge can be collected for proper disposal;
- Only minimal chemicals, hazardous substances and fuel will be stored on site works, within an enclosed and covered secure area that has an impervious floor and impervious bund around it (with capacity at least 120% of the total capacity of the tanks). The storage area will be located away from watercourses, flood prone areas, offices and barracks/accommodation. Equipment maintenance areas and fuel storage areas shall be provided with drainage leading to an oil-water separator that will be regularly maintained to ensure efficiency;
- Oil stained refuse such as oily rags, spent oil filters and used oil shall be collected and disposed of through recyclers/authorized waste handlers and disposal in authorized waste facilities;

- Waste oil, used lubricant and other hazardous wastes will be stored in tightly sealed containers. Transport and off-site disposal of such wastes shall comply with applicable laws and regulations;
- Spill clean-up materials (e.g. absorbent pads, etc.) specifically designed for petroleum products and other hazardous substances will be available where such materials are being stored and used. If spills or leaks do occur, clean-up operations will commence immediately. Spill response kits will be located at the workshop(s) where the servicing will take place and also at the refuelling point(s);
- All personnel involved with refuelling and with the servicing of equipment will be familiar with the use of the spill response kits and will be trained in the emergency procedures as described in the Emergency Response for Hazardous Materials Sub Plan (ESMMP-CP and SS-ESMMP);
- Discharge of oil contaminated water into the environment shall be prohibited; and
- Restoration of temporary work sites shall include removal and treatment or proper disposal of oil contaminated soils.

Appendix H provides comprehensive management, mitigation and monitoring requirements for the NN1HPP for hazardous waste (SP06) and general waste management (SP05). Applicable measures from these ESMMP-CP sub-plans should be incorporated into SS-ESMMP to ensure contractual obligation for implementation.

### **Post-Construction**

#### *Non-hazardous waste*

Short-term non-hazardous waste storage and handling areas will comprise:

- A sorting area to separate material to be recycled, biodegradable materials, and non-recyclable residue. Clearly marked bins will be provided at the market, school, community hall, and at strategically located locations near residential areas;
- NNP1 will facilitate the designation of a licensed waste recycling / removal company and will work with the HSRA to identify funding mechanism post-NNP1 involvement;
- The landfill will be utilised for non-hazardous waste only - The facility will:
  - » Have the capacity for at least 5 years of waste disposal in the prepared landfill and space for a development of additional pits for a second 5 years. The landfill area should be selected based on suitability for expansion indefinitely.
  - » The landfills will be designed to ensure waste does not leach to groundwater, including consideration of groundwater elevations, lining of pits that will not allow seepage, and additional information.
  - » Will be covered with soil on a weekly basis to prevent scavenging and wind-blown rubbish.
- Rubbish bins will be clearly visible, impervious to rain, and regularly checked to ensure waste removal is frequent enough; and
- HSRA resident training will include waste management (recycling, rubbish bins, etc.), and implications of improper waste management (pests, disease, impacted water quality, etc.).

#### *Hazardous waste*

- Septic and greywater facilities must be designed to contain the anticipated volumes of wastewater produced in households, kitchen, and additional facilities and must include provision for managing potential septic tank overflows. Septic systems should either treat wastewater in-situ or should be open systems for periodic wastewater removal by a licensed operator;
- A designated facility should be designed for hydrocarbon storage in the HSRA, with minimum design criteria as per Construction phase, above (bundling, rain cover, concrete flooring);



- The hydrocarbon storage facility should be equipped with spill clean-up material (e.g. Sorbex or similar), with villagers' trained in spill prevention and clean-up;
- MSDS should be provided for all hazardous materials stored in the HSRA (in Lao and English), with storage, handling, and disposal of materials conducted as per MSDS or product labelling;
- Hazardous materials (including hydrocarbons) will not be disposed of in landfill facilities or receiving waters. A licensed service provider should be contracted to remove wastes from the site for transport to a designated facility;
- Fertilisers, dolomite, and other soil amendments should be stored in a designated facility, that is covered from rain, with flooring to prevent storage on soil surfaces;
- The soil amendment storage area should be located at least 50 m from any natural watercourses, with upstream sheet flow diverted around the facility;
- If pesticides / herbicides are utilised, only those certified for use in Lao PDR may be utilised. Pesticides / herbicides must be stored off the ground, in designated facilities covered from rain. The storage facility should be located at least 50 m from surface water; and
- HSRA residents will be trained in the proper storage, handling, and disposal of hazardous materials and hazardous wastes.

### ***Assessment of Impacts***

Construction phase impacts are expected to be limited to small volumes of construction excess and rubbish that are improperly disposed of. NNP1 will have to diligently audit contractors to ensure proper disposal of non-hazardous wastes. If storage facilities are properly designed and implemented, and the mitigation measures in SP06 and above applied, hazardous wastes should not provide significant impacts to the receiving environment during construction.

Post construction impacts will be largely depended on the suitability of storage and handling facilities, and the efficacy of training and awareness campaigns. It is anticipated that NNP1 will assist residents of the HSRA in protecting themselves and their environmental (refer to Appendix A).

## **7.2 Environmental Impacts and Mitigation Measures**

### **7.2.1 Terrestrial Biodiversity**

Impacts to terrestrial biodiversity will occur during construction and operations. However, high value biodiversity areas exist almost exclusively within the Nam Ngiep Nam Mang PFA portion of the HSRA. The primary physical disturbance to vegetative communities and habitat for terrestrial biodiversity, conducted within the Resettlement Development Site, will occur in heavily disturbed areas that have been recently subjected to slash and burn agriculture and livestock grazing.

Impacts within the PFA will be minimised by the prohibition of infrastructure development in the PFA and the sustainable management practices that will be prescribed for the area (refer to Appendix A).

Some indirect impacts to terrestrial biodiversity are unavoidable, as the fallow land in the RDS provides habitat for a number of terrestrial species. Additionally, resource extraction (TFP, NTFP, terrestrial species from hunting) will increase post-construction with the resettlement of up to 750 households to the HSRA.

### ***Issues and Findings***

#### ***Construction***

Construction phase impacts to terrestrial biodiversity will include:

- Permanent conversion of vegetated areas in the RDS to infrastructure (residential and agricultural), including 56 ha of disturbed Mixed Deciduous Forest, 112 ha of Upper Mixed Deciduous Forest / Bamboo mosaic, 7 ha of Bamboo Forest, 558 ha of Old Fallow, and 602 ha of Young Fallow (refer to Table 7-3);
- Impacts to terrestrial fauna are expected to be restricted to loss of marginal habitat; and
- Potential introduction or spread of invasive plant species during site preparations.

The majority of remnant patches of degraded UMD and UMDB forest in the RDS will be avoided during construction (refer to Figure 2-2). These ‘islands’ of natural forest will remain adjacent the paddy fields and housing development areas during construction. Future land use determination for these areas will be determined during PLUP. It is anticipated that they will be zoned for Conservation Forest, Utilisation Forest, or Spirit Forest.

Riparian forest along watercourses in the HSRA RDS will be protected with an exclusion zone (25 m on each side of perennial streams / 10 m on each side of ephemeral streams). Irrigation canals and water resource infrastructure will impact small areas of riparian vegetation, which will be revegetated following construction.

No HSRA infrastructure will be developed in the Nam Ngiep-Nam Mang National Protected Forest (PFA).

**Table 7-3 Permanent forest conversion area as a result of HSRA construction and operations<sup>^</sup>**

Land Use	Upper Mixed Deciduous Forest	Upper Mixed / Bamboo Mosaic	Bamboo Forest	Old Fallow	Young Fallow	Total
HSRA infrastructure (residential and water infrastructure)	-	6.65	-	104.46	172.52	<b>283.63</b>
Paddy fields	21.03	0.63	-	137.60	167.64	<b>326.90</b>
Upland agriculture	-	61.13	-	244.20	108.37	<b>413.70</b>
Plantations	-	31.97	2.52	45.28	97.22	<b>176.99</b>
Livestock grazing	35.27	11.93	4.43	26.35	55.77	<b>133.68</b>
<b>Total</b>	<b>56.30</b>	<b>112.31</b>	<b>6.95</b>	<b>557.89</b>	<b>601.55</b>	<b>1335.10</b>

Source: Earth Systems 2015

<sup>^</sup>Note – footprints of HSRA components do not equal actual size, only size vegetated areas impacted

### Post-Construction

Potential operations phase impacts to terrestrial biodiversity are expected to include:

- Conversion of 724 ha of primarily fallow / disturbed mixed deciduous forest resulting from upland agricultural activity, plantation establishment, and livestock grazing area implementation in the HSRA resettlement development area (refer to Table 7-3);
- Settlement adjacent the Nam Ngiep-Nam Mang National Protected Forest will lead to an increase in hunting and forest resource collection (i.e. TFP and NTFP) by villagers, potentially including threatened flora or fauna that are known to occur or may occur in the region; and
- Tree harvesting for firewood / construction material in the HSRA RDS may lead to losses of high value species, though this is considered unlikely to occur as the development area is primarily fallow.

## **Management and Mitigation**

### **Construction**

NNP1 will implement the following measures to minimise impacts to terrestrial biodiversity during construction:

- HSRA infrastructure, agricultural plots, and livestock areas will primarily be implemented on highly disturbed vegetation / habitat (primarily fallow);
- The area of vegetation clearance will be minimised during construction to that required for Project components (i.e. clearly delineating boundaries and ensuring personnel clear accordingly);
- The Project footprint will be surveyed by a qualified botanist during detailed design to identify threatened flora. Threatened plants / trees will be flagged, with GPS coordinates recorded. Plants / trees small enough for transplant will be relocated to a location at least 100 m from disturbance areas. Larger individuals will be avoided to the extent practicable;
- An inspection by a nominated NNP1 monitor will be conducted for each site prior to the commencement of vegetation clearance to ensure Project requirements for biodiversity management have been met. Official approval will be required by NNP1 before vegetation clearance works proceed;
- Road construction into the PFA will be prohibited;
- Hunting and NTFP gathering by NNP1 personnel and construction workers will be prohibited;
- The introduction and spread of invasive species will be minimised (refer to Section 7.2.2);
- Biodiversity management requirements for the Project will be included in the environmental training and awareness program for construction workers and contractors, including the ban on hunting/fishing/harvesting of NTFPs, vegetation clearance requirements, and the importance of protecting threatened species; and
- Vegetation clearance will be monitored by NNP1 to ensure it is conducted within approved areas and according to specifications identified in the SS-ESMMP.

It is recommended that NNP1 consider rehabilitating the remnant logging access roads in the PFA to limit potential future harvesting activities.

### **Post-Construction**

Terrestrial biodiversity will be sustainably managed through implementation of Total Protection Zones, Conservation Forests, and Utilisation Forests in the PFA and through sustainable management practices in the Resettlement Development Site (refer to INRMP, Appendix A).

NNP1 will conduct the following management and mitigation measures, post construction:

- NNP1 will educate villagers on priority threatened flora and fauna species in the region through an environmental awareness and training program. The program should include identification keys / photographs of threatened species and posters in the local language. The awareness program should focus on providing an understanding of the value of sustaining biodiversity in the region;
- Land use designations will be clearly defined following PLUP (during the training program), including sustainable resource collection practices for the PFA (including GOL statutory requirements for Conservation Forests and Total Protection Zones);
- NNP1 will rehabilitate and revegetate riparian buffer zones that were disturbed during construction of the HSRA infrastructure (e.g. river crossings, water intake conduits, environmental release conduits);

- Reforestation activities will be supported by NNP1 in collaboration with the Village Forest Group (VFG);
- NNP1 will monitor the implementation of management measures identified in Appendix A, and assess the effectiveness of the program. Where ineffective, adaptive management strategies will be implemented to successfully mitigate impacts; and
- NNP1 will conduct a comprehensive survey of Utilisation Forests to identify threatened species. Threatened species will not be harvested (refer to Appendix A).

### ***Assessment of Impacts***

Impacts to terrestrial biodiversity from construction of the HSRA will primarily be limited to removal of fallow vegetation and low to moderate level habitat for terrestrial fauna. Application of the management and mitigation measures prescribed above are expected to minimise construction phase impacts to less than significant.

The extent of post-construction impacts to terrestrial biodiversity will be contingent on the successful application of land zoning and prescription of management measures in the INRMP. High value biodiversity is in relatively difficult areas to access. By rehabilitating remnant logging roads in the PFA and implementing an awareness campaign, it is anticipated that impacts to threatened species and high value habitat will be minimised. The resettlement of up to 750 household in the HSRA will increase hunting and TFP / NTFP gathering in the PFA, which may impact species' populations / diversity over time.

## **7.2.2 Weeds and Pest Management**

### ***Issues and Findings***

Construction of the HSRA and resettlement of households is not expected to promote pests and diseases. However, vegetation clearance / earthworks will provide disturbed area for the spread of invasive plants, which already occur in the Resettlement Development Site. Plantations may be affected by various pests that damage common plantation species in Lao PDR.

Without careful management of invasive plants and animal / plant pests and diseases, the primary impacts to the HSRA, including the resettled villagers, may include:

- Spread of invasive vegetation into the PFA;
- Reduced yield and losses in crops and plantations;
- Losses in livestock, poultry and fish farm production;
- Cross-species transmission to local native fauna and flora; and
- Potential impacts on the livelihoods of local households;

### ***Invasive Plants / Weeds***

A number of non-native invasive plant species occur in the HSRA, primarily within the more highly disturbed areas of the Resettlement Development Site. These plants are pioneer species, able to establish and dominate disturbed areas that would otherwise be colonised by native pioneer species, typically providing lesser habitat value and often lesser nutrient value (as many pioneer species are nitrogen fixers). As these species are fairly widespread in the lower topography of the HSRA, they pose a threat of further establishment following vegetation clearance in the HSRA for construction and annual / periodic clearance for crop production as well as encroachment on more pristine habitat following timber harvest. The introduction of construction vehicles provides the potential for introduction of new weed species.

### ***Crop Pests***



A number of pests occur in Lao PDR that are widely known to damage crops and plantation trees potentially relevant to the HSRA. These include pests / pathogens that damage Teak, Acacia, Eucalyptus, and a number of fruiting trees including Mango and citrus trees.

Rodent pests such as rats and mice have been reported to pose a significant problem for crop production as agricultural pests (particularly for rice cultivation) by eating newly planted crops as well as pre- and post-harvest grains. This can result in significant economic and livelihood losses for cultivators if rodent populations are not adequately controlled (ACIAR 2015a; Earth Systems 2015b).

#### *Livestock Pests and Diseases*

Frequent outbreaks of disease and pests in buffalo, cattle, chickens, pigs and fish have been documented in the Bolikhamxay province and Bolikhan district, including instances of foot-and-mouth disease virus in ruminants and pigs, classical swine fever virus, and avian influenza virus in bird populations (including poultry) (ACIAR 2015b). These contagious diseases spread readily if not adequately managed, and pose a threat to farmers in the region as well as to the local biodiversity (via cross-species transmission). Outbreaks are generally found to be the result of the introduction of infected stock, the localised movement and trade of infected animals and plants, and possibly through the importation of contaminated products (ACIAR 2015c).

### **Management and Mitigation**

#### **Construction**

##### *Invasive Plants*

The following management measures are recommended to minimise the introduction or spread of invasive plants during construction:

- Topsoil and vegetation (for mulching) removed from an area during site-clearance activities will be reused only in that area and landscaping / re-vegetation will utilise locally native species;
- Cleaning area for tools, equipment, and vehicles that will be transported to the HSRA for construction will be designated and utilised. Cleaning areas should be located away from waterways, sensitive habitats, and should be near areas already infested with invasive plants; and
- Plantation species must be non-invasive. For example, utilise known sterile stock of otherwise potentially invasive tree species (e.g. eucalyptus clones currently used in Lao PDR).

#### **Post-Construction**

##### *Invasive Plants*

An invasive species management plan should be developed for agricultural plots in the HSRA. This may include ploughing or herbicide applications. Herbicide can be applied in an environmentally and socially responsible manner given selection of appropriate herbicides (e.g. those that do not impair aquatic biota or habitat), application at the appropriate time of year (generally with respect to rain), and strict adherence to product labels and MSDS (i.e. PPE and disposal of containers) as well as GOL legislation for banned chemicals.

##### *Pests and Diseases*

Pest and disease management within the HSRA will be achieved through the application of an *Integrated Pest and Disease Management Program* targeting village animal production and agricultural systems. The program will include surveillance, diagnosis, and preventative and control measures, which are further described in the INRMP (Appendix A). NNP1 will work with PAFO / DAFO, the Department of Livestock and Fisheries, and resettled villagers to implement the Program.

## **Assessment of Impacts**

### *Invasive Plants*

The introduction and spread of invasive plants can be effectively managed. Weed species that already occur in the HSRA will not be eradicated, but implementation of measures to avoid the introduction and spread of weeds and application of eradication measures in upland farming plots and plantations will minimise impacts for terrestrial habitat and limit potential losses to crop yields.

### *Pests and Diseases*

Avoidance and minimisation of pests and diseases will rely on the development and effective implementation of the *Integrated Pest and Disease Management Plan*, community awareness and education campaigns, and reporting systems. These issues will be the primary responsibility of the Village Forestry Group, in coordination with PAFO, DAFO, DLF and NNP1. If management measures are widely promoted, the potential for impacts to livelihoods will likely be reduced in comparison to pre-resettlement conditions.

## **7.2.3 Aquatic Habitat and Biology**

### **Issues and Findings**

Aquatic habitat, aquatic species, and fish migration in the HSRA will be moderately to highly impacted, with the severity of impacts relative to the stream location and the section of stream. Impacts to habitat and aquatic biology will occur throughout construction and operations, with the greatest potential for impacts during operations.

Impacts to fish populations, species diversity (potentially including a number of threatened species), and fish migration may be particularly significant (for the Houay Soup), if design / management regimes do not provide for environmental flow regimes (Section 7.1.2) and fish passage on Houay Soup Noi and Ngai. However, on a regional / global scale, impacts to fish population from HSRA development and inhabitation will be minor (i.e. primarily for the Houay Soup and its tributaries) and from increased fishing pressure in HSRA streams.

### **Construction**

Impoundment of the Houay Soup Noi for irrigation and domestic water supply intake from the Houay Soup Ngai may dry the lower reaches of these streams during the dry season (eliminating aquatic flora and fauna) and may block upstream migration for spawning fish during the rainy season. In addition, the irrigation canals for rice paddies will cross the Houay Soup channel. Final design of irrigation canals has not yet been completed with respect to their intersection with the Houay Soup and the effect on downstream flow.

Implementation of the Environmental Flow regime described in Section 7.1.2 would provide baseflow throughout the year with additional flow added to the system when water levels in the Irrigation Reservoir activate the spillway. Additional water will flow into the Houay Soup Noi and Houay Soup Ngai from tributaries downstream of the reservoir dam / domestic water supply intake during the rainy season.

### **Post Construction**

Impacts to aquatic biodiversity may be significant post-construction, as follows:

- Migratory fish may be unable to reach upper reaches of Houay Soup tributaries and ephemeral streams of the HSRA, potentially cutting off spawning grounds (pending final design);
- Decreased flow in the Houay Soup Noi and Houay Soup Ngai will impact habitat, likely providing water for lesser fish populations and possibly impacting the diversity of aquatic biota. Decreased flow may also impact aquatic vegetation, indirectly impacting aquatic organisms' breeding, hiding from prey, etc. These impacts will be significant without implementation of an environmental flow;

- Fishing / aquatic resource collection in each of the HSRA streams (primarily Houay Khinguak Ngai, Houay Soup Noi, Houay Soup Ngai and Houay Khinguak Noi) and wetlands (Nong Pa and Nong Da) is expected to increase, with corresponding impacts to aquatic species' populations and species composition;
- Water from the Nam Ngiep Re-regulation Reservoir will be used to fill the irrigation reservoir. Water from the Re-regulation Reservoir, released to Houay Soup Noi via environmental flow or via the spillway, may have low dissolved oxygen concentration, potentially impacting the health of aquatic organisms in the Houay Soup Noi; and
- Use of the Irrigation Reservoir for aquaculture will allow for fish escape into the wild. If non-native species are used, this may impact native fish populations and species composition.

### **Management and Mitigation**

#### **Construction**

The following are recommended to minimise impacts to HSRA aquatic habitat and aquatic biology during design / construction:

- Prohibit NNP1 personnel and contractors from fishing / aquatic resource collection in the HSRA;
- Provision of an environmental flow regime for the Houay Soup Noi and Houay Soup Ngai that allows at least baseflow conditions to bypass the Irrigation Dam / domestic water intake. This may be achieved by:
  - » Providing adequate water volume to the Irrigation Reservoir from the Re-regulation Reservoir throughout the year to allow baseflow during the dry season (while maintaining at least minimum operating level in the Irrigation Reservoir) to activate the Irrigation Dam spillway during the rainy season to provide greater flow for fish migration;
  - » Construction Option 2 for domestic water supply (refer to Section 2) to replace Houay Soup Ngai intake with water from the Houay Soup Noi Irrigation Reservoir; and
  - » Consider constructing a larger water holding tank for domestic water supply to allow intake only during the rainy season to provide for annual domestic water requirements.
- Design irrigation canals to allow natural Houay Soup Noi and Houay Soup Ngai flow to pass beneath the canals (e.g. piped across channels);
- Prohibit construction, diversion, etc. on Houay Khinguak Ngai, Houay Khinguak Noi, and ephemeral streams of the HSRA (to the extent practicable for ephemeral streams intersected by irrigation canals);
- Implement the aquaculture pond in the Irrigation Reservoir to provide fish for HSRA villagers. It is anticipated that this will offset some of the fishing pressure on HSRA streams; and
- Design aeration structures (rip-rap in channels / drop-offs, etc.) in the channel that conveys water from the Re-regulation Reservoir to the Irrigation Reservoir to increase dissolved oxygen concentrations.

#### **Post-Construction**

The following are recommended to minimise impacts during post construction:

- Support the GOL and the HSRA community through implementation of the INRMP;
- Ensure management measures identified for design / construction phase continue throughout operations;

- Train village members in sustainable aquaculture to ensure the pond maximises yield per resident, minimising the need for fishing HSRA streams; and
- Utilise fish species native to the Nam Ngiep River for stocking the aquaculture pond / Irrigation Reservoir. Stress the importance of raising only native fish to HSRA residents during training and convey the potential impacts of non-native fish escape.

### **Assessment of Impacts**

The potential for impacts to aquatic habitat downstream of the Houay Soup Noi Irrigation Dam and the Houay Soup Ngai domestic water intake are significant. The implementation of a continuous environmental release (minimum of baseflow), and provision of a bypass conduit for migratory fish should minimise impacts to aquatic biology to low – moderate. Designing irrigation canals that pipe water past the natural stream channels will allow for the ongoing existence of aquatic habitat and migratory stream channels.

Implementation of the aquaculture pond will reduce fishing / other aquatic resource collection from HSRA streams. However, fishing pressure will increase with resettlement into the area, and moderate to significant impacts are anticipated.

## **7.3 Social Impacts and Mitigation Measures**

### **7.3.1 Land, Assets and Agricultural Livelihoods**

#### **Issues and Findings**

- The establishment and development of the HSRA will result in the allocation of 6,108 ha including 2,393 ha of land for resettlement development for up to 750 households from the five (5) resettlement communities that will lose land and assets due to the creation of the NN1HP main and regulation reservoirs;
- A section of the HSRA will be established on land currently allocated to the three (3) host communities of Ban Hatsaykham, Ban Hat Gniun and Ban Somseun. This will result in the loss of 2191.09 ha of productive land for these host communities (refer to Table 7-4);
- No settlement areas or permanent structures (with the exception of the NNP1 demonstration farm) have been identified within the proposed HSRA however a number of temporary agricultural huts exist;
- A substantial percentage of the current village lands (PONRE Bolikhamsay 2012) of Ban Hatsaykham (63%) and Ban Hat Gniun (69%) will be lost to the HSRA development. Approximately 2,171 ha in the proposed HSRA is currently an agricultural zone for villagers in Ban Hatsaykham and Ban Hat Gniun. Agricultural livelihoods of up to 113 households and 688 people will be impacted. According to village surveys, land use analysis (Earth Systems 2015b) and initial land and asset surveying (NNP1 2014d) this is estimated to include:
  - » Three (3) households who will lose 8.46 ha of rice paddy fields which produce on average 4.6 tonnes / ha of rice annually;
  - » 110 households who will lose 2161 ha of land currently used for permanent and shifting cultivation. Currently each household cultivates an average of 3-5 ha per year, with annual rice yields ranging from 1-4 tonnes / ha and a production of other crops (yields not calculated);
  - » Three (3) household who will lose 1.81 ha of young plantations (planted 2012); and
  - » 25 households who rear approximately 250 head of cattle on agricultural fields and on grasslands within the HSRA.



- A small percentage (8%) of Ban Somseun's village land will be lost due to the HSRA development. Approximately 345 ha of the affected land area is currently used for agricultural activities. Approximately 27 households and 135 people derive livelihoods from these activities. According to village surveys, land use analysis (Earth Systems 2015b) and initial land and asset surveying (NNP1 2014d) this is estimated to include:
  - » Between two (2) and five (5) households who will lose a total of 1.28 ha of rice paddy fields (note village surveying indicates a larger area of up to 8 ha) which produce between 2.8 to 5.4 tonnes / ha of rice annually.
  - » 27 households who will lose 343.51 ha of land currently used for permanent and shifting cultivation. Currently each household cultivates an average of 5 ha per year, with annual rice yields ranging from 2.8 to 5.4 tonnes/ha and a production of other crops (yields not calculated).
  - » Nine (9) households who will lose will lose access to agricultural fields and grasslands within the HSRA used to rear approximately 50 head of cattle.
- Proof of ownership of individual land parcels is limited. Some information is held in village land logs and to a lesser extent tax receipts, however the majority of land has been allocated through informal systems without clear documentation;
- The potential loss of land in Ban Hatsaykham, Ban Hat Gniun and Ban Somseun is compounded by reductions in the total village land areas completed in 2012 after the establishment of the PFA and other land impacts caused by the Main Project;
- The village boundaries of Ban Thaheua, previously identified in the REDP (NNP1 2014b) as an HSRA host community, are not affected by the proposed HSRA and no households from this village use the area for agriculture cultivation;
- Hatsaykham has agreed to relocate to the proposed HSRA and therefore will benefit from the proposed resettlement development and livelihood development program. Ban Hat Gniun and Ban Somseun will not be relocated and require other forms of compensation and livelihood restoration; and
- NNP1's REDP outlines compensation and livelihood restoration commitments for host and resettlement communities. However the identification of significant land loss for Ban Hat Gniun and PAPs from Ban Somseun will require re-evaluation of mitigation measures.

### ***Management and Mitigation***

#### ***Construction***

NNP1 will implement relevant management and mitigation measures outlined in the REDP (NNP1 2014b). Key measures will include:

- Completion of land (and asset) compensation activities before commencement of construction activities in accordance with the REDP (NNP1 2014b);
- Implementation of livelihood restoration activities for PAPs ensuring that:
  - » PAPs remain at the same or better level than before the Project;
  - » Impacted households are elevated above the National Poverty Line; and
  - » Significantly impacted communities increase the average community income to 200% of their baseline income ten years after COD.

NNP1 will implement the following additional management and mitigation measures:

- Recognise the significant loss of productive land in Hat Gniun and PAPs from Ban Somseun and implement measures outlined in the REDP (and livelihood restoration plan) accordingly.

Consideration should be given to replacement land and / or development of alternative livelihoods in line with the Project's policy on 'significantly impacted households' (NNP1 2014b).

### ***Post Construction Period***

- NNP1 will implement livelihood restoration activities for PAPs in accordance with the REDP (NNP1 2014b) for 10 years following the pre-construction period of the Main Project (December 2013) or five (5) years of a stabilisation phase after COD.

### ***Assessment of Impacts***

The allocation of lands for the HSRA will allow for the development of a settlement and productive lands that will facilitate compensation and livelihood restoration (NNP1 2014b) for households directly affected by the inundation of the NN1HP reservoirs.

The establishment and development of the HSRA will result in the loss of land currently allocated to Ban Hatsaykham, Ban Hat Gniun and Ban Somseun. A substantial percentage of the total village lands of Ban Hatsaykham (63%) and Ban Hat Gniun (69%) will be lost to the HSRA development. The affected land area includes agricultural and cattle grazing zones for these communities. Households from Hatsaykham will be compensated through resettlement to the HSRA. Households from Hat Gniun and Ban Somseun who will not be resettled will be provided with compensation. Effective implementation of the REDP and additional management and mitigation measures outlined above are expected to result in fair and adequate compensation for all PAPs from these communities.

**Table 7-4 Summary of Impacted Lands**

Village / Community	PFA							RDS and PAA							% of Total Village Land
	Rice Paddy	Other Ag Areas*	Plantations	Grassland	Forest Areas^	Other	TOTAL	Rice Paddy	Other Ag Areas*	Plantations	Grassland	Forest Areas^	Other	TOTAL	
Ban Hatsaykham		553.67		46.17	628.58	45.06	1273.47	1.43	453.45		2.99	117.70	3.04	578.60	63%
Ban Hat Gniun		45.29			50.80	1.35	97.44	7.03	1108.88	1.81		75.91	3.05	1196.67	69%
Ban Somseun								1.28	343.51			69.38	1.64	415.81	8%
<b>TOTAL</b>		<b>598.96</b>		<b>46.17</b>	<b>679.38</b>	<b>46.41</b>	<b>1370.91</b>	<b>9.74</b>	<b>1905.84</b>	<b>1.81</b>	<b>2.99</b>	<b>262.99</b>	<b>7.73</b>	<b>2191.09</b>	<b>40%</b>

Source: Earth Systems 2015b

\*includes cleared land, permanent fields, shifting cultivation and fallow areas

^ includes UMD Forest, UMD/Bamboo Mosaic, Bamboo, Riparian Forest

## 7.3.2 Forest Resource Use

### *Issues and Findings*

- The HSRA will include 3,715 ha of PFA which will be zoned in accordance with PM Decree 333 on National Protected Forests (2010) and managed sustainably through the implementation of the *Integrated Natural Resource Management Plan* (Appendix A). This has the potential to protect and enhance the forest and forest resources within the HSRA, benefiting resettled communities;
- The establishment of the HSRA (RDS and PFA) will result in the loss of or loss of access to forest habitats and agricultural landscapes currently used by villagers in Ban Hatsaykham, Ban Hat Gniun, Ban Somseun and surrounding communities as sources for NTFPs, TFPs and wildlife. Forest resources are important in the daily life of these villagers as an important food source and for construction. NTFPs and wildlife are an important food source for villagers, although due to improved access over the last year (for Ban Hatsaykham and Ban Hat Gniun) more income is expected to be derived from these products. Timber products are reportedly mostly used in the communities however it is also likely that these are sold to outsiders;
- The loss of areas currently used for TFP/NTFP harvesting and hunting within the HSRA is compounded by the loss of access to forest resources resulting from the establishment of the PFA in 2012. Potential impacts to forest resource use as a result of the HSRA are also compounded by the potential impacts of the Main Project (i.e. habitat loss and workforce; see SIA (NNP1 2014a);
- The presence of the workforce (construction) and new resettled community (post-construction period) has the potential to result in increased hunting and collection of forest resources. In the absence of effective management, this would result in a reduced availability of forest resources in the wider area;
- NNP1's REDP outlines compensation and livelihood restoration commitments for host and resettlement communities (with the exception of Ban Somseun). These include intensive rice and crop cultivation, intensive livestock rearing, commercial plantations and NTFP domestication activities. These activities, restricted to the RDS are expected to eliminate agriculture activities occurring within the PFA, which will allow disturbed forest to generate and enhance the availability of forest resources, also benefiting resettled communities; and
- NNP1's INRMP and WMP are currently being drafted. A key factor for the sustainable management of the HSRA (PFA) is community forest management. NNP1 is currently negotiating with the GOL for community use rights for resettled villagers in this area and the inclusion of the HSRA under the Project's Watershed Management Plan.

### *Management and Mitigation*

#### *Construction*

NNP1 will implement relevant management and mitigation measures outlined in Sections 7.1 and 7.2 and the REDP (NNP1 2014b). Key measures will include:

- Management of terrestrial biology resources as outlined in Section 7.2.1; and
- Implementation of resettlement and livelihood restoration activities for PAPs from host communities and resettlement communities in accordance with REDP (NNP1 2014b) including:
  - » Intensive rice and crop cultivation, intensive livestock rearing, commercial plantations and NTFP domestication activities; and
  - » Conduct of participatory land use planning in the HSRA and surrounding host communities identify, zone and plan for remaining forest resources in these communities.



NNP1 will implement the following additional management and mitigation measures:

- Recognise the loss of forest resources and potential for significant loss of forest resource based livelihoods for the residents of Hat Gniun, Ban Somseun, and surrounding communities and update the REDP giving further consideration to the type and adequacy of compensation measures. In addition to livelihood restoration activities outlined in the current REDP, NNP1 will work with GOL authorities to secure community use rights to PFA areas previously within these village boundaries (pre 2012) and not within the HSRA; and
- Coordinate the GOL and resettled communities to finalise the INRMP for the HSRA (RDS and PFA) and ensure that:
  - » Community use rights for the HSRA (PFA) are formally secured through engagement with GOL authorities and the implementation of the participatory land use planning process
  - » the HSRA is included within the NN1HP watershed; and
  - » Measures outlined in the INRMP are considered in the drafting of the Watershed Management Plan.

### **Post Construction**

- NNP1 will implement forest resource livelihood restoration activities for PAPs in accordance with the NNP1 REDP for 10 years following the pre-construction period of the Main Project (December 2013) and for up to five (5) years during a stabilisation phase after COD; and
- NNP1 will support the implementation of the INRMP for the HSRA until the end of the concession (27<sup>th</sup> year of operation).

### **Assessment of Impacts**

The establishment of the HSRA (and within this the PFA) and successful implementation of the management and mitigation measures in this IEE, REDP (NNP1 2014b), INRMP (Earth Systems 2015b) and draft Watershed Management Plan (NNP1 2015) is expected to provide resettled villagers with a sustainable supply of forest resources.

The key potential impact is the loss of access to agricultural landscapes and forests currently utilised by host communities for forest resource based livelihoods. Villagers in Hatsaykham will be relocated and will benefit from the establishment of the HSRA and sustainable management of forest resources. The forest resource based livelihoods of villagers from Ban Hat Gniun and Ban Somseun are expected to be restored or supplemented through effective implementation of livelihood restoration programs in these respective communities and the provision of community use rights to other areas within the PFA, and support for the management of these areas.

## **7.3.3 Fisheries and Aquatic Resource Use**

### **Issues and Findings**

- The development of the RDS (including irrigation and domestic water infrastructure) has the potential to impact natural fisheries and aquatic resources in the HSRA (refer to Section 7.2.3);
- Resettled villagers are expected to benefit from community use rights to and sustainable management of the remaining natural waterways (and fish and aquatic resources), however, the increase in fishing pressure may reduce fish populations. Resettled communities are also expected to benefit from the establishment of aquaculture schemes (i.e. stocking of the Irrigation Reservoir);
- Fisheries and aquatic resources sourced from within the HSRA and the Nam Ngiep River are an important livelihood for host villagers in Ban Hatsaykham, Ban Hat Gniun and Ban Somseun (and other surrounding communities) both for consumption and sale. The establishment of the HSRA has

the potential to impact these livelihoods, both through the impact of the RDS on waterways and aquatic resources and the assigning of common use rights to resettled villagers which restrict access for host communities (and surrounding communities); and

- Impacts to fisheries and fish / aquatic resource based livelihoods are likely to be compounded by the potential long-term impacts resulting from the main NN1HP including the damming of the Nam Ngiep River. There may be a short term 'windfall' for host communities and resettled communities who benefit from increased availability of fish who are prevented from migrating upstream.

### ***Management and Mitigation***

#### ***Construction***

NNP1 will implement relevant management and mitigation measures outlined above and in the REDP (NNP1 2014b). Key measures will include:

- Protection of aquatic habitat via implementation of the environmental flow regime on Houay Soup Noi and Houay Soup Ngai (refer to Section 7.1.2); retention and / or revegetation of riparian vegetation (refer to Section 7.2.1); and management of water quality (refer to Section 7.1.3);
- Prohibition of NNP1 / contractors from fishing HSRA streams during construction;
- Implementation of resettlement and livelihood restoration activities for PAPs from host communities and resettlement communities in accordance with REDP (NNP1 2014b) including:
  - » Aquaculture programs including the provision of fingerings, ponds/cages and feeds and training;
  - » Fisheries co-management; and
  - » Substitute livelihood activities (i.e. livestock development).

NNP1 will implement the following additional management and mitigation measures:

- Development aquaculture specifically within the HSRA Irrigation Reservoir and support resettlers in managing it effectively.

#### ***Post Construction***

- NNP1 will implement fisheries and aquatic resource livelihood restoration activities for PAPs in accordance with the NNP1 REDP for 10 years following the pre-construction period of the Main Project (December 2013) and up to five (5) years of a stabilisation phase after COD.

### ***Assessment of Impacts***

Long term demining of the Nam Ngiep River and development of infrastructure in the RDS and fishing pressure in the HSRA will significantly reduce the availability of natural aquatic species. The effective implementation of aquaculture schemes is expected to partially offset this loss. Other substitute livelihood restoration activities are expected to reduce dependency on fisheries for consumption and sale.

## **7.3.4 Vulnerable People**

### ***Issues and Findings***

- A number of vulnerable households have been identified in each of the host and resettlement communities. These includes households with a widowed/female head; elderly / infirmed with no support; disabled members; and households deemed 'absolutely poor'. Other vulnerable groups identified include ethnic minorities (i.e. predominately Hmong resettlement communities), women and PAPs without legal title to land and or property; and

- Due to their vulnerability, there is potential for these households and groups to experience greater impacts or receive less benefits as a result of the establishment and development of the HSRA.

#### ***Management and Mitigation***

- NNP1 will implement specific measures for vulnerable people accordance with REDP (NNP1 2014b) and other social development plans including the Project's Livelihood Restoration Plan and Cultural Awareness / Heritage Preservation Action Plan.

#### ***Assessment of Impacts***

A number of vulnerable households and groups have been identified in host and resettlement communities. The successful implementation of specific measures for vulnerable people outlined in the REDP (NNP1 2014b) and other social development plans are expected to mitigate potential impacts and enhance benefits for vulnerable people, resulting in improved conditions.

### **7.3.5 Benefits to Host Communities**

#### ***Issues and Findings***

- Residents of Ban Hatsaykham will be relocated to the HSRA and will benefit from the establishment and development of the HSRA (refer to Section 7.3.6). Residents from Ban Hat Gniun will benefit from the development of infrastructure in the HSRA and also from a specific program to upgrade in-village infrastructure;
- While PAPs from Ban Somseun will receive compensation and livelihood restoration support, they are not expected to directly benefit from the development of the HSRA;
- Residents from Ban Hat Gniun, and to a lesser extent Ban Somseun may receive indirect benefits from further development of the surrounding area including improved infrastructure and services and development of the local economy; and
- The REDP (NNP1 2014b) while noting the potential indirect benefits does not outline measures to ensure these indirect benefits are maximised.

#### ***Management and Mitigation***

NNP1 will update the REDP to include measures for ensuring indirect benefits from the HSRA development are maximised including:

- Support the GOL to update socio-economic development plans (and cluster plans) for the local area including the HSRA and surrounding communities.

#### ***Assessment of Impacts***

With the effective implementation of the contractor SS-ESMMP, REDP (NNP1 2014b), INRMP (Earth Systems 2015b) and additional measures outlined above, host communities are expected to experience minimal indirect benefits from the development infrastructure and services in the HSRA and the surrounding area.

### **7.3.6 Benefits to Resettlement Communities**

#### ***Issues and Findings***

- Residents of the resettlement communities which choose to relocate to the HSRA are expected to benefit from the establishment and development of the area (in addition to compensation and livelihood restoration measures);

- Direct benefits are likely to include access to the Project community development program; raising income and housing to national standards; improved in-village services and infrastructure (i.e. education, health, roads, electricity); and support for the management of natural resources through the INRMP and the potential use of the NNP1 watershed management fund; and
- Indirect benefits are likely to include better access to district and provincial services; reduced UXO risk; and increased monitoring / oversight (from GOL and Project financiers) regarding the successful development of the area.

### ***Management and Mitigation***

- NNP1 will implement culturally appropriate benefits for resettlers in accordance with REDP (NNP1 2014b); and
- NNP1 will update the REDP to include measures for ensuring indirect benefits are maximised including support to the GOL to update socio-economic development plans (and cluster plants) for the local area including the HSRA and surrounding communities.

### ***Assessment of Impacts***

With the effective implementation of the REDP (NNP1 2014b), INRMP (Earth Systems 2015b), and additional measures outlined above, resettlers are expected to experience moderate direct and indirect benefits from the development infrastructure and services in the HSRA and the surrounding area.

## **7.3.7 Cultural Heritage and Archaeology**

### ***Issues and Findings***

- No archaeological and culturally significant sites of national and regional importance have been identified within the HSRA;
- One local culturally significant site was identified within the HSRA: a sacred rock near Houay Thamdin. Anecdotal evidence indicates that the site is considered an important place respected by local villagers. One cemetery was identified in the north east corner of the HSRA, however, this cemetery is located outside the HSRA;
- There is potential for proposed construction activities to cause adverse impacts to yet to be identified sites or places of cultural heritage value within the HSRA during the Construction phase; and
- There are no natural sites of international or national significance in the HSRA. However a number of natural sites of local significance or aesthetic value exist in the area (i.e. caves and waterfalls).

### ***Management and Mitigation***

#### ***Construction***

NNP1 will implement management and mitigation measures outlined in the REDP (NNP1 2014b) and other social development plans. The following measures will be implemented during construction:

- Construction activities will avoid impacts on known sites of cultural or religious significance;
- NNP1 will implement a Chance Find Procedure, adhering to the following steps:
  - » The contractor will cease operations where artefacts / archaeological finds are discovered;
  - » NNP1 will consult with the Head of Village and Culture and Tourism Administration Office for advice regarding next steps; and
  - » The contractor will resume work only after provision of official notification by the Culture and Tourism Administration Office.



- Contractors will be trained to identify potential sites or artefacts of cultural significance. Personnel will be trained in the reporting protocol and communication procedures stipulated in the Chance Find Procedure;

### ***Post Construction Period***

NNP1 will ensure the protection and management of identified cultural and natural heritage during the post construction period through the implementation of the INRMP (Earth Systems 2015).

NNP1 will monitor for instances where identified cultural and natural heritage sites within the HSRA have been encroached on, destroyed or damaged by human or natural causes, for which immediate protective measures shall be implemented to maintain the identified natural heritage values in coordination with the local cultural heritage administration via official notification.

### ***Assessment of Impacts***

No globally or regionally significant cultural or archaeological sites have been identified in the area. A number of locally important cultural sites / natural assets have been identified. The implementation of management and mitigation measures outlined above and in the REDP (NNP1 2014b) and INRMP (Earth Systems 2015b) are expected to effectively manage these sites and any chance finds during the construction and post construction periods.

## **7.3.8 Noise and Vibration**

### ***Issues and Findings***

#### ***Construction***

The existing acoustic environment of the HSRA is typical of a rural setting in Lao PDR, which is dominated by natural sounds (e.g. birds, insects, wind, etc.) and noises from farming and forestry activities, with low levels of transportation throughout the area. Construction works will generate noise and vibration during site preparation, earthworks, installation of facilities, road construction, etc.

No settlements are located within the HSRA and the surrounds are sparsely populated. At the onset of construction, sensitive receptors are expected to be limited to the construction workforce as the nearest settlements - Ban Hatsaykham and Ban Hat Gniun are ~1.0 and 2.6 km from the HSRA construction footprint, respectively. Upon resettlement of Ban Hatsaykham in approximately April, 2016, noise and vibration may provide nuisance level impacts to resettled villagers, as infrastructure construction will continue for 1-2 years.

Noise levels are not expected to exceed the Project guideline (i.e. National Environmental Standards of Lao PDR, 2009) for Maximum Sound Level (115 dB(A)), but will likely exceed ambient noise standards (55 dB(A) during daylight hours for residential areas), which will provide nuisance level disturbance for resettled Ban Hatsaykham villagers. Construction workers may also experience short-term nuisance levels of noise when construction activity occurs in the vicinity of the temporary work camp.

Due to the specified works being conducted (i.e. no blasting), vibration impacts are expected to be negligible.

#### ***Post-Construction***

Post-construction phase impacts from noise and vibration will be limited to villagers' activities, and are therefore considered negligible with respect to NNP1 operations.

## **Management and Mitigation**

### **Construction**

Key noise management and mitigation measures during the construction phase include the following:

- As much as possible, noisy construction activities will be limited to daytime when within 200 m of a community settlement (i.e. resettled Hatsaykham village). Otherwise, potentially affected people will be notified and suitable noise attenuation measures shall be implemented. Potentially affected residents near construction activities will be informed of scheduled commencement and completion dates, hours of activities and noise reduction measures to be implemented prior to the commencement of noisy activities;
- The siting of noisy activities and equipment shall consider natural buffers (e.g. hills) and / or the potential to install barriers around the source to reduce noise levels at nearby receptor sites where siting options exist;
- The proposed siting of noise sources that can be located at the discretion of the Project (i.e. not site-dependant) will be reviewed by the NNP1 Site Manager. This officer shall either approve the proposed sites of noisy activities or request the Contractor to consider alternative sites;
- Stationary noise sources (e.g. generators) that generate noise levels well above background levels (i.e. 45 dB(A) and above) shall be set back as far as possible from dwellings, workforce camps, schools, offices, businesses and other receptor sites;
- During school examination periods (following relocation of Ban Hatsaykham), noisy construction activities will be avoided near schools. The contractor will closely coordinate with the school administration on construction schedules to ensure that noise level from site works will be adequately mitigated so as not to be disruptive during school hours;
- Extended idling of construction vehicles will be avoided near sensitive receptors;
- Vehicles will be restricted to designated routes / areas and speed limits will be enforced, particularly near settlements and other sensitive receptors;
- Appropriate personal protection equipment (PPE) will be provided to construction workers for noise protection; and
- The Project Grievance Redress Mechanism (GRM) will be implemented for the community to submit noise / vibration related complaints. If complaints are received about excessive noise levels in the vicinity of communities, the Owner will consult with the complainant to identify appropriate additional mitigation measures (e.g. additional shielding, change of equipment type, restriction of construction hours in particular area) to be implemented.

### **Post-Construction**

Where appropriate, NNP1 may continue to implement relevant noise measures during the operations phase through the GRM. Additional noise measures may be developed in accordance with the IFC Noise Management Guidelines (IFC 2007).

### **Assessment of Impacts**

Noise and vibration during early construction works will not impact sensitive receptors on the left bank (opposite side) of the Nam Ngiep River. With the resettlement of Ban Hatsaykham in April 2016, during HSRA construction, it is anticipated that these villagers will be exposed to nuisance level noise impacts and negligible impacts from vibration.

These impacts will be minimised through application of the prescribed management and mitigation measures (primarily restricting work to daylight hours) and expected to be low to moderate at times for noise and low for vibration.

## 7.3.9 Air Quality

### *Issues and Findings*

#### *Construction*

Prior to the first phase of relocation (April 2016) air quality impacts are expected to be isolated to construction personnel.

Following relocation of Ban Hatsaykham residents, particulate matter (dust) emissions from transportation on unsealed roads, site preparation for paddy fields, and site preparation for residential infrastructure may be a nuisance for residents, particularly during the dry season.

Air quality impacts from vehicle and additional exhaust emissions are not expected to be significant with adequate measures in place.

#### *Post-Construction*

Post-construction, increased traffic on unsealed roads and intensive soil cultivation in the HSRA are expected to result in dust impacts to sensitive receptors (i.e. the relocated community). Moreover, further nuisance may occur from fires in the HSRA (although burning of waste and shifting cultivation are intended to be eliminated).

The main road will be sealed, preventing what would otherwise be the most likely contributor to airborne particulate matter during operations.

### *Management and Mitigation*

#### *Construction*

NNP1 and the Construction Contractor will implement a comprehensive emission and dust control plan to protect the local air quality. Implementation of these measures will be particularly important following resettlement of Ban Hatsaykham (April 2016) while construction of the remainder of the HSRA continues. Key measures include:

- Contractors will be supplied with appropriate PPE (i.e. masks) during the dry season;
- Dust suppression and control methods (e.g. regular water sprays) will be employed for dust-generating activities (e.g. quarry sites, earthworks, road construction, etc.) near sensitive receptors (i.e. relocated Ban Hatsaykham residents);
- Major earthworks and excavation in dry, windy conditions will be avoided following relocation of Ban Hatsaykham residents;
- Construction vehicles will be restricted to designated access routes (e.g. avoid passage through settlements where practical) and will adhere to speed limits;
- Construction haul vehicles transporting fill or other dusty materials will have covered loads;
- The construction fleet will be regularly maintained to ensure plant and vehicles are compliant with local air quality standards for exhaust emissions;
- Burning or incineration of wastes (e.g. cleared vegetative waste, construction materials) will be prohibited;
- Topsoil stockpiles to be retained during the rainy season will be treated to minimise dust generation (e.g. seeding with a cover crop or compaction with a backhoe bucket);
- Exposed surfaces will be progressively rehabilitated within one month following the completion of use to reduce dust and erosion generation (with planting conducted at the onset of the first rainy season);

- The GRM will be implemented for relocated villagers to allow air quality or dust related complaints; and
- Sensitive receptor areas will be monitored for excessive dust daily through visual inspections during high dust-generating activities near sensitive receptors.

### **Post-Construction**

The emission and dust control plan will be reviewed and updated during the operations phase to ensure potential dust and smoke impacts from proposed village activities within the HSRA are adequately minimised. This includes the continued implementation of dust suppression and control methods, and the establishment of a community fire management plan for villagers to minimise the risk of bushfires. Details of the bushfire management plan are further specified in the INRMP developed for the HSRA and PFA (Appendix A).

### **Assessment of Impacts**

Early construction works will not impact sensitive receptors on the left bank (opposite side) of the Nam Ngiep River. With the resettlement of Ban Hatsaykham in April 2016, during HSRA construction, it is anticipated that these villagers will be exposed to nuisance level air quality impacts from dust generated during the dry season.

These impacts will be minimised through application of the prescribed management and mitigation measures and should and are expected to be low. The development and application of adaptive management measures may be required to further minimise dust generation if complaints are lodged through the grievance redress mechanism.

## **7.3.10 UXO**

### **Issues and Findings**

- The Bolikhamxay Province is considered one of the 10 heaviest UXO contaminated provinces according to the Statement by the Delegation of Lao PDR on Victim Assistance (Intercessional Meeting of States Parties to the Convention on Cluster Munitions, Geneva, 2013), however the HSRA Preliminary Works Area was not as heavily bombed as neighbouring Districts;
- UXO clearance was completed for the HSRA Preliminary Access Road, village development area and paddy rice field area for Ban Hatsaykham in early 2015. No live UXO were identified during the UXO clearance. Residual UXO risk, although unlikely, for this area; and
- UXO clearance has not been completed for all HSRA Resettlement Development Site and agricultural / plantation areas. Development of each will provide risk for contractors during construction and resettled peoples during site preparation for agricultural activities.

### **Management and Mitigation**

#### **Construction**

NNP1 will ensure that construction workers are trained in the potential risks associated with disturbance of UXO. During construction, the following will be required:

- An appropriately qualified organisation will be engaged to undertake survey and disposal of UXO in areas where Project activity will occur, prior to the commencement of any construction works on-site;
- The priority method of UXO disposal shall be in-situ explosion. Where this is not possible alternative proven methods of disposal may be implemented;
- All cleared areas will be semi-permanently marked. Within 30 days of completion of clearing work at a site, a clearance report will be prepared, which describes (via GPS) and maps boundaries of



cleared areas as well as the survey methodology, disposal and QC processes implemented, description of UXO and disposal (as applies) and certification that the area has been cleared of UXO and is suitable for its intended purpose;

- As part of the construction worker training program, personnel will be trained in potential risks associated with UXO disturbance and procedures to be followed if potential UXO are identified during construction; and
- A UXO notification will be implemented in communities that are located in the vicinity of survey and disposal works at the time of undertaking.

### ***Post-Construction***

UXO clearance for paddy fields (likely during construction and post-construction), upland agriculture / tree plantations (during operations) shall be conducted by a qualified organisation (as per construction phase).

As per the contracted workforce, HSRA residents shall be trained in potential risks associated with UXO disturbance and procedures to be followed if potential UXO are identified during agricultural / plantation works.

Signs shall be posted (in appropriate languages) that instruct HSRA residents (particularly children) regarding UXO identification and appropriate procedures following identification of potential UXO.

### ***Assessment of Impacts***

With implementation of UXO clearance and the associated management, mitigation, reporting, and consultation (including awareness campaign) requirements specified in the ESMMP-CP (SP12) and above, it is anticipated that UXO will not pose a risk to construction contractors and resettled villagers in the HSRA.

## 8 INSTITUTIONAL REQUIREMENTS AND ENVIRONMENTAL MONITORING PLAN

### 8.1 Institutional Arrangements

Senior Management at NNP1 is responsible for the ongoing implementation of management and monitoring activities throughout the life of the NN1HP.

#### 8.1.1 Environmental and Social Department (ESD)

NNP1 has established an Environmental and Social Department which is responsible for implementing the monitoring and reporting program in compliance with the NN1HP Concession Agreement and the ESMMP-CP.

The ESD NNP1 consists of two divisions:

1. Social Management Office (SMO NNP1) which is (in part) responsible for land acquisition compensation works and social monitoring; and
2. Environmental Management Office (NNP1 EMO) which is responsible for all other environmental monitoring aspects.

#### 8.1.2 NNP1 Technical Department

The Technical Department (NNP1 TD) plays an important role in ensuring NN1HP compliance with its environmental and social obligations. The Department liaises with statutory bodies and head contractors to perform in accordance with all the applicable technical standards and regulations. The Technical Department also strives to enhance the performance of the contractors by following the construction plans and implementing routine inspections.

#### 8.1.3 Contractors

Contractors employed by NNP1 are required to plan, implement and monitor environmental and social management and mitigation measures in compliance with the Project's environmental and social management plans (refer to Section 8.2). Implementation is primarily undertaken by the Contractor's Environmental Inspector, and supervised, reviewed, and verified by the NNP1's ESD.

#### 8.1.4 Other Monitoring Institutions

Other institutions involved in environment and social monitoring of the road construction works include:

- Ministry of Natural Resources and Environment (MONRE);
- MONRE's Environmental Monitoring Unit;
- Resettlement Management Unit;
- Independent Monitoring Agency; and
- Asian Development Bank Monitoring Team.

## 8.2 Environmental and Social Management Plans

### 8.2.1 Environmental and Social and Management Plan for Construction Phase

An Environmental and Social Management and Monitoring Plan-Construction Phase (ESMMP-CP) was prepared for the NN1HP by ERM in 2014. The ESMMP-CP was prepared to address environmental and social compliance of NNP1 during the construction phase.

Under the ESMMP-CP, a number of sub-plans were developed to provide management and mitigation strategies for potential environmental and social impacts (refer to Appendix H of this report). Those most relevant to HSRA construction include:

- SP1: Erosion and Sediment Control;
- SP2: Water Availability and Pollution Control;
- SP3: Emissions and Dust Control;
- SP4: Noise and Vibration;
- SP5: Waste Management;
- SP6: Vegetation Clearing;
- SP7: Landscaping and Re-Vegetation;
- SP8: Protected Area Management;
- SP9: Biodiversity Management;
- SP12: Unexploded Ordinance (UXO) Survey and Disposal;
- SP17: Emergency Preparedness; and
- SP18: Cultural Resources.

Applicable management and mitigation measures detailed in these sub plans are expected to be incorporated into the Contractors EMP and SS-ESMMPs for review and approval by NNP1 and implementation during the construction.

Prior to hydropower operations commencing, NNP1 will develop a detailed ESMMP for the Operation Phase (ESMMP-OP). The management, mitigation and monitoring measures identified in this document may be included in the ESMMP-OP to ensure NNP1 commitment to integration of site-specific measures (including a maintenance program) during the phase of joint management of the HSRA following resettlement.

### 8.2.2 Resettlement and Ethnic Peoples Development Plan

A Resettlement and Ethnic Peoples Development Plan (REDP) was prepared by NN1HP in 2014. The REDP was prepared to address social compliance of NNP1 during the construction and operation phases of the Project.

The REDP includes:

- Entitlement Policy and Eligibility Matrix;
- Livelihood and Income Restoration Plan;
- Ethnic Peoples' Development Plan; and
- Public Consultation, Participation and Disclosure Plan

NNP1 will maintain the Grievance Redress Mechanism established Project-wide for community residents in the HSRA to submit any complaints (e.g. noise, dust, etc.) or grievances during the construction and operation phases.

### 8.2.3 Social Development Plan

A Social Development Plan was prepared by NN1P in 2014. This plan includes:

- Public Health Action Plan;
- Labour Management Plan;
- Community Development Plan;
- Gender Action Plan;
- Youth and Children Action Plan; and
- Cultural Awareness / Heritage Preservation Action Plan.

## 8.3 Management and Monitoring Program

### 8.3.1 Construction

Sections 7.2 and 7.3 contain site-specific environmental and social management and mitigation measures for NNP1 to implement during construction. Contractor EMPs and SS-ESMMPs will include monitoring requirements to ensure implementation of environmental and social management measures identified in this IEE. The management, mitigation, and monitoring measures identified above and prescribed in EMPs and SS-ESMMPs will be incorporated into construction contracts.

Key environmental and social requirements to be incorporated into this program for the construction phase are provided in Table 8-1 below.



**Table 8-1 Environmental and Social Monitoring Plan for the HSRA – Construction Phase**

Impact aspect	Management and mitigation measures	Monitoring method	Location	Frequency	Responsibility
Hydrology	Implement measures detailed in Section 7.1.2 for the environmental release regime and potential flood risks.	Visual observation of implementation and effectiveness.	Upstream and downstream of Houay Soup Noi and Ngai irrigation supply dam and domestic water supply intake.	Pre-construction flood modelling, Monthly hydrology monitoring	NNP1 and Construction Contractor
Water Quality	Implement surface water quality management measures as per Section 7.1.3 and 7.1.4.	Field sampling for: pH, DO, Temperature, TSS / turbidity. Sampling for laboratory analyses: pH, DO, BOD, COD, total coliform, faecal coliform, N-NO <sub>3</sub> , N-NH <sub>4</sub> , sulphate, arsenic, cadmium, chromium, copper, lead, mercury, nickel, zinc, manganese. (refer to CA, Annex C, Appendix 2).	Upstream and downstream of Houay Soup Noi and Ngai irrigation supply dam and domestic water supply intake Upstream and downstream drainage and storm water discharge outlets at construction sites in the HSRA, access roads, and ancillary components (e.g. waste dump, waste collection facilities at work camps, etc.).	Monthly	NNP1 and Construction Contractor
	Manage effluent as per Section 7.1.3 and 7.1.6	Sampling for following laboratory analyses: pH, BOD, COD, TSS, Oils and grease, Ammonia-N, Total N, Total P, Total coliforms, arsenic, cadmium, chromium, copper, fluoride, iron, lead, mercury, nickel, selenium, silver, sulphides, zinc. (refer to CA, Annex C, Appendix 2)		Bi-annually (rainy season / dry season)	
Drinking water and water supply	Provide adequate drinking water for construction work camps.	Drinking water quality monitoring in accordance with Appendix I (or provision of bottled water).	Potable water supply at construction worker camp.	Monthly	NNP1 and Construction Contractor
Erosion and sediment transport	Implement measures detailed in Section 7.1.4.	Verification of implementation and efficacy of erosion and sediment control facilities, including visual observation of design, capacity, maintenance requirements, etc. and measurement of turbidity and / or total suspended solids (refer to water quality).	Upstream and downstream of storm water discharge outlets at construction sites, roads / disturbed sites.	Monthly	NNP1 and Construction Contractor
Hazardous and non-hazardous waste	Implement relevant measures detailed in Section 7.1.3 and 7.1.6 to manage non-hazardous waste generated by Project construction.	Verification of implementation including visual inspection of waste facilities, and storage areas; and maintenance of a waste inventory	All general waste storage areas and facilities.	Weekly	NNP1 and Construction Contractor

Impact aspect	Management and mitigation measures	Monitoring method	Location	Frequency	Responsibility
	Implement relevant measures detailed in Sections 7.1.3 and 7.1.6 to manage hazardous waste generated by Project construction.	Verification of implementation, including hazardous waste inventory; visual inspection of facilities, storage areas, and spill response kits; and reporting and response to hazardous spills and leaks.	All areas where hazardous materials are handled and stored.	Weekly	NNP1 and Construction Contractor
Terrestrial biodiversity	Survey proposed footprint during Project design to avoid threatened fauna to the extent practicable.	A qualified botanist will survey the Project footprint for threatened flora species. Individuals will be flagged with GPS coordinates recorded.	Construction areas earmarked for clearing (e.g. RDS, access roads, and ancillary components).	Pre-construction	NNP1
	Transplant threatened flora (if small enough) and avoid larger individuals in the Project footprint to the extent practicable.			Weekly	NNP1 and Construction Contractor
	Implement relevant measures detailed in Section 7.2.1 to manage potential terrestrial biodiversity impacts. Monitor vegetation clearing throughout the HSRA.	Visual observation - extent of disturbance / vegetation clearing for construction, condition of surrounding habitat and level of disturbance, presence of local weeds.	Project-wide	Ongoing	NNP1 and Construction Contractor
	Implement a wildlife incident reporting system for contractors and villagers to report wildlife encounters and illegal activities involving poaching or harvesting of TFPs/NTFPs.	Record incidents involving wildlife (e.g. road incidents, poaching or illegal harvesting of TFPs/NTFPs)			
Aquatic habitat and biology	Implement relevant measures detailed in Sections 7.1.2 and 7.2.3 to manage potential aquatic biodiversity impacts.	Verification of implementation and efficacy.	Upstream and downstream of Houay Soup Noi and Ngai irrigation supply dam and domestic water supply intake.	Weekly	NNP1 and Construction Contractor
	Conduct aquatic habitat and biology monitoring.	Monitor environmental flow regime, condition of habitat and water quality, and presence of local aquatic flora and fauna.	Houay Soup Noi and Gnai.	Monthly	NNP1
	Implement a Project-wide incident reporting system allowing contractors and villagers to report illegal activities involving fishing or collection of aquatic resources.	Reportable incident records involving aquatic wildlife.	Project-wide.	Ongoing	NNP1 and Construction Contractor
Invasive vegetation	Implement relevant measures detailed in Section 7.2.2 to prevent introduction and spread of invasive species. Monitoring for the spread of invasive species.	Weed monitoring, including presence and extent of priority weed species.	Vegetation surrounding and in disturbed areas of HSRA, access roads, and ancillary components.	Biannually	NNP1 and Construction Contractor
Loss of land, assets and livelihoods	Implement relevant measures specified in Section 7.3.1 and in the REDP regarding steps to be taken for loss of land, assets and livelihoods.	Grievance Redress Mechanism (GRM).	Project affected communities.	Pre-construction	NNP1 in consultation with Project affected People
Site access	Implement measures specified in Section 7.3.2 to manage site access issues to the right bank and HSRA.	Verification of implementation.	Within and near the HSRA.	Monthly	NNP1 and Construction Contractor

Impact aspect	Management and mitigation measures	Monitoring method	Location	Frequency	Responsibility
Archaeology and cultural heritage	Implement relevant measures detailed in Section 7.3.7 to manage potential cultural heritage impacts, including a 'Chance Finds Procedure'.	Verification of implementation, including records of chance finds.	Within and near the HSRA.	Monthly	NNP1 and Construction Contractor
UXO	Implement relevant measures specified in Section 7.3.10 to manage potential impacts from UXOs.	UXO clearance surveys (Appendix H).	In planned construction areas not previously surveyed for UXOs.	Pre-construction	NNP1 and Construction Contractor
Noise and vibration	Implement relevant measures specified in Section 7.3.8 to ensure noise emissions and ambient noise levels comply with the Lao National Environmental Standard for noise.	Noise monitoring for dB(A) following relocation of Ban Hatsaykham.	At sensitive receptors (i.e. Ban Hatsaykham relocation area).	Biannually	NNP1 and Construction Contractor
	Implement the Project Grievance Redress Mechanism for community residents in and near the HSRA to submit noise and vibration complaints or grievances during construction.	Verification of GRM implementation	Project-wide.	Ongoing	NNP1 and Construction Contractor
Air quality	Baseline air quality (particulate matter)	Measurement of particulate matter (PM <sub>10</sub> and PM <sub>2.5</sub> )	HSRA Settlement Area.	Pre-construction	NNP1
	Implement relevant measures specified in Section 7.3.9 to ensure air / dust emissions and ambient air levels comply with the Lao National Environmental Standard for ambient air quality.	Measurement of particulate matter (PM <sub>10</sub> and PM <sub>2.5</sub> ).	At Ban Hatsaykham relocation site and HSRA work camps.	Biannually	NNP1 and Construction Contractor
	Implement the Project Grievance Redress Mechanism for community residents in and near the HSRA to submit air quality complaints or grievances during the construction phase.	Verification of GRM implementation.	Project-wide.	Ongoing	NNP1 and Construction Contractor
Workforce training and awareness	Implement relevant awareness and training measures specified in Section 8.3.2 for the construction workforce.	Monitor and record implementation of workforce awareness training and review training register.	HSRA construction workforce.	Routine	NNP1 and Construction Contractor
Community training and awareness	Implement relevant awareness and training measures specified in Section 8.3.2 for the local community.	Monitor and record community awareness training and review community training register.	HSRA residents and other users of the HSRA.	Annual and ongoing	NNP1 in collaboration with GOL and Village Committees
Temporary infrastructure	Provide buffer areas at construction worksites. Decommission temporary infrastructure and sites including landscaping and visual characteristics in consultation with the resettled communities.	Verification of implementation.	HSRA, access roads, and ancillary components (e.g. quarries and borrow areas).	Pre-construction and post-construction	NNP1 and Construction Contractors)

Source: Earth Systems 2015

### 8.3.2 Post-Construction

Where relevant, the environmental and social management measures implemented during the construction phase should be reviewed and adapted into the ESMMP-OP (for operations / post-construction). NNP1 will ensure the ESMMP-OP and relevant sub-plans (if applicable) are periodically reviewed and updated to ensure they remain relevant and effective (e.g. for changed HSRA conditions, unexpected environmental impact identified, etc.).

The suite of environmental and social management measures expected to be implemented in the HSRA post construction are summarised in Table 8-2 below and include a focus on regular maintenance to ensure facilities are operating effectively upon formal HSRA handover to the village and the GOL.

NNP1 involvement in HSRA post-construction management, mitigation, monitoring, maintenance, training, etc. will continue, at a minimum, until official transfer of the HSRA from NNP1 ownership to village / GOL ownership. Official transfer will occur after MONRE is satisfied that CA requirements have been met (e.g. training requirements for villagers, financial planning for operations and maintenance completed, land tenure certificates registered, etc.).



**Table 8-2 Environmental and Social Monitoring Plan for the HSRA – Post-Construction Phase**

Impact aspect	Management and mitigation measures	Monitoring method	Location	Frequency	Responsibility
UXO	Conduct and document UXO clearance surveys for areas where activities involving ground disturbance will be undertaken (that have not previously been surveyed for UXOs). Inform HSRA villagers to avoid disturbing areas where UXO surveys have not been conducted.	UXO clearance surveys, refer to sub-plan SP12 (Appendix H).	In any new areas previously not surveyed for UXOs for upland agriculture or plantations.	Before any activities are undertaken in the affected area.	NNP1 in collaboration with the Resettled Community
Soil fertility	Develop a detailed monitoring program that measures soil fertility and the effectiveness of soil improvement and cultivation methods used by villagers.	Soil fertility monitoring to consider: <ul style="list-style-type: none"> <li>• Soil quality and suitability for identified crops, including regular analysis of physio-chemical properties against the target values of soil improvement (refer to Table 7-2 – Section 7.1.5);</li> <li>• Type and quantities of organic and chemical inputs used for agriculture; and</li> <li>• Any organic and chemical inputs contaminating surface water further downstream (e.g. Nam Ngiep and tributaries).</li> </ul>	Upland and lowland agricultural areas and plantation lands.	At least 2 months in advance of planting seasons.	NNP1 in collaboration with the Resettled Community
Aquaculture and fish farming	Develop a detailed monitoring program that measures the effectiveness of fish farming methods used by villagers and quality of effluent.	Ongoing collaboration with villagers to ensure aquaculture scheme is effective. Monitor for any organic and chemical inputs entering the Houay Soup.	HSRA / Houay Soup.	Periodic (e.g. biannually).	NNP1 in collaboration with the Resettled Community
Compensation and livelihood restoration	Review and update the social management and monitoring requirements for the implementation of the livelihood restoration program.	Monitor socio-economic indicators as set out in the REDP. External reviews and audit to verify implementation of livelihood restoration program.	HSRA.	Annually.	NNP1

Impact aspect	Management and mitigation measures	Monitoring method	Location	Frequency	Responsibility
Access roads	Perform road maintenance and repairs as necessary for safety purposes and to reduce maintenance requirements upon formal handover of the HSRA.	Routine checks on the condition of road (e.g. for potholes). Reported grievances or road incidents.	Access roads for the HSRA.	Quarterly until HSRA transfer	NNP1 in collaboration with the Resettled Community
Domestic water supply	Perform scheduled maintenance, upgrades and repairs for operational effectiveness and safety purposes.	Routine checks on the condition of facilities (e.g. for leakage in domestic piping system, failure in water treatment facility, etc.).	Domestic water piping system, water intakes, and residence taps.	Monthly until transfer of facility	NNP1 in collaboration with the Resettled Community
	Drinking water quality.	Bacteriological parameters (total coliform, faecal coliform, entero virus). Physical-Chemical Parameters, Health Significant Parameters, and Priority Parameters (Appendix I and Concession Agreement – Annex C, Appendix 2) E.g.: pH, DO, BOD, COD, total coliform, faecal coliform, N-NO <sub>3</sub> , N-NH <sub>4</sub> , sulphate, arsenic, cadmium, chromium, copper, lead, mercury, nickel, zinc, manganese.	Domestic water piping system and sub-sample of residence taps.	Monthly until transfer of facility  Annually until transfer of facility	
Irrigation water supply	Perform scheduled maintenance, upgrades and repairs for operational effectiveness and safety purposes.	Routine checks on the condition of facilities.	Irrigation water reticulation system, reservoir, and intakes.	Monthly until HSRA transfer	NNP1 in collaboration with the Resettled Community
		Monitor water levels in the irrigation water reservoir via regular visual inspections to ensure sufficient freeboard is maintained for safety.	Irrigation water reservoir.	Weekly until HSRA transfer	
		Independent audit of dam structural integrity by a suitably qualified specialist for operational safety.	Irrigation water reservoir.	Once-off (prior to relinquishment to the GOL)	
Other community facilities and infrastructure	Monitor the condition of community facilities and infrastructure to determine if upgrades, repairs or maintenance are required.	Routine visual observation; Grievance Redress Mechanism.	Throughout the HSRA.	Monthly until HSRA transfer	NNP1 in collaboration with the Resettled Community

Impact aspect	Management and mitigation measures	Monitoring method	Location	Frequency	Responsibility
Rehabilitation	Continue to regularly monitor rehabilitation areas to assess the success of restoration activities as necessary.	Routine monitoring records to consider area revegetated/rehabilitated; survival rate of planted seedlings; and invasive weed presence.	Rehabilitation areas throughout the HSRA and PFA.	Ongoing until HSRA transfer	NNP1
Reportable incidents	Maintain the established Project incident reporting systems for villagers to report incidents such as chance finds, wildlife encounters, and observation of illegal activities involving poaching or harvesting of TFPs/NTFPs, etc.	Verification of implementation.	Project-wide.	Ongoing throughout Stabilisation Phase	NNP1
Community health and safety	Coordinate and implement relevant emergency notification and evacuation procedures with the GOL and relevant Village Committees to ensure community safety within the HSRA, e.g. NN1 HPP Emergency Preparedness and Response Plan, Bushfire Management Plan applicable for the HSRA and PFA, etc.	Verification of implementation.	HSRA.	Ongoing throughout Stabilisation Phase	NNP1
Community relations and Project grievances	Maintain the Project grievance redress mechanism for community residents in and near the HSRA to submit relevant complaints or grievances (e.g. dust complaint).	Verification of implementation. Logged grievances and complaints Informal discussion.	Project-wide.	Ongoing throughout Stabilisation Phase	NNP1
Community capacity training and awareness	Implement relevant capacity training and awareness measures specified in Section 8.3.2 for the local community, including: <ul style="list-style-type: none"> <li>Specific training to nominated villagers to perform maintenance and repairs on community facilities and infrastructure; and</li> <li>Awareness of the INRMP and associated bans, rules and restrictions which applies to the HSRA and PFA.</li> </ul>	Review of community training register.	HSRA residents and other users of the HSRA.	Ongoing throughout Stabilisation Phase	NNP1 in collaboration with GOL and Village Committees
Invasive species	Monitor for invasive species introduction and spread.	Reporting and checks for invasive species.	HSRA and PFA.	Ongoing until HSRA transfer	NNP1 in collaboration with Village Committees

Source: Earth Systems 2015

### ***Maintenance of community facilities and infrastructure***

As outlined in Section 7, NNP1 involvement in HSRA post-construction management, mitigation, monitoring, maintenance, training, etc. will continue, at a minimum, until official transfer of the HSRA from NNP1 ownership to village / GOL ownership. Official transfer will occur after MONRE is satisfied that CA requirements have been met (e.g. training requirements for villagers, financial planning for operations and maintenance completed, land tenure certificates registered, etc.).

NNP1 will facilitate regular monitoring for infrastructure and facilities essential to the community, such as access roads, livestock fencing, and facilities for irrigation and aquaculture. Appropriate repairs, maintenance, and upgrades will be performed as necessary by the relevant concerned parties, and specific training will be provided to nominated HSRA residents to ensure there is capacity for ongoing maintenance of community infrastructure and facilities after NNP1 relinquishes the HSRA prior to official transfer of the HSRA to the villagers / GOL.

NNP1 will negotiate with residents of the HSRA and applicable GOL staff to finalise an acceptable model for financing ongoing operations and maintenance of infrastructure. Several financing options under consideration are briefly described in Section 2.4 and further detailed in the REDP (NNP1 2014b).

NNP1 will facilitate community health and safety within the HSRA post-construction by supporting the implementation of scheduled maintenance programs involving community sanitation and hygiene infrastructure and facilities (e.g. drinking water supply, waste management facilities), as well as ongoing coordination and implementation of emergency notification and evacuation procedures with the GOL and relevant Village Committees (e.g. NN1 HPP Emergency Preparedness and Response Plan, Bushfire Management Plan applicable for the HSRA and PFA, etc.).

### ***Integrated Natural Resource Management***

The INRMP (see Appendix A) will be incorporated as a sub-plan of the WMP and implemented under the oversight of the Watershed Management Committee over the 27 year concession period.

A number of environmental and social management measures will need to be continued to ensure potential impacts from ongoing activities within the HSRA are effectively minimised. As such, the responsibilities and implementation of relevant environmental and social requirements to be continued should be adequately described and negotiated between GOL, affected communities and NNP1 prior to the transition.

## **8.3.3 Training and maintenance requirements**

### ***Workforce training and awareness***

NNP1 and the Construction Contractor will ensure all workers complete mandatory induction and training programs educating them on the requirements of relevant environmental plans (i.e. IEE contractor EMP and SS-ESMMP, REDP, etc.), raising awareness on the following aspects:

- Project ban and penalties for firearm possession, illegal logging, poaching, fishing, and collection of forestry products;
- UXO;
- Adherence to local traffic regulations and rules;
- Non-disturbance and cultural awareness of resettlement communities;
- Erosion and sediment control;
- Health, safety and hygiene;
- Waste management; and
- Other aspects, as required.



### ***Community training and awareness***

Post HSRA construction, HSRA residents will participate in training programs organised / facilitated by NNP1 and the GOL educating them on statutory obligations applicable to the HSRA and raising awareness on the following aspects:

- HSRA bans and penalties for illegal logging, poaching, fishing, grazing, and collection of forestry products (i.e. TFPs/NTFPs), particularly in Total Protection Zones and Controlled Use Zones within community forests;
- Environmental issues, including soil fertility improvement, erosion and sediment control, water quality, biodiversity conservation, and waste management;
- Social issues, including general health, safety, hygiene, and cultural heritage protection;
- UXO; and
- Other aspects, as required.

NNP1 will also provide specific training to nominated village representatives to ensure adequate maintenance of facilities and infrastructure essential to the community can be carried out, including for local access roads, irrigation and drinking water systems, waste management facilities, aquaculture farms, plantations, etc.

### ***Grievance Redress Mechanism***

NNP1 had developed and implemented a Grievance Redress Mechanism (GRM) during Project construction. This procedure will be implemented during HSRA construction and post-construction until formal handover of the HSRA to the community and the GOL. Success of the GRM will require that stakeholders are aware of the GRM process.

The Grievance Redress Mechanism will include:

- Promoting productive relationships with local communities and identifying concerns through consultation, disclosures, participatory planning and decision making with Project Affected Peoples to prevent grievances wherever possible;
- Ongoing engagement with stakeholders throughout the Project (particularly PAPs), with appropriately documented discussions and agreements signed (voluntarily) by all parties involved in negotiation;
- Address and resolve differences or grievances associated with the Project through the established GRM procedures, including the following five (5) stages of Project GRM, further elaborated in the Project ESMMP-CP:
  - » Stage 1: PAPs will register grievances with the Village Grievance Committee (VGC). The committee will organise a meeting within 15 days from the date of formal grievance receipt. The VG will generate and sign a report and will submit the grievance to NNP1;
  - » Stage 2: If either the PAPs or NNP1 is not satisfied with the decision of the VGC, or if NNP1 / contractors do not abide with the decision, and appeal can be made directly by NNP1 or by the PAP or by the VGC on behalf of the PAP. The appeals are forwarded to the District Grievance Committee (DGC). The DGC will meet in a public place within 20 days from the date of formal receipt of the grievance. Representatives from NNP1 must be available to provide relevant information. The DGC provides a written / signed report;
  - » Stage 3: If the PAP is not satisfied with the decision of the DGC or if NNP1 / contractors do not abide by the decision, and appeal can be made to the Provincial Grievance Redress Committee (PGRC). The PGRC will consider the grievance in consultation with representatives of MONRE and NNP1 within 20 days of complaint filing;

- » Stage 4: If the PAP is not satisfied with the decision of the PGRC, or in the absence of response within the stipulated time, the grievance can be submitted to the Court of Law by the PAPs, a representative of an NGO, the VGC on behalf of the PAPs, or at the request of NNP1. The Court of Law will follow up with representative authorities to make the final and binding decision; and
- » Stage 5: If NNP1 / contractors are 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 for up to and for no more than one year after the official date of construction completion.

### **8.3.4 Budget**

#### ***Contractors***

Contractors are obligated to provide suitably qualified staff and an appropriate budget to implement management and mitigation measures identified in Section 7 and to monitor the implementation and efficacy of these measures (refer to Table 8.1). Staff and budgeting for environmental / social management, mitigation, monitoring and reporting will be included in contracts as contractor obligations. Site-specific management obligations (i.e. design of environmental / social management and mitigation measures) will be included in contractor' Site-Specific Environmental and Social Management Plans (SS-ESMMP) for the HSRA. Implementation of the measures identified in the HSRA SS-ESMMP will be contractually binding.

#### ***NNP1***

NNP1 costs associated with environmental and social management, mitigation, monitoring and reporting during construction (and post construction) will be included in the existing ESD operational budget, with adequate provision of resources to monitor construction and maintenance requirements and analyse parameters for ensuring the efficacy of controls implemented.

## 9 PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

NNP1's overall approach and commitment to public consultation and information dissemination is outlined in the Project's *Public Consultation and Information Disclosure Plan* (ERM 2014; NNP1 2014a). This Plan is compliant with GOL legislation (and the ADB's Safeguard Policy Statement (ADB 2009)).

An updated PCDP has been developed to guide activities during the construction and post construction phases of the HSRA development (refer to Appendix B). This Plan documents all PCD activities that have been conducted to date in relation to the HSRA and outlines a strategy and management plan for continued stakeholder engagement and information dissemination of environmental, social and other Project related matters during the development and operation of the HSRA.

The PCDP for the HSRA:

- Adopts the objectives and approach outlined in the Project's existing PCDP (ERM 2014);
- Recognizes and builds off the significant PCD activities conducted by NNP1 to-date;
- Promotes close collaboration with NNP1 SMO/EMO and GOL partners during PCD activity implementation;
- Improves (where possible), engagement and involvement of key stakeholders in the planning for the HSRA development; and
- Ensures compliance with GOL legislation and ADB safeguards requirements.

### 9.1 PCD Objectives

The goal of NNP1's PCD activities are to ensure opportunities exist for stakeholders to be involved in Project design, including potentially affected people.

Key objectives are to:

- Ensure that stakeholders concerns are incorporated in the Project design and implementation;
- Increase stakeholder awareness and familiarity with the Project;
- Ensure transparency in the decision-making process;
- Enhance the potential benefits by directly involving relevant stakeholders;
- Support a robust mechanism for recording and resolving project related issues and grievances; and
- Monitor the effectiveness of environmental and social impact mitigation, resettlement, compensation and livelihood restoration.

### 9.2 Summary of Consultation Activities

#### 9.2.1 Previous Consultations

PCD activities for the Project began early in the Project preparation stage (2007) and have been carried out on an ongoing basis throughout the Project cycle. Activities have included meetings, focus groups discussions, and participatory engagements with affected communities; meetings and consultation with GOL agencies; and a number of stakeholder forums with a wide range of Project stakeholders.

### **Resettlement Communities**

Earlier PCD activities (2007 onwards) regarding resettlement and the HSRA were focused on PAPs in 'resettlement communities' who will be impacted by reservoir inundation including:

- Three (3) communities in Zone 2: Upper Reservoir Area (2UR);
- Four (4) communities in Zone 2: Lower Reservoir Area (2LR); and
- One (1) village in Zone 3: Construction Area (Z3).

Consultations with resettlement communities resulted in a number of key milestones:

- Agreement of resettlement options;
- Site selection; and
- Confirmed project design.

### **Host Communities**

More recent PCD activities (2014 onwards) have also included PAP's in 'host communities' who are currently using the proposed HSRA including:

- One (1) village in the Construction Zone (Z3);
- Two (2) communities in the Downstream Area (Zone 4).

Consultations with host communities have included:

- EIA / SIA consultations;
- Land and asset registration;
- Engagement with external monitoring agencies.

A summary of these activities and results is provided in Appendix B.

## **9.2.2 IEE HSRA Update Consultations**

PCD activities to support development of the IEE and INRMP have been designed and conducted in accordance with GOL and ADB safeguard standards. The first round of consultations focussed on data collection, general feedback and inputs into initial INRMP design while the second round of consultations involved a presentation of new information and discussion on the proposed detailed design of the HSRA.

Key topics for each element of the presentations were as follows:

- INRMP – Outline and discussion of preliminary land and forest zoning allocations that were developed and Protected Forest Area management in the proposed HSRA. Discussion of next steps in the PLUP process; and
- IEE – Discussion of the potential environmental and social impacts of the design and proposed mitigation and management measures during the construction and post construction phase.

Consultations with host communities have included:

- Provincial exhibition with GOL stakeholders;
- Provincial and district meetings with the GOL;
- Information gathering and Consultations with Host Communities; and
- Consultations with Resettlement Communities.

A summary of the results of these activities is provided in Appendix B.



## 9.3 PCD Activities: Resettlement Implementation

The following section outlines planned PCD activities during the construction and post construction phases of the HSRA. These activities will be implemented in accordance with NNP1's existing PCD principles and approaches outlined in the REDP (NNP1 2014) and summarised in Section 2.5.

### 9.3.1 On-ground PCD Activities

On-ground PCD activities relating to the development of the HSRA will be conducted in three (3) phase as outlined below.

#### ***Preparation***

Preparatory PCD activities commenced during the feasibility phase of the project and will continue during the construction phase until the majority of PAPs have been resettled to the HSRA. These activities will be led by NNP1 and include:

- Consultation and use of existing grievance mechanisms with host communities and later resettled villagers from Ban Hatsaykham concerning potential impacts related to the construction of the HSRA facilities;
- Further consultation with GOL and host communities regarding compensation and livelihood restoration activities and the conduct of participatory land use planning activities to ensure adequate allocation of village land and land use zones;
- Conduct of indicative Choice Survey on Resettlement/Self-Resettlement including consultations on Resettlement Plan for 2LR and resettlement options for women, youth and vulnerable people;
- Further consultations with GOL and resettlement villages regarding the INRMP and proposed land use planning and process for the HSRA;
- Construction of facilities within the HSRA for the conduct of effective PCD activities (i.e. village meeting building and village notice board); and
- Preliminary participatory land use planning activities with villagers from Ban Hatsaykham from April 2018 (planned resettlement date).

#### ***Participatory Land Use Planning***

Formal PLUP activities will commence in 2018 when the PAPs from 2LR villages have resettled to the HSRA. These activities will be led by relevant government provincial and district authorities with the support of NNP1. Activities are outlined in detail in the INRMP and include:

- Establishment of the village committee and natural resource management groups;
- Consultation activities to finalise village land and forest zoning;
- Consultation activities to finalise village natural resource management plans and agreements for GOL endorsement;
- Conduct of land registration and titling for individual land and community land;
- Provision of relevant land and forest data to village, district and provincial authorities; and
- On-going NNP1 engagement and support during the implementation of natural resource management plans and agreements.

During the PLUP process NNP1 will also:

- Establish a formal grievance mechanism for the newly established Houay Soup village; and

- Conduct Livelihood Restoration and Community Development Activities including programs for agricultural extension, health, education and vulnerable households.

### Monitoring

NNP1 will work closely with GOL authorities and Project lenders to ensure that the following monitoring activities are undertaken:

- Implementation of an ongoing social monitoring and management program including regular consultations with village and GOL authorities and monthly, quarterly, annual government reporting; and
- A participatory review of PLUP implementation by relevant GOL authorities with the support of NNP1, two (2) years after the completion of Phase 2 PLUP activities.

### Other monitoring

- EMU monitoring; and
- External monitoring reports from LTA, IAP missions.

## 9.4 Other PCD Activities

Other PCD activities will include:

- Provincial and central government engagements such as meetings, workshops, exhibitions, site visits etc.; and
- Wider stakeholder PCD activities including public reporting, public information dissemination (i.e. website) and the conduct of broader stakeholder forums.

**Table 9-1 PCD Management Plan - Targets and Actions, Schedule, Responsibilities**

Action	Schedule/ Frequency	Responsibility	Monitoring
<b>On-Ground PCD Activities</b>			
<b>Preparation Activities</b>			
Consultation and use of existing grievance mechanisms with host communities and later resettled villagers from Ban Hatsaykham concerning potential impacts related to the construction of the HSRA facilities.	October 2015 / weekly	NNP1 SMO	EMU/LTA/IAP
Further consultation with GOL and host communities regarding compensation and livelihood restoration activities and the conduct of participatory land use planning activities to ensure adequate allocation of village land and land use zones.	October / as required	NNP1 SMO	EMU/LTA/IAP
Conduct of indicative Choice Survey on Resettlement/Self-Resettlement including consultations on Resettlement Plan for 2LR and resettlement options for women, youth and vulnerable people.	September until December 2015	NNP1 SMO	EMU/LTA/IAP

Further consultations with GOL and resettlement villages regarding the INRMP and proposed land use planning and process for the HSRA.	October 2015 / as required	NNP1 SMO	EMU/LTA/IAP
Construction of facilities within the HSRA for the conduct of effective PCD activities (i.e. village meeting building and village notice board).	April 2016 / once	NNP1 SMO	EMU/LTA/IAP
Preliminary participatory land use planning activities with villagers from Ban Hatsaykham from April 2016 (planned resettlement date).	April 2016 / as required	NNP1 SMO	EMU/LTA/IAP
<b>Participatory Land Use Planning</b>			
Establishment of the village committee and natural resource management groups.	2018 / as required	PONRE/DONRE/P AFO/DAFO, NNP1 / RMU	WMC/PCLRC and LTA/IAP
Consultation activities to finalise village land and forest zoning.	2018 / as required	PONRE/DONRE/P AFO/DAFO, NNP1 / RMU	WMC/PCLRC and LTA/IAP
Consultation activities to finalise village natural resource management plans and agreements for GOL endorsement.	2018 / as required	PONRE/DONRE/P AFO/DAFO, NNP1 / RMU	WMC/PCLRC and LTA/IAP
Provision of relevant land and forest data to village, district and provincial authorities.	2018 / as required	PONRE/DONRE/P AFO/DAFO, NNP1 / RMU	WMC/PCLRC and LTA/IAP
On-going NNP1 engagement and support during the implementation of natural resource management plans and agreements.	2018 / as required	PONRE/DONRE/P AFO/DAFO, NNP1 / RMU	WMC/PCLRC and LTA/IAP
Establish and implement a formal grievance mechanism for the newly established Houay Soup village.	2018 / as required	NNP1 / RMU	PCLRC and LTA/IAP
Conduct Livelihood Restoration and Community Development Activities including programs for agricultural extension, health, education and vulnerable households.	April 2016 / Ongoing until the end of 2023, five years after COD	NNP1 / RMU	WMC/PCLRC and LTA/IAP
<b>Monitoring</b>			
Implementation of an ongoing social monitoring and management program including regular consultations with village and GOL authorities and monthly, quarterly, annual government reporting.	Monthly, Quarterly, Semi-annual	NNP1 SMO, LTA and IAP Missions	PCLRC and LTA/IAP
A participatory review of PLUP implementation two (2) years after the completion of Phase 2 PLUP activities.	two (2) years after the completion of Phase 2 PLUP activities	PONRE/DONRE/P AFO/DAFO, NNP1 / RMU	PCLRC and LTA/IAP
EMU Monitoring.	Ongoing / As required	NNP1/EMU	EMU and LTA/IAP
External monitoring reports from LTA, IAP missions.	Semi-annual	LTA/IAP	LTA/IAP
<b>Other PCD Activities</b>			

Provincial and central government engagements such as meetings, workshops, exhibitions, site visits etc.	Quarterly / As required	NNP1 SMO	GOL/LTA/IAP
Wider stakeholder PCD activities including public reporting, public information dissemination (i.e. website) and the conduct of broader stakeholder forums.	As required	NNP1 SMO	GOL/LTA/IAP

Source: REDP 2014, Earth Systems 2015



## 10 CONCLUSION

The assessment of the IEE concludes that the establishment of the HSRA is important so as to enable the planned resettlement for the Nam Ngiep Hydropower Project.

The proposed HSRA is considered a viable site for the NNP1 resettlement program:

- The HSRA has ample forest resources and water resources. Communal land use rights will be required to sustainably manage and provide adequate resources for the resettled communities;
- While HSRA soils have been confirmed to be poor for agriculture purposes across the HSRA, the physical and chemical deficiencies can be suitably ameliorated with the implementation of a robust soil improvement program;
- The siting of the RDS will primarily occur on highly disturbed land and habitat;
- Preliminary modelling indicates that a small part of the residential area may reside in the peak storm event flood zone. With the annexure of the additional 648 ha, ample land exists for re-siting if required. Current road alignment and design should be considered in the context of the anticipated flood regime; and
- Implementation of an environmental flow is considered a key factor in sustaining aquatic habitat and aquatic fauna in the Ban Houay Soup and its tributaries.

Residents of Ban Hat Gniun and to a lesser extent Ban Somseun who are currently allocated and using land and natural resources inside the proposed HSRA have the potential to be significantly impacted by the establishment of the HSRA. These PAPs require compensation to be implemented in accordance with the REDP (NNP1 2014).

Monitoring and management of the HSRA during the construction and post construction phases will be required to ensure that Nam Ngiep environmental and social standards are implemented.

### ***Key Recommendations***

It is recommended that NNP1:

- Consult with the GOL and ADB regarding HSRA host communities and the identification of approximately 30 households from Ban Somseun, prior to the commencement of construction;
- Continue to work with the GOL and residents of Ban Hat Gniun and Ban Somseun to identify suitable compensation, livelihood restoration, and / or provision of additional village land to recompense for land / livelihood losses associated with HSRA development and the decrease in agriculture / livestock land for these two communities, before completion of HSRA construction;
- Conduct flood modelling to ensure HSRA infrastructure, including residential areas and road networks, are outside the flood zone for peak annual storm events;
- Engineer the Houay Soup Noi irrigation water supply dam and the Houay Soup Ngai domestic water intake facility to provide for ongoing (365 days per year) environmental flows equivalent to at least baseflow for these streams. Adequate water volume will be available, given sourcing from the Nam Ngiep River Re-regulation Reservoir;
- Ensure continuous hydrologic connectivity of the Houay Soup Noi and Houay Soup Ngai with the Nam Ngiep River to allow for continued fish residency and migration. Engineer the irrigation channels to allow continuous stream flow to bypass the irrigation system or merge them with discharge outlets at the river; and
- Rehabilitate and revegetate unused logging road network in the PFA to restrict vehicular access, minimising the likelihood of large-scale timber operations in the higher elevations of the PFA.

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# 12 APPENDICES

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## **Appendix A: Integrated Natural Resource Management Plan**

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## **Appendix B: Public Consultation, Participation and Information Dissemination Plan for HSRA development**

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## **Appendix C: Infrastructure Schedule**

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## **Appendix D: Terrestrial Flora, NTFP and TFP**

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## Appendix E: Terrestrial Fauna

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## **Appendix F: Fish and Aquatic Resources**

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## **Appendix G: Soils Analysis**

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## **Appendix H: ESMMP-CP Sub-Plans (ERM, 2014)**

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## **Appendix I: Applicable Project Standards (ERM, 2014)**

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## **Appendix J: Requests and Approvals for PFA Land Category Transformation for PFA to HSRA Settlement Area**

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# 12 APPENDICES

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## **Appendix A: Integrated Natural Resource Management Plan**

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See separate report



# INTEGRATED NATURAL RESOURCE MANAGEMENT PLAN

**FOR THE HOUAY SOUP RESETTLEMENT AREA**

**FINAL**



November 2015





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For and on behalf of Earth Systems

Approved by: Nigel Murphy

Signed: 

Position: Principal Director

Date: 18 November 2015

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## ACRONYMS

ACIAR	Australian Centre for Agricultural Research
ADB	Asian Development Bank
AMP	Agricultural Management Plan
APFORGEN	Asia Pacific Forest Genetic Resources Programme
BOD	Biochemical/Biological Oxygen Demand
CA	Concession Agreement
CEC	Cation Exchange Capacity
CEMP	Contractor Environmental Management Plan
CHMP	Cultural Heritage Management Plan
COD	Commercial Operating Date
COD	Chemical Oxygen Demand
CUZs	Controlled Use Zones
DAFO	District Agricultural and Forestry Office
DBH	Diameter at Breast Height
DLF	Department of Livestock and Fisheries
DLMA	District Land Management Authority
DO	Dissolved Oxygen
DONRE	District Office of Natural Resources and Environment
EHVMP	Ecosystems Health and Vitality Management Plan
EIA	Environmental Impact Assessment
EM	Effective Microorganisms
EMO	Environmental Management Office
EMU	Environmental Management Unit
ES	Earth Systems Sole Co., Ltd
ESD	Environmental and Social Division
ESMMP-CP	Environmental and Social Monitoring and Management Plan for the Construction Phase
ESMMP-OP	Environmental and Social Monitoring and Management Plan for the Operation Phase
FAO	Food and Agriculture Organization
FMA	Forestry Management Agreement
FMP	Forest Management Plan
FMU	Forestry Management Unit
GOL	Government of Laos
HSRA	Houay Soup Resettlement Area
IAP	Independent Advisory Panel
ICEM	International Centre for Environmental Management
IEE	Initial Environmental Examination
INRM	Integrated Natural Resource Management

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INRMP	Integrated Natural Resource Management Plan
ISRIC	International Soil Reference and Information Centre
IUCN	International Union for Conservation of Nature
LFMA	Land and Forest Management Agreement
LKS	Local Knowledge Surveys
LUP-LA	Land Use Planning and Land Allocation
MAF	Ministry of Agriculture and Forestry
MONRE	Ministry of Natural Resources and Environment
MSDS	Material Safety Data Sheet
NA	National Assembly
NBCA	National Biodiversity Conservation Area
NLMA	National Land Management Authority
NN1HP	Nam Ngiep 1 Hydropower Project
NNP1	Nam Ngiep 1 Power Company
NPK	Nitrogen, Phosphorous and Potassium
NRM	Natural Resource Management
NTFP	Non-Timber Forest Products
PAA	Priority Agricultural Area
PAFO	Provincial Agricultural and Forestry Office
PAP	Project Affected People
PFA	Protected Forest Area
pH	Potential Hydrogen
PLUP	Participatory Land Use Planning
PM	Prime Minister
PMF	Probable Maximum Flood
PPA	Provincial Protected Area
PRLRC	Provincial Resettlement and Livelihood Restoration Committee
RAP	Resettlement Action Plan
RDS	Resettlement Development Site
REDP	Resettlement and Ethic Development Plan
RMU	Resettlement Management Unit
SDP	Social Development Plan
SMO	Social Management Office
SMP	Settlement Management Plan
SS-ESMMP	Site Specific Environmental and Social Management and Monitoring Plan
TABI	The Agro Biodiversity Initiative
TFP	Timber Forest Products
TORs	Terms of Reference
TPZs	Total Protected Zones
UMD	Upper Mixed Deciduous

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UMDB	Upper Mixed Deciduous Bamboo Mosaic
UNESCO	United Nations Educational Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UXO	Unexploded Ordnance
VAC	Village Aquaculture Committee
VAG	Village Agriculture Group
VCF	Village Conservation Forest
VFC	Village Forest Committee
VFMA	Village Forest Management Agreement
VFO	Village Forest Organisation
VFU	Village Forest Unit
WAHMP	Water and Aquatic Habitat Management Plan
WMC	Watershed Management Committee
WMP	Water Management Plan

# EXECUTIVE SUMMARY

## Introduction

The *Integrated Natural Resource Management Plan* (INRMP) for the Houay Soup Resettlement Area (HSRA) has been prepared by Earth Systems for the Nam Ngiep 1 Power Company (NNP1). It presents a series of integrated management measures and 'next steps' for implementation by the GOL and local communities with the support of NNP1, to ensure the sustainable management and use of land, forest and water resources within the HSRA.

The INRMP should be read in conjunction with the *Initial Environmental Examination* of the HSRA (November 2015). The IEE provides an environmental and social baseline; outlines potential environmental and social impacts; and provides a series of management and mitigation measures during construction and post construction phases of the HSRA development.

The objectives of the INRMP to:

- Confirm that the HSRA has adequate resources to meet the needs of resettled communities;
- Promote the sustainable development, management and use of natural resources to support livelihoods and enhanced ecosystem health and vitality;
- Promote collaboration between and strengthened capacity of the local community and relevant government authorities responsible for managing the HSRA natural resources; and
- Ensure that natural resources within the HSRA are managed in accordance with GOL policy and statutory requirements as well as international best practices.

The INRMP includes:

- Preliminary land and forest use zoning of the HSRA.
- Sub-plans for settlement areas; agricultural resources; forest resources; water resources; ecosystems health and vitality; and cultural heritage (and a framework for NTFP management – refer to Appendix B).
- Implementing arrangements including overarching institutional arrangements.

The HSRA will be included and managed as part of the NN1HP watershed area. As such, this INRMP will be included as an appendix to the Project's *Watershed Management Plan* (currently being drafted) and implemented by the NNP1 in coordination with relevant GOL agencies and the Houay Soup resettlement community.

## Background

The Houay Soup Resettlement Area is the NN1HP's designated resettlement site (refer to the Project's Concession Agreement, Annex C). This site was selected in consultation with PAPs after extensive analysis of a number of resettlement site options. The HSRA totals 6,108 ha and is located on the right bank of the Nam Ngiep River, immediately south of NN1HP's Re-regulation Dam.

A joint (GOL and NNP1) field survey of the proposed 6,108 ha site in June 2014 led to the approval of 1,745 ha of land for the purpose of resettlement and livelihood restoration for NN1HP Project Affected People (PAP) (MONRE Decision 6423, September 2014); and the identification of the remaining 4,363 ha as overlapping with the Nam Ngiep Nam Mang Protected Forest Area (PFA), a National Protected Forest (MAF Decree 333, 2010).

The GOL has since approved the annexure of 648 ha from the PFA for resettlement site development (MONRE Decision 4466, July 2015) and has indicated that the remaining 3,715 ha area may be used by PAPs as long as it is managed in accordance with a sustainable management plan.



During the IAP and ADB missions in December 2014, both parties requested additional assessment of the proposed HSRA development with greater attention on how the resources in the PFA land, particularly forests, are going to be managed.

In May 2015, NNP1 commissioned Earth Systems to conduct an Initial Environmental Examination (IEE) for the HSRA including a standalone *Integrated Natural Resource Management Plan* and *Public Consultation and Dissemination Plan*.

### **Description of the HSRA**

The 6,108 ha HSRA is currently delineated into two distinct units

- Resettlement Development Site; and
- Protected Forest Area.

The physical and biological character of the units facilitate resource management planning for the HSRA.

The 2,393 ha Resettlement Development Site (RDS) is characterised by flat to rolling topography that is suitable for HSRA infrastructure development (housing, community assets, roads, domestic and agricultural water supply infrastructure, and aquaculture) as well as upland / lowland agriculture, plantations and livestock grazing areas. Further, the RDS is largely comprised of highly degraded fallow habitat, ensuring HSRA development will not result in the removal of high value biodiversity during construction and agricultural / livestock site preparation / utilisation.

In contrast, the 3,715 ha Protected Forest Area (PFA) portion of the HSRA is largely comprised of moderately disturbed to pristine Upper Mixed Deciduous Forest and Mixed Deciduous / Bamboo mosaic, which is suited for the ongoing provision of Timber Forest Products (TFP) and Non-Timber Forest Products (NTFP), if sustainably managed. In addition, the perennial streams crossing the HSRA are sourced from the PFA, with the majority of their respective catchments within the HSRA. These resources may be easily protected to provide an ongoing source of domestic water supply and irrigation water supply.

### **Preliminary Land and Forest Zoning**

Preliminary land and forest zoning of the HSRA (refer to figure 0-1) forms the basis for the development of the INRMP. This zoning was informed by a series of studies including: initial land use planning of the RDS, the IEE (ES, November 2015); resource capability assessment (Appendix A); and GOL requirements for participatory land use planning (MAF/NLMA 2010) and the management of national protected areas (PM Decree 333).

The guiding principles for preliminary zoning include:

- That the RDS should be zoned as the primary area for the village settlement and intensive agricultural development; and
- That the PFA should be protected and zoned as per Decree 333 with controlled use zones being utilised as the primary village forest areas (i.e. conservation and utilisation forests).

The results of the preliminary land and forest zoning can be used as the basis for establishing the HSRA and completing Participatory Land Use Planning (PLUP) with resettlement villages. Through this process, resettled villagers will identify and/or confirm specific village agricultural and forestry zones; and be granted customary user rights to all land within the HSRA (including the PFA). The State will legally recognise traditional ownership and customary user rights to land and forest resources within the village boundaries.

The following activities are required to complete the PLUP process for the HSRA: completion of land and forest zoning; completion of the PLUP process; and monitoring of the implementation and outcomes of the HSRA PLUP activities.

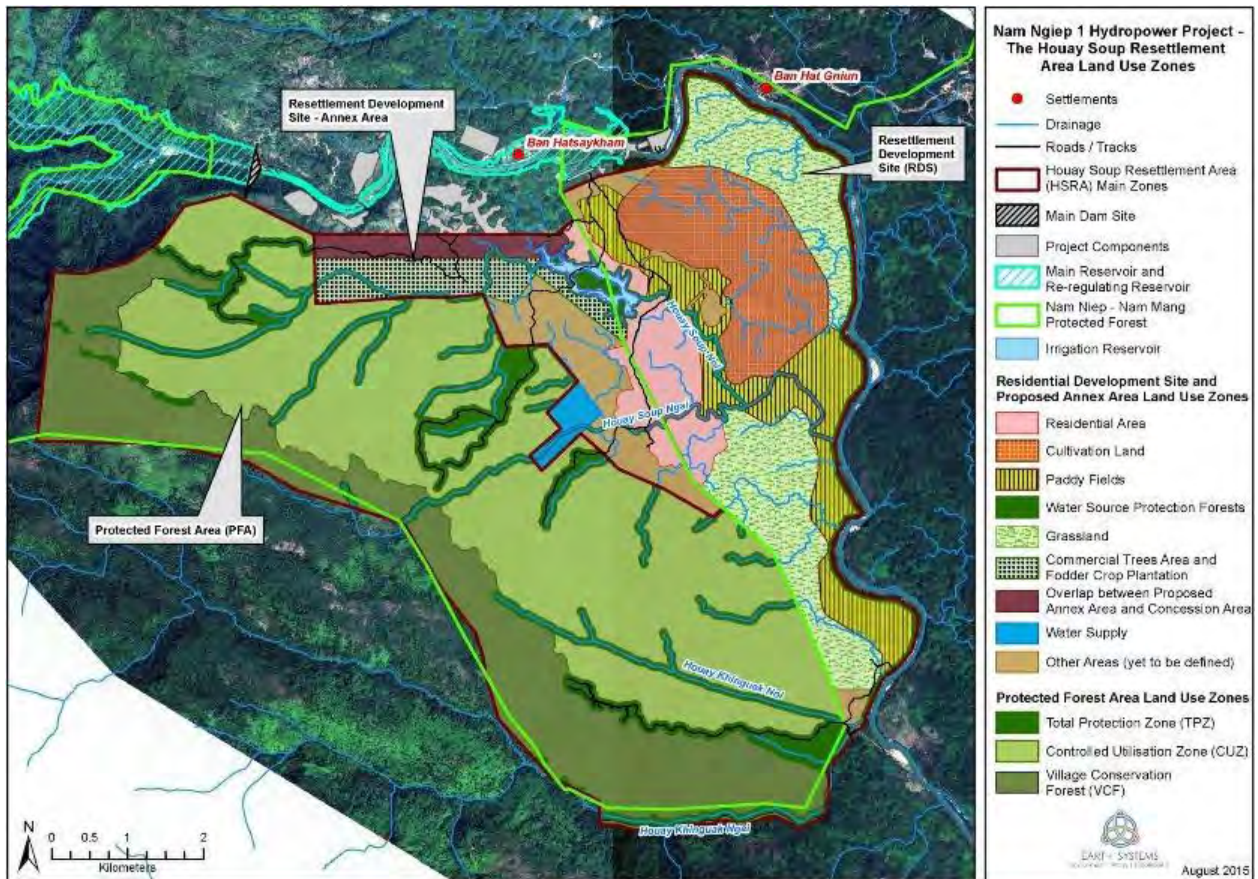


Figure 0-1 Preliminary HSRA Land and Forest Use Zoning

Source: Earth Systems 2015

## Natural Resource Management Sub-Plans

### Settlements Management

The Settlement Management Plan (SMP) has been developed to provide a framework for the preservation and management of the remaining ecology and natural amenity within the residential area of the HSRA. The overall aim of the SMP is to ensure that the residential area is developed in an environmentally sensitive manner and managed in a way that promotes sustainable and resilient communities. Key targets for the implementation of the SMP are: a) establishment of a village settlement management authority; b) endorsement of the village settlement management plan; c) environmentally sensitive planning and development; d) effective village waste management; environmental awareness; and e) monitoring and enforcement of management plans.

### Agricultural Landscapes Management

This Agriculture Management Plan (AMP) includes upland / lowland crops, plantation, animal husbandry, and aquaculture. The overall aim of the AMP is to ensure that the agricultural areas within the HSRA remain diverse and that productivity is increased through sustainable use of soil and water resources. The AMP identifies REDP strategies and more specific measures to develop and provide support for sustainable production of each for villagers of the HSRA. Key targets for the implementation of the AMP are: a) establishment of relevant village agriculture groups; b) endorsement of the agriculture management plan; c) development of agreements with relevant village committees regarding proposed agricultural management agreements; e) finalisation of the agricultural area certification and titling; f) review and implementation of the soil improvement program; g) development and implementation of relevant commercial plantation management sub-plans and registration; h) education campaign focussing on improving the community understanding of agricultural and animal production based livelihoods (e.g. soil improvement, aquaculture farming, pests and diseases, etc.); and i) monitoring and enforcement framework

to ensure issues with agriculture production, soil fertility and aquaculture schemes are managed appropriately.

### *Forest Management*

The Forest Management Plan (FMP) has been developed to provide a framework for sustainable management and enhancement of forest ecosystems and ecosystem services, with a focus on the PFA, within the context of HSRA resource requirements. Forest resources managed under this plan include: terrestrial habitats and flora; terrestrial fauna; and the ecosystem services that maintain the growth and survival of terrestrial biological resources (i.e. water and soils).

Responsibility for the management of forests across the HSRA will be shared between the government and village authorities. NNP1 will support these institutions. Key targets outlined in the FMP include: a) the establishment of village forest groups; b) review and endorsement of the forest management plan by the GOL; c) development of village forest management agreements (FMAs); d) delineation of forest zones; e) implementation of a forest rehabilitation program; f) implementation of an invasive species eradication program; g) development and implementation of commercial tree plantation management sub-plans; h) environmental education and awareness (forestry) of resettled communities; and i) forest monitoring and enforcement of the FMAs.

### *Water Resource and Aquatic Habitat Management*

The Water and Aquatic Habitat Management Plan (WAHMP) has been developed to ensure the sustainable use and management of water and aquatic resources within the HSRA. The HSRA IEE (ES, November 2015) includes further evaluation of potential impacts to downstream receptors. These resources include: surface and groundwater; and aquatic habitat, including streams and wetlands.

Key targets outlined in the WAHMP include: a) establishment of village water users group and village forest groups; b) review and endorsement of the water and aquatic habitat management plan by the GOL; c) development of village water management agreements; d) design and implementation of environmental flow conduits / regime for Houay Soup Noi and Houay Soup Ngai; e) development of a water resource infrastructure maintenance program; f) ensure management and mitigation measures identified in the WAHMP and HSRA IEE for hydrology, water quality, and aquatic habitat are incorporated into contractor CEMPs and SS-ESMMPs and ensure these management measures are contractual obligations; g) environmental education and awareness campaign for water resource management and protection; h) monitoring and enforcement of WAHMP management agreements; and i) development and implementation of water quality and hydrology monitoring regime.

### *Ecosystem Health and Vitality*

The ecosystems health and vitality management plan (EHVMP) aims to protect and enhance the health and vitality of ecosystems in landscapes and water resources across the HSRA. The EHVMP covers the following aspects: fire management; invasive species management; pest and disease control; and climate change. In addition, the establishment of Total Protection Zones, and Forest Conservation Zones will directly and indirectly promote incremental improvement in ecosystem health and vitality in the HSRA. Key targets outlined in the EHVMP are: a) development and implementation of a range of community-based programs to manage forest fires, invasive weeds, pests and diseases, and climate change effects within the HSRA; b) establishment of various reporting, monitoring and warning systems for the management of floods, forest fires and invasive species spread; c) coordinated flood response and management in the event of an emergency within the Nam Ngiep River Basin using real-time information available; d) community awareness and education programs focusing on the management of fire, invasive weeds, pests and diseases, and climate change effects within the HSRA; and f) adaptation to climate change effects for the NN1HP Dam Design and agricultural livelihoods within the HSRA.



### *Cultural Heritage*

The Cultural Heritage Management Plan (CHMP) has been developed to ensure the identification and management of cultural heritage within the HSRA including tangible and intangible assets and values of cultural, pre-historical, historical, archaeological, and natural significance.

Key targets outlined in the CHMP include measures to identify sites / artefacts of cultural heritage, and methods for managing chance finds of artefacts or cultural significant sites. Culturally significant areas will be developed in the HSRA during PLUP, with communities designating cemeteries, spirit forest, etc. that will be protected in accordance with their traditional practices. Key targets outlined in the CHMP include: a) establishment of relevant Village Groups responsible for cultural heritage management; b) review and endorsement of the Cultural Heritage Management Plan (CHMP), including the established chance finds procedure; c) community awareness and education of resettled communities on cultural heritage management; and d) monitoring and enforcement by responsible authorities for the ongoing management of identified natural or cultural heritage assets/sites.

### *NTFP Framework*

An NTFP management framework has been developed (refer to Appendix B). The Framework provides background information and guidance for the development of a detailed *NTFP Species Inventory and Management Plan*, which will be used to manage and monitor NTFP use in the HSRA. The overall aim of NTFP management in the HSRA is to promote sustainable use of NTFP's while minimising potential impacts and risks to biodiversity values. The management of NTFPs within the HSRA will need to take into consideration: a) permitted uses and restrictions of NTFPs in different Forest Management Zones within the HSRA; b) NTFP quota system; c) the potential for an NTFP quota system for use amongst villages based on a 'sustainable yield'; d) a restocking program for NTFPs in areas of diminishing stocks; and e) options for supplementary domesticated NTFP gardens. A Terms of Reference (TOR) for the development of a detailed *NTFP Species Inventory and Management Plan* is provided.

### **Plan Implementation and Management**

The INRMP will be implemented over the following phases:

- *HSRA construction phase* (October 2015 to late 2018) when the resettlement village will be constructed and agricultural lands developed.
- *HSRA post construction phase* (late 2018 to December 2024) which will commence after the relocation of PAPs from 2LR villages and continue until NNP1 has completed the resettlement and livelihood restoration program
- *HSRA 'operation' phase* (January 2025 until end of the project concession) which will commence after the completion of the resettlement and livelihood restoration program and run until the end of the project concession period.

The implementation of the INRMP will be led by the GOL and village authorities with the support of NNP1. Existing institutional arrangements for the management of the NN1HP will be utilised for the implementation of the INRM.

- The NNP1 will be responsible for the implementation of the INRMP in coordination with relevant GOL agencies and the newly established Houay Soup resettlement community.
- The PRLRC will coordinate with the WMC on the implementation of the INRMP during the construction and post construction phases of the HSRA development.

Specific institutional requirements for the implementation of INRMP sub-plans (i.e. settlements; agricultural lands; forests and forest resources; water resources; ecosystem health and vitality; and cultural heritage) are outlined within each sub-plan and in Section 9 of this report. The implementation of the INRMP will be monitored by the WMC. The Plan will be reviewed and updated every 3 years.

# 1 INTRODUCTION

The *Integrated Natural Resource Management Plan* (INRMP) for the Houay Soup Resettlement Area (HSRA) has been prepared by Earth Systems for the Nam Ngiep 1 Power Company (NNP1). It presents a series of integrated management measures and ‘next steps’ to be implemented by the GOL and local communities with the support of NNP1 to ensure the sustainable management and use of land, forest and water resources within the HSRA. This INRMP should be read in conjunction with the *Initial Environmental Examination of the HSRA* (September 2015).

The HSRA will be included and managed as part of the NN1HP watershed area. As such, this INRMP will be included as an appendix to the Project’s *Watershed Management Plan* (currently being drafted) and will be implemented by the NNP1 in coordination with relevant GOL agencies and the Houay Soup resettlement community.

## 1.1 Background

Nam Ngiep 1 Power Company (NNP1) has received a Concession Agreement (CA) from the Government of Lao PDR (GOL) to build and operate the Nam Ngiep 1 Hydropower Project (NN1HP) in Central Lao PDR. The NN1HP will generate power from a main dam (272 MW) and a Re-regulation Dam (18 MW) on the Nam Ngiep River in Bolikhan District, Bolikhamxay Province. As many as 3,300 project affected people (PAPs) from 750 households in five (5) communities are expected to require relocation.

The Houay Soup Resettlement Area (HSRA) is the NN1HP’s designated resettlement site (refer to the Project’s Concession Agreement, Annex C). This site was selected in consultation with PAPs after extensive analysis of a number of resettlement site options. The HSRA totals 6,108 ha and is located on the right bank of the Nam Ngiep River, immediately south of NN1HP’s Re-regulation Dam (refer to Figure 2-1).

A joint (GOL and NNP1) field survey of the proposed 6,108 ha site in June 2014 led to the approval of 1,745 ha of land for the purpose of resettlement and livelihood restoration for NN1HP Project Affected People (PAP) (MONRE Decision 6423, September 2014); and the identification of the remaining 4,363 ha as overlapping with the Nam Ngiep Nam Nang Protected Forest Area (PFA), a National Protected Forest (MAF Decree 333, 2010).

The GOL has since approved the annexure of 648 ha from the PFA for resettlement site development (MONRE Decision 4466, July 2015) and has indicated that the remaining 3,715 ha area may be used by PAPs as long as it is managed in accordance with a sustainable management plan.

During the IAP and ADB missions in December 2014, both parties requested additional assessment of the proposed HSRA development with greater attention on how the resources in the PFA land, particularly forests, will be managed.

In May 2015, NNP1 commissioned Earth Systems to conduct an IEE for the HSRA including a standalone *Integrated Natural Resource Management Plan* and *Public Consultation and Dissemination Plan* (HSRA IEE, Appendix B).

## 1.2 Objectives of the INRMP

The objectives of the INRMP to:

- Confirm that the HSRA has adequate resources to meet the needs of resettled communities;



- Promote the sustainable development, management and use of natural resources to support livelihoods and enhanced ecosystem health and vitality;
- Promote collaboration between and strengthened capacity of the local community and relevant government authorities responsible for managing the HSRA natural resources; and
- Ensure that natural resources within the HSRA are managed in accordance with GOL policy and statutory requirements as well as international best practices.

## 1.3 INRM Approach and Principles

### 1.3.1 Approach

The approach to INRM outlined in this plan is based on existing Government of Lao (GOL) laws, policy and practice. This includes:

- The *National Biodiversity Management Strategy and Action Plan to 2020* (GOL, 2004) which outlines a set of principles and key issues relevant for integrated management of the country's natural resources (refer to below);
- *The Handbook for Participatory Land Use Planning* (MAF/NLMA 2010) which outlines the formal process required for the establishment of the HSRA and specific measures regarding Protected Forest Areas; and
- The Prime Ministerial Decree 333/2010 on National Protected Forests which outlines the legal requirements for the establishment and management of the Nam Ngiep Nam Mang Protected Forest Area

### 1.3.2 Principles

Key principles for integrated natural resource management in the HSRA, adapted from the GOL's Biodiversity Strategy 2020, are outlined below.

- Natural resources within the HSRA will be managed and used sustainably to reduce poverty, restore and enhance livelihoods as well as the quality of life of resettlers and surrounding communities;
- Human settlements should be developed in an environmentally sensitive manner and managed in a way that promotes sustainable and resilient communities;
- Agricultural areas within the HSRA will remain diverse and productivity will be increased through sustainable use of soil and water resources;
- Forests within the HSRA will remain rich and productive and will be enhanced through conservation and protection and the sustainable management and use of biological and physical resources;
- Water resources (surface and ground) within the HSRA shall remain clean and abundant, and be improved, through sustainable development and where necessary, conservation and protection;
- Terrestrial and aquatic biodiversity within the HSRA will be maintained, through the protection, the conservation and the sustainable utilisation of biodiversity resources, including wild, semi-domesticated and domesticated biodiversity;
- Cultural and natural heritage sites of local, regional and international significance should be identified, protected and sustainably managed;
- The rights of resettlers to use and benefit from natural resources within the HSRA shall be established and safeguarded through the GOL's participatory land use planning process; and
- Natural resources within the HSRA shall be managed in accordance with Lao PDR law including the development and enforcement of village natural resource management plans / agreements.

## 1.4 INRMP Methodology

The INRMP is based on information collected during the EIA process and more specifically the IEE for the HSRA (ES, November 2015) and the Resource Capability Assessment (refer to Appendix A) conducted for the INRMP. The assessment of resources informed preliminary land and forest use planning and the development of a series of natural resource management sub-plans.

Through the IEE consultation exercises conducted in August 2015, Project affected people (PAPs) requiring relocation as a result of the NN1HP were consulted on the preliminary land use planning and proposed management planning. Further consultations and information dissemination measures are provided in the *Public Consultation and Disclosure Plan* (HSRA IEE, Appendix B).

## 1.5 Structure of the Plan

The INRMP is structured as follows:

- Section 1: Introduction to the INRMP including background, plan objective; INRM approach and principles; and the methodology employed to develop the plan.
- Section 2: Preliminary land and forest use zoning of the HSRA based on the requirements of the GOL's PLUP process and Decree 333 on Nationally Protected Forests and results of the resource capability assessment (Appendix A)
- Sections 3 to 8: Five (5) natural resource management sub-plans for settlement areas; agricultural resources; forest resources; water resources; ecosystems health and vitality; and cultural heritage. Each subplan contains management objectives; background information; identification of values, risks and potential impact to the resource; and management and monitoring activities, key performance indicators and implementation arrangements
- Section 9: Implementing arrangements including overarching institutional arrangements; a monitoring framework and indicative budget.

## 1.6 Lao PDR Policy and Legislation

The policy and legal framework in Lao PDR for natural resource management is summarised in Table 1-1. Specific laws and regulations applicable to the management of specific resources within the HSRA are provided in Appendix D.

**Table 1-1 Relevant Lao PDR Laws for forest management**

INRM Aspect	Key Policy and Legislation
Settlements (and socio-economic development)	<ul style="list-style-type: none"> <li>• Constitution of Lao PDR 1991 (amended 2003)</li> <li>• <i>Land Law 2003</i></li> <li>• National Socio-economic Development Strategy</li> </ul>
Agricultural Resources	<ul style="list-style-type: none"> <li>• Law on Agriculture 1998</li> <li>• Law on Irrigation 2012</li> <li>• Agricultural Development Strategy 2011-2020</li> </ul>
Forests and Terrestrial Resources	<ul style="list-style-type: none"> <li>• Law on Forestry 2007</li> <li>• Forestry Strategy to the year 2020</li> <li>• Prime Ministerial Decree 333/2010 on Protected Forests</li> </ul>
Water and Aquatic Resources	<ul style="list-style-type: none"> <li>• Law on Water and Water Resources 1996</li> <li>• Draft National Water Resources Strategy 2010</li> </ul>
Biodiversity	<ul style="list-style-type: none"> <li>• Law on Wildlife and Aquatic Biodiversity</li> <li>• National Biodiversity Strategy and Action Plan to 2020</li> </ul>
Cultural Heritage Resources	<ul style="list-style-type: none"> <li>• Law on National Heritage 2013</li> </ul>

## 2 LAND AND FOREST ZONING IN THE HSRA

This section outlines preliminary land and forest use zoning for the HSRA and presents a series of management measures or 'next steps' for completion of the PLUP process.

### 2.1 Current Land Use Planning

The Nam Ngiep Hydropower Project HSRA, located in Bolikhan District, Bolikhamsay Province, abuts the Nam Ngiep River immediately south (river right) of the Project's Main Dam and Re-Regulation Dam (refer to Figure 2-1).

A summary of the land zones designated within the HSRA is provided in Table 2-1.

**Table 2-1 Current Land Zoning within the HSRA**

Current Zoning	Brief description	Total area (ha)
Resettlement Development Site (RDS)	1,745 ha currently utilised by villagers of Ban Hat Gniun, Ban Hatsaykham, and Ban Somseun. Approved by GOL for HSRA resettlement development (MONRE Decision 6423/2014).  648 ha previously part of the PFA, now annexed for the RDS (MONRE Decision 4466/2015)	2,393
Protected Forest Area (PFA)	The remaining portion of the HSRA within the Nam Ngiep Nam Mang Protected Forest Area.	3,715
<b>Total</b>		<b>6,108</b>

Source: Earth Systems 2015

#### **Resettlement Development Site**

The 2,393 ha Resettlement Development Site (RDS) is characterised by flat to rolling topography as well as upland / lowland agriculture, plantations and livestock grazing areas. Further, the RDS is largely comprised of highly degraded fallow habitat, ensuring HSRA development will not result in the removal of high value biodiversity during construction and agriculturally / livestock site preparation / utilisation.

#### **Protected Forest Area**

The 3,715 ha Protected Forest Area (PFA) portion of the HSRA is largely comprised of moderately disturbed to pristine Upper Mixed Deciduous Forest, which is suited for the ongoing provision of Timber Forest Products (TFP) and Non-Timber Forest Products (NTFP), if sustainably managed. In addition, the perennial streams crossing the HSRA are sourced from the PFA, with the majority of their respective catchments within the HSRA. These resources may be easily protected to provide an ongoing source of domestic water supply and irrigation water supply.

### 2.2 Preliminary HSRA Land and Forest Use Zoning

#### 2.2.1 Objectives

The objectives of land and forest zoning (adapted from (adapted from MAF and NLMA 2010) are to:

- Define the extent and boundaries of future land use types and their areas within HSRA;
- Assign agricultural production and forest utilisation areas large enough for food security and commercial crops and self-sufficiency as a means towards livelihood restoration;

- Facilitate effective management and use of forest and agricultural land resources within the HSRA; and
- Ensure that the statutory requirements for land and forest zoning are met.

## 2.2.2 Resource Capability Assessment

A resource capability assessment was conducted on the HSRA (and surrounding areas) to inform the zoning and land use planning process. This included:

- Livelihood and Income Restoration Requirements;
- Land use and vegetation analysis;
- Soil analysis;
- Slope analysis; and
- Water resources analysis.

The results of this assessment are outlined in Appendix A. Further information is provided in the IEE HSRA (ES, 2015).

## 2.3 Land and Forest Zoning

The guiding principles for the proposed zoning (refer to Table 2-2) include:

- The RDS should be zoned as the primary area for the village settlement and intensive agricultural development; and
- The PFA should be protected and zoned as per Decree 333, with controlled use zones being utilised as the primary village forest areas (i.e. conservation and utilisation forests).

**Table 2-2 Defining characteristics of Village Land and Forest Zones**

Location	PFA Zone	Village Management Categorisation	Defining Characteristics and Principles
Protection Forest Area	Total Protection Zones (PM Decree 333)	Protection Forest Zone (including water source protection)	<ul style="list-style-type: none"> <li>• Areas with steep slopes</li> <li>• Areas with dispersible soils</li> <li>• Areas near rivers, stream banks and roads</li> <li>• No construction and industry</li> <li>• No production use</li> <li>• Should be regenerated to protection status</li> <li>• Has potential to revert naturally to a protection forest category</li> </ul>
		Conservation Forest Zone	<ul style="list-style-type: none"> <li>• Areas where plant and animal biodiversity is sufficient in quantity, variation and natural value to justify delineation as "conservation"</li> <li>• Has eco-tourism potential</li> </ul>
	Controlled Use Zones (PM Decree 333)	Utilisation Forest	<ul style="list-style-type: none"> <li>• Forest areas for sustainable community and village use</li> <li>• Areas not suitable for definition as "Protection Forest Zone" or "Conservation Forest Zone"</li> <li>• Areas that have been used by the community in the past (e.g. fallow and degraded land)</li> <li>• Close to the villages</li> </ul>
		Spirit or Sacred Forest/s	<ul style="list-style-type: none"> <li>• Cemetery ("Pa sa"), "Huang harm", "Maehasak"</li> <li>• These areas may later be registered as communal lands</li> </ul>
Resettlement Development Site	N/A	Village Residential Area	<ul style="list-style-type: none"> <li>• Areas set aside for village settlement with provision for an expanding population</li> </ul>
		Water Source Protection Forests (as per Protection Forest Zone)	<ul style="list-style-type: none"> <li>• Areas with steep slopes</li> <li>• Areas with fragile soils</li> <li>• Areas near river, stream banks and roads</li> </ul>

Location	PFA Zone	Village Management Categorisation	Defining Characteristics and Principles
			<ul style="list-style-type: none"> <li>No construction and industry use</li> <li>No production use</li> <li>Areas that can be regenerated to protection status</li> <li>Has potential to revert naturally to a protection forest category</li> </ul>
		Utilisation Forest	As above
		Spirit or Sacred Forest/s	As above
		Plantation Forest Zone	<ul style="list-style-type: none"> <li>Degraded forest or bare land</li> <li>Land in excess of village agricultural requirements for future populations</li> <li>Land with moderate slopes not in excess of 25 degrees</li> <li>Land that villagers have agreed to make available for plantation investment purposes</li> <li>Suitable soil characteristics for plantations, or the addition of soil amendments</li> </ul>
		Agricultural Zones	<ul style="list-style-type: none"> <li>Areas required for food and commercial crop production including upland and lowland areas</li> <li>Areas suitable for livestock production</li> <li>Land held in reserve for future populations</li> <li>Land for future conversion to banded paddy</li> <li>Degraded areas with low forest regeneration potential</li> <li>Settlement lands</li> </ul>
		Other areas	<ul style="list-style-type: none"> <li>Bald or barren land</li> <li>Rock areas and gravel pits</li> <li>Streams and natural ponds</li> <li>Lakes and dams</li> <li>Roads</li> </ul>

Source: MAF/NLMA 2010

Proposed land and forest zoning of the HSRA outlined in Table 2-3 and Figure 2-1 below is consistent with the guiding principles listed above.

**Table 2-3 Proposed land use zoning in the HSRA**

Village Land use category	PFA		RDS		Total	
	Ha	%	Ha	%	Ha	%
Residential	-	-	241.19	10.08%	241.19	3.94%
Lowland agriculture	-	-	368.84	15.41%	368.84	6.03%
Grazing	-	-	586.76	24.51%	586.76	9.60%
Upland agriculture	-	-	427.16	17.85%	427.16	6.99%
Plantation	-	-	262.05	10.95%	165.68	4.29%
Utilisation forest	2047.44	55.03	-	-	2047.44	33.49%
Conservation forest	1103.25	29.65	-	-	1103.25	18.04%
Water source forest (and water supply) <sup>^</sup>	-	-	225.48	9.42%	225.48	3.69%
Protection Forest*	570.01	15.32	-	-	570.01	9.32%
Other			282.03	11.78%	282.03	4.61%
<b>Total</b>	<b>3720.7</b>	<b>100</b>	<b>2393.5</b>	<b>100</b>	<b>6114.2<sup>#</sup></b>	<b>100</b>

Source: Earth Systems 2015

<sup>^</sup> Includes water source protection forests, water supply area and irrigation reservoir

<sup>#</sup> GIS files supplied by NNP1 cover 6,114.2 ha (while HSRA is 6,108 ha).



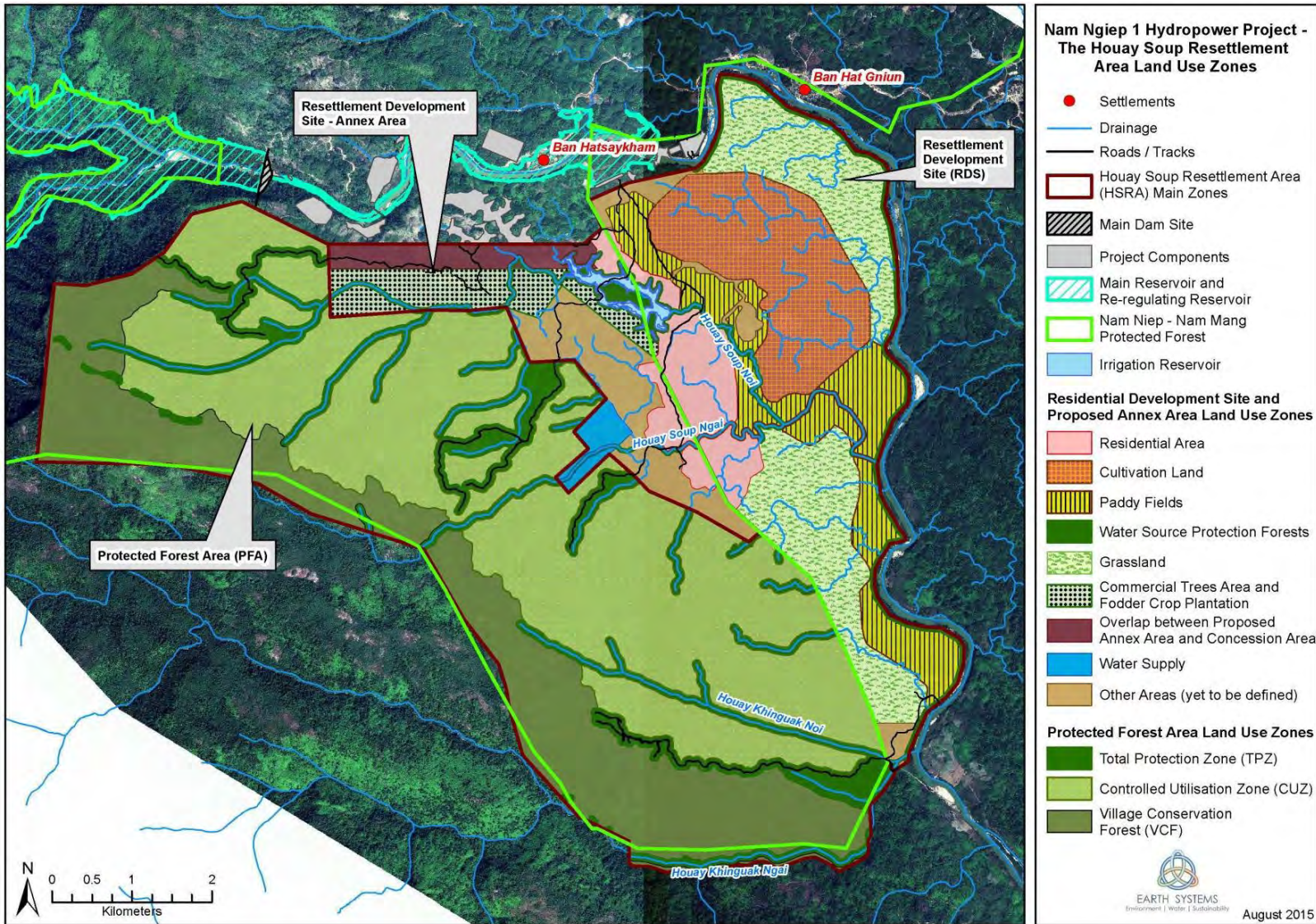


Figure 2-1 Preliminary HSRA Land and Forest Use Zoning

Source: Earth Systems 2015

### 2.3.1 Protected Forest Area

As outlined in Table 2-3, the PFA portion of the HSRA has been zoned as follows:

- Total Protection Zone
  - » Village Protected Forest (570 ha)
- Controlled use zone
  - » Village conservation forest (1,103 ha)
  - » Village utilization forest (2,047 ha)

#### **Total Protection Zones**

Total Protection Zones (TPZ) 'absolutely prohibit' human activities which may impact the integrity of the forest and biological resources in these areas. These zones must be strictly protected (Forest Law, 2007).

TPZs include steep sloped areas (i.e. over 35 degrees); stream origins; road and riparian buffer zones (i.e. 50 m buffers on each side); and corridor areas. The presence of natural and modified forest areas (i.e. UMD, UMD / Bamboo Mosaic and Bamboo) has also been considered.

A total of 570 ha within the HSRA PFA has been zoned as TPZ (refer to Figure 2-1). This area mainly consists of road and riparian buffer and water source protection areas. Land use and habitat is predominately UMD and bamboo / UMD mosaic forest (57%) and fallow (36%) (refer to 2-4).

The area directly to the west (Mount Phou Hong) and outside the current HSRA boundary, consists of a steep slope (the majority over 35 degrees) and is recommended for zoning as TPZ.

#### **Controlled Use Zones**

Controlled use zones are less sensitive areas within the PFA where activities are permitted that will not cause negative impact on the continued function of the forest and associated ecosystems. In the HSRA PFA, these zones include all areas not zoned as TPZs.

A total of 3,150 ha within the HSRA PFA has been zoned as CUZs. CUZs are outlined in Figure 2-1. A profile of the land use and vegetation within these zones is provided in Table 2-4.

Note, a *Village Conservation Forest*, within the CUZ, is proposed along the southern boundary of the HSRA (refer to Section 2.3.2). The remaining area is proposed as *Village Utilisation Forest*.

**Table 2-4 Land Use / Habitat Profile of the HSRA PFA Zones**

Category	Total Protection		Controlled Use		Total (Ha)
	Ha	%	Ha	%	
UMD	33.70	5.91	129.36	4.11	163.05
Bamboo / UMD mosaic	289.94	50.86	2035.70	64.61	2325.63
Bamboo	13.90	2.44	270.15	8.57	284.05
Grassland	2.32	0.41	79.51	2.52	81.83
Old Fallow	66.44	11.66	240.91	7.65	307.36
Young Fallow	137.53	24.13	332.05	10.54	469.58
Cultivated Land	0.03	0.00	1.07	0.03	1.10
Roads / Tracks	10.92	1.92	-	0.00	10.92
Rock Outcrops	8.04	1.41	61.94	1.97	69.98



Category	Total Protection		Controlled Use		Total (Ha)
	Ha	%	Ha	%	
Water	7.19	1.26	-	0.00	7.19
Total Area (ha)	570.01	100.00	3150.69	100.00	3720.70

Source: Earth Systems 2015

### 2.3.2 Resettlement Development Site

Proposed land use zoning developed by NNP1 and confirmed through additional analysis is outlined in Table 2-3 and includes:

- Village residential zone (241 ha);
- Village agriculture zone
  - » Lowland rice cultivations areas (367 ha)
  - » Upland cultivations areas (427 ha);
  - » Cattle grazing areas (587 ha);
- Village forest zone
  - » Plantation areas (262 ha);
  - » Water source protection forest (i.e. riparian buffers and water supply) (225 ha).

In addition to the above, unallocated 'other areas' total 282 ha. It is anticipated that these areas will be used for additional agriculture or forestry / plantation areas as required.

#### ***Village Residential Zone***

The village residential zone is the area set aside for the village settlement. This includes residential plots (no less than 800 m<sup>2</sup> or 60 ha for 750 households) and other community areas such as utility infrastructure, community buildings and recreational areas. The allocated residential area of 241 ha includes land for current development to meet the needs of the Project resettlement and expansion areas to meet the needs of anticipated growth.

#### ***Village Agricultural Zone***

The village agricultural zone is the area required for village food and commercial crop production. This includes lowland rice fields (367 ha); upland cultivation areas (427); and livestock grazing areas (587 ha). These areas all meet land allocation requirements outlined in the REDP (NNP1 2014). Unallocated 'other' areas to the west of the residential area and to the south of the lower grazing area offer opportunity for further agricultural zone development.

#### ***Village Forest Zone***

Village forest zones within the RDS include plantation areas (262 ha) and water source protection forest (225 ha). Unallocated 'other' areas to the west of the residential area offer an opportunity for further plantation area development. These areas and small pockets of hilly / fallow areas within the lowland agricultural areas provide opportunity for the establishment of village utilization or spirit forests.

## 2.4 Implementing Arrangements

The results of the preliminary land and forest zoning can be used as the basis for establishing the HSRA and completing PLUP with resettlement villages. Through this process, resettled villagers will identify and/or confirm specific village agricultural and forestry zones. It is anticipated that exclusive access rights to PFA

resources will be granted to PAP relocated to the HSRA, and this granting process was ongoing at the time of writing.

### 2.4.1 Institutional Arrangements

Institutional and implementation arrangements are outlined in the REDP (NNP1, 2014). This includes:

- Provincial Resettlement and Livelihood Restoration Committee (PRLRC) and its secretariat representing the GOL;
- The Resettlement Management Unit (RMU) responsible for GOL participation and coordination with NNP1; and
- District and Village Development and Coordination Committees

NNP1 (SMO) in collaboration with the RMU and relevant district authorities will lead the completion of the participatory land use planning process with resettled villagers. At the district level, roles and responsibilities for PLUP are shared and /or divided between the District Agriculture and Forestry Office (DAFO) and the District Office of Natural Resources and Environment (DONRE). Authorities from these line agencies at the provincial and central level also play a role in the PULP approval process.

### 2.4.2 Implementation

The following activities are required to complete the PLUP process for the HSRA:

- Completion of land and forest zoning including:
  - » Confirmation of the HSRA boundary; and
  - » Identification / confirmation of village land and forest zoning.
- Completion of the PLUP process (refer to Sections 3-8):
  - » Establishment of village land and forest management groups / village authorities responsible coordinating villager inputs into HSRA land and forest zoning and management planning;
  - » Review and finalisation of draft management plans and the development of management agreements;
  - » Conduct of individual and communal land registration and tilting activities; and
  - » Data record keeping and information dissemination activities.
- Monitoring of the implementation and outcomes of the HSRA PLUP activities.

A summary of the targets, actions and responsibilities for land use planning in the HSRA is outlined in Table 9-1.

## 3 SETTLEMENT AREA MANAGEMENT

### 3.1 Introduction

The Settlement Management Plan (SMP) has been developed to provide a framework for the preservation and management of the remaining ecology and natural amenity within the residential area of the HSRA

#### 3.1.1 Background

Preliminary zoning of the resettlement development site of the HSRA is outlined in Section 2.3.

The residential area totals approximately 241 ha. This includes:

- Residential plots (~800 m<sup>2</sup>) for up to 750 households including house with toilet and yard / garden;
- Community buildings including a health centre, market, bus stop, community hall, village office, community playground / sporting ground;
- Public infrastructure and utilities including community roads, domestic water treatment / supply, electricity distribution and solid waste facility; and
- Other public / green spaces (i.e. nature strips, water source protection forests, etc. ...).

The residential area is surrounded by agriculture and forest land designated to the resettled community.

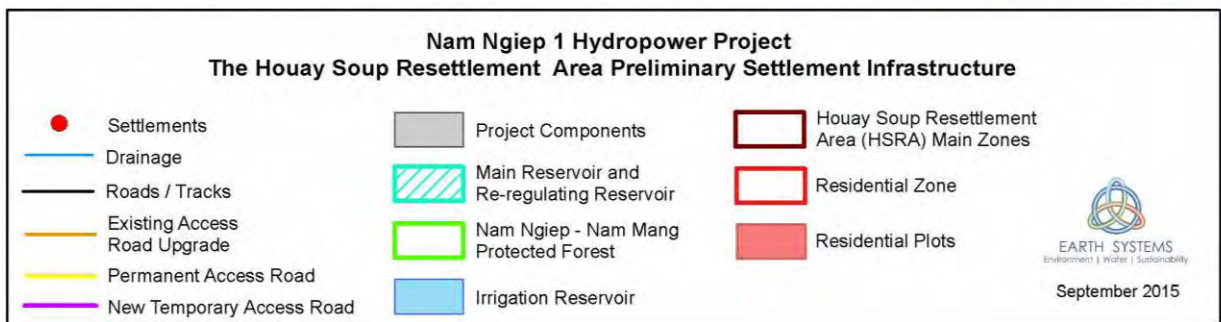
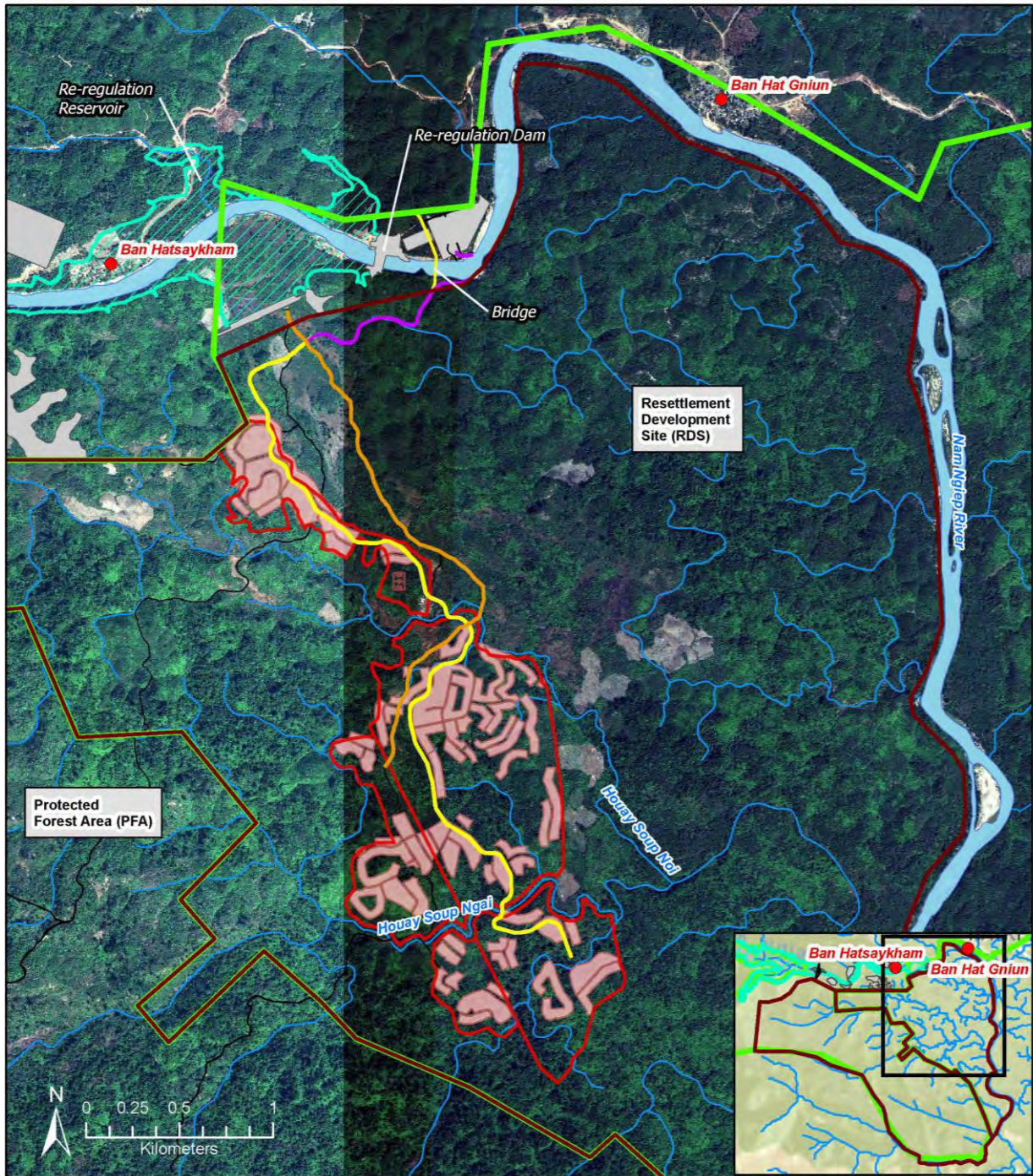
#### 3.1.2 Objectives

The overall aim of the SMP is to ensure that the residential area is developed in an environmentally sensitive manner and managed in a way that promotes sustainable and resilient communities.

The objectives of the Plan are to:

- Promote the sustainable development, management and use of the HSRA settlement area to support livelihoods and enhanced ecosystem health and vitality;
- Promote collaboration between and strengthened capacity of the local community and relevant government authorities responsible for managing ecology and natural amenity in the HSRA settlement area; and
- Ensure that ecology and natural amenity in the settlement area is managed in accordance with GOL policy and statutory requirements as well as international best practices.





**Figure 3-1. Preliminary HSRA Settlement Layout**



## 3.2 Ecology and Natural Amenity

### 3.2.1 Context

The site for the residential area consists primarily of agriculture / fallow areas with small pockets of degraded Mixed Deciduous / Bamboo Forest. Two (2) perennial streams run through the area – the Houay Soup Noi and Houay Soup Ngai. The area has a recent history of commercial logging, slash and burn agriculture, and livestock grazing that has altered the landscape and its original ecological functions.

The development of the residential area infrastructure will further alter the natural environment. Land for residential plots and communal buildings will be raised and levelled. Right of ways will be established for roads, transmission lines and domestic water supply. The Houay Soup Noi and Houay Soup Ngai will be developed for domestic water and irrigation water supply. Domestic wastewater facilities (septic) will be installed and a solid waste facility will be constructed. Public / green spaces such as a village soccer field and 'green areas' will be created – some of which preserving the existing habitats and environmental values of the area (i.e. water source protection forests).

### 3.2.2 Key Risks and Impacts

Key risks and potential impacts to ecology and natural amenity include:

- Poor urban planning and development; and
- Poor management of wastes generated by the settlement.

### 3.2.3 Management

Management measures to ensure the protection of ecology and natural amenity in the settlement area include:

#### ***Urban Planning and Development***

- Ensure residential development is conducted in areas of limited environmental risks e.g. flooding, erosion and landslip, and fire;
- Establish defined edges to urban areas where they meet rural land;
- Preserve, protect and restore local sensitive environments such as waterways within the settlement area including the preservation of riparian buffers (10 metres ephemeral; 25 metres perennial on each side of streams). Refer to 'waterway protection forests' (Section 5);
- Ensure the provision of public open space (i.e. recreational / park lands, riparian buffers) to reflect the rural identity of the village while providing amenity to housing locations;
- Preserve, protect and restore native vegetation on private and public land; and
- Ensure community awareness regarding the boundary of the settlement area (i.e through land use planning and mapping – refer to Section 2) and the village requirements regarding the management of this area.

#### ***Management of Settlement Waste***

- Ensure environmental services and infrastructure (i.e. water supply, wastewater treatment, solid waste disposal) are developed, maintained and managed according to Lao PDR requirements including National Environmental Standards (MONRE, 2009);
- Ensure community awareness regarding the management of domestic waste including unnecessary burning of domestic rubbish and green waste;

- Integration of NNP1 waste management programs (ie. recycling initiative) into the residential area of the HSRA; and
- Management of waste streams from domesticated livestock including water supply protection (refer to HSRA IEE).

### 3.3 Implementing Arrangements

#### 3.3.1 Institutional Arrangements

Village land and forest use planning (including the identification and demarcation of the village settlement area and within it residential areas, public facilities and protected environments) will be led by the PRLRC and RMU in collaboration with the NNP1 SMO, DAFO and DONRE (refer to Section 2).

Responsibility for the management of the ecology and natural amenity within residential area is shared between the government and village authorities (refer to Section 9.2 for further detail). NNP1 will support these institutions:

- District Authority: Responsible for coordinating with the village authority and local service providers regarding the management of the village and village cluster.
- Village Authority: Responsible for coordinating with the district authority and local service providers regarding the management of the village.

#### 3.3.2 Summary of Targets, Actions and Responsibilities

A summary of targets, actions and responsibilities for the implementation of the Village Settlement Management Plan (VSMP) is provided below and in Table 9-2.

Key targets include:

- Identification and endorsement of an applicable Village Authority for collaboration in implementing VSMP
- Endorsement of the Village Settlement Management Plan
- Environmentally Sensitive Planning and development
- Effective Village Waste Management
- Environmental Awareness
- Monitoring and Enforcement of Management Plans.

## 4 AGRICULTURAL LANDSCAPES MANAGEMENT

### 4.1 Introduction

This Agriculture Management Plan (AMP) includes upland / lowland crops, plantation, animal husbandry, and aquaculture (as per the Law on Agriculture, 1998). The AMP identifies REDP strategies and more specific measures to develop and provide support for sustainable agricultural production in the HSRA.

#### 4.1.1 Background

NNP1 is committed to livelihood and income restoration activities, including provision and support of agricultural resources in the HSRA (refer to Project CA and RAP). Livelihood and income restoration requirements are outlined in the Project's Livelihood and Income Restoration Plan (REDP 2014), including:

- Poverty Elimination: Raising households above the national poverty line;
- Maintaining Economic Parity: A living standard of at least pre-project level for every household; and
- Net Income Improvement: Increase of average community net income by 200% within 10 years from Commercial Operations Date (COD) from what will be measured in the baseline socioeconomic survey, to be carried out after cut-off-date close to the effective date.

The primary method for achieving these outcomes includes a collaborative approach to developing lowland (irrigated) rice cultivation areas, permanent upland agricultural areas, plantations, cattle grazing areas, and an aquaculture scheme.

#### 4.1.2 Objectives

The overall aim of the AMP is to ensure that the agricultural areas within the HSRA remain diverse and that productivity is increased through sustainable use of soil and water resources.

The objectives of the Plan are to:

- Promote the sustainable development, management and use of agricultural landscapes to support livelihoods and enhanced agro-ecosystem health and vitality;
- Promote collaboration between and strengthened capacity of the local community and relevant government authorities responsible for managing the agricultural landscapes and resources; and
- Ensure that agricultural landscapes and resources within the HSRA are managed in accordance with GOL policy and statutory requirements as well as international best practices.



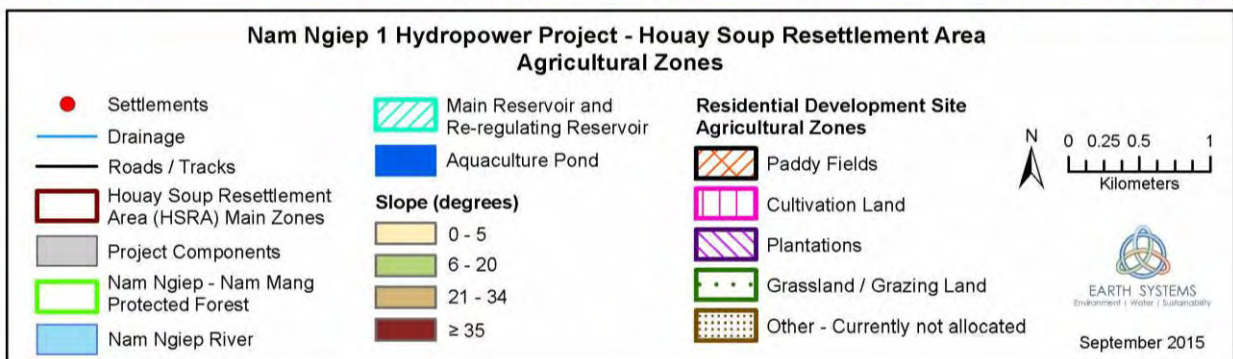
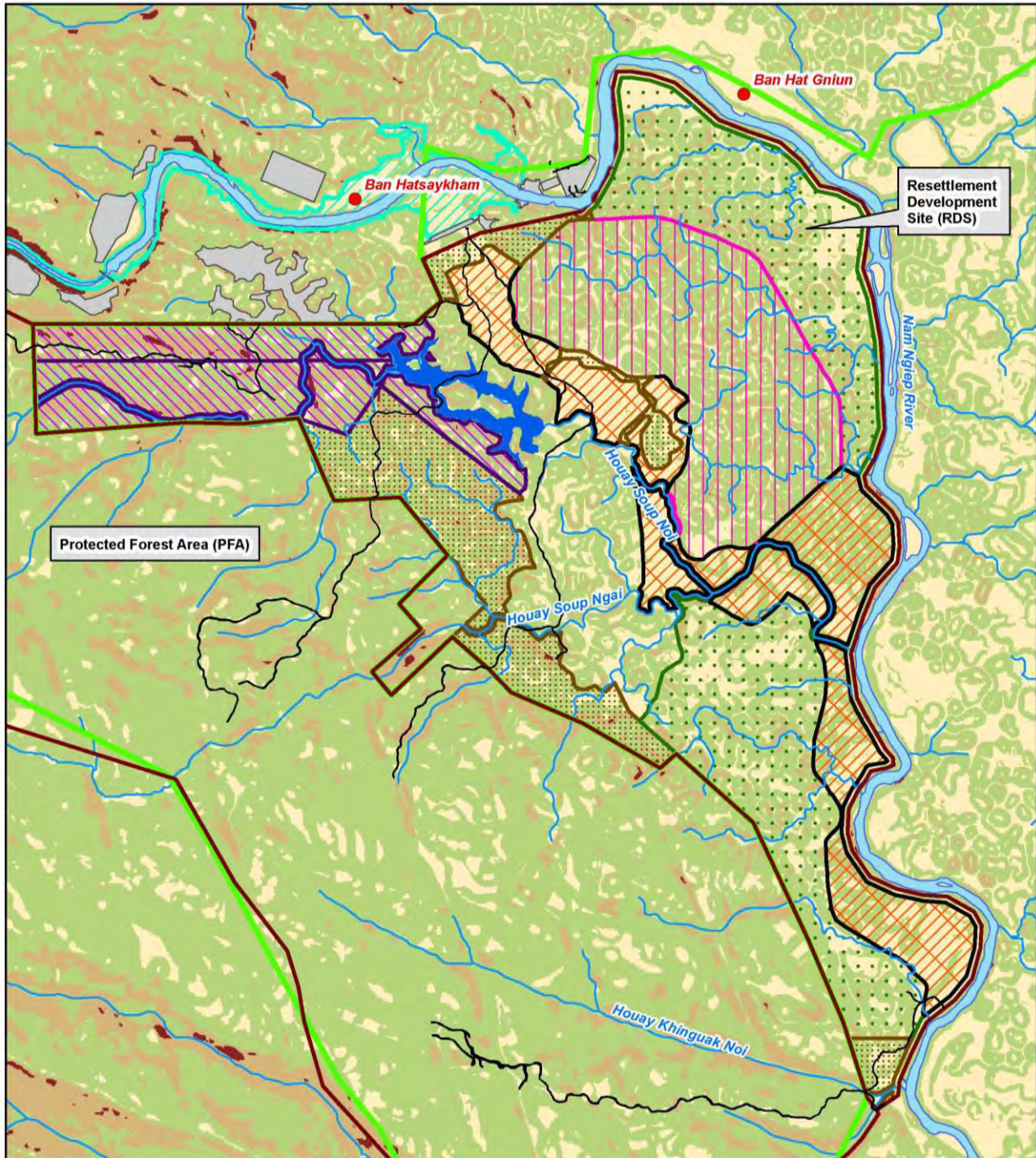


Figure 4-1. Preliminary HSRA Agricultural Zoning



## 4.2 Cropping

### 4.2.1 Context

In the context of the AMP, cropping includes irrigated lowland rice production and upland agricultural production (not including plantation, which are addressed below) – refer to Figure 4-1. The REDP specifies HSRA land allocation requirements for lowland and upland crop production (refer to Table 4-1). However, it is anticipated that land use zoning and development will provide slightly more land than that required to meet stipulated minimums. The lowland and upland cropping areas will be allocated to PAPs either privately or as community land title.

**Table 4-1 Land allocation requirements for cropping**

Method	Land Allocation (ha)			Estimated Requirement*	Preliminary Allocation
	Min.per person	Min.per household	Max. per household		
Lowland	0.1	0.3	1.5	330	368.8
Upland	0.1 ha per household member, multiplied by the # / household			330	427.2

Source: NNP1, 2014

\*Assumes all 750 households with approximately 3,300 people relocate. Source: REDP, NNP1 2014b

### 4.2.2 Key Risks and Impacts

Potential key risks and impacts for crops include:

- Acidic soils (and associated aluminium toxicity) inhibiting crop yields;
- Soil infertility inhibiting crop yields;
- Inadequate long-term commitment to soil improvement programs following NNP1 involvement in the programs (e.g. through funding issues);
- Pests and diseases leading to inadequate yields, plant mortality; and
- Livestock grazing of crops.

### 4.2.3 Management

NNP1 developed a demonstration farm within the HSRA in 2014 to trial various soil improvement techniques and yield responses for varying crops. The results of these trials inform some of the management planning (in particular, soil improvement).

#### **Lowland Agriculture**

The following measures comprise the preliminary lowland agricultural management plan:

- **Site Delineation:** NNP1 has identified the preliminary footprints for the Northern, Central, and Southern paddy. The delineation will have to be refined to include a 50 m riparian buffer for the Nam Ngiiep River, 25 m riparian buffers (each side) for the Houay Soup perennial tributaries, and 10 m riparian buffers (each side) for ephemeral streams. All riparian buffers will be measured from the crest (top of bank) of the main channel of the water course. Final delineation will be subject to PLUP (refer to Section 4.3.3, below);
- **Implementing arrangements:** PLUP and land titling will be required prior to site preparation (refer to Section 4.3.3, below). NNP1 will facilitate development and endorsement of a Village Agriculture Group (VAG) to assist in AMP implementation;

- **Site Preparation:** Some land levelling will be required (paddy field area slopes range from 0-5 degrees), and berms will be constructed to retain irrigated water. Care will be taken during this process to retain topsoils and keep as much of the upper soils layers in position;
- **Soil Improvement:** The soil improvement program will be initiated during the 2014 / 2015 dry season (refer to Section 4.6). Fertilisers and soils additives must comply with recommendations from the Department of Agriculture;
- **Irrigation:** Paddy fields will be irrigated from the Houay Soup Noi Irrigation Reservoir for approximately 8 months over the dry season to allow for more than one crop per year. The systems has been designed to provide at least  $1.04 \text{ m}^3 / \text{sec} / 1,000 \text{ ha}$  (NNP1, 2014). The use of irrigation must comply with the Law on Water and Water Resources (GOL, 1996);

The irrigation infrastructure is as follows:

- » The reservoir will have a maximum retention capacity of 2.25 million  $\text{m}^3$ , a live storage of 400,000  $\text{m}^3$  (operational depth of 1.5 m), and will cover approximately 67 ha when full; and
- » Reservoir water from Houay Soup Noi will be supplemented with water from the Project Re-regulation Reservoir for at least four (4) hours per day. The Re-ruglation Reservoir will provide  $4.6 \text{ m}^3 / \text{s}$  ( $63,000 \text{ m}^3 / \text{day}$ ) of water which will be gravity fed via an 825 m concrete lined canal to the irrigation reservoir.

The irrigation reservoir will have three outlets to canals that will convey water to paddy fields:

- » Outlet 1 will feed a 3,850 m concrete lined irrigation canal to the northern section of the paddy area. This canal will branch into two sections to supply approximately 68 ha.
  - » Outlet 2 will feed a 1,093 m concrete lined canal to a 38 ha paddy field in the middle of the paddy area, primarily for relocated residents of Ban Hatsaykham (resettled first in early 2016).
  - » Outlet 3 will supply  $\sim 2.91 \text{ m}^3 / \text{s}$  to the southern section of the paddy field via a 4,200 m concrete lined canal to directly irrigate 124 ha of paddy field and will supply water to four (4) pumping stations that will pump water to four canals that feed 266 ha of paddy fields in the southeast of the HSRA.
- **Fencing:** Paddy fields will be fenced by a standard agricultural electric wire fence to prevent large livestock from feeding on crops.
  - **Crop Selection:** The specific rice species will be determined by PAPs, with input from NNP1 regarding the results of the demonstration farm pilot activities.

### ***Upland Agriculture***

A major focus of the GOL in recent years has been a reduction in swidden agriculture. This AMP focuses on the development of permanent agricultural areas through implementation of a robust soil improvement programs. Swidden agriculture cannot be prohibited, but NNP1 will support the HSRA in developing permanent plots that meet the sustenance and livelihood needs of the villagers to promote a move away from swidden agriculture. Swidden agriculture will probibited in steep areas and those prone to erosion, as required under Decree 333, however in areas where it is permitted, the PLUP process and livelihood development programs will work with villages to extend the rotaion period between plots and allow recovery.

Cash crops are currently produced in the region, including corn, cassava, and rubber. The Project has commissioned a consultancy for a Rapid Market Assessment to better understand market mechanisms for these and other cash crops, which will form the basis for further livelihood activities in the resettlement site. However, crop selection will ultimately be decided by villagers of the HSRA.

The following steps will be implemented:

- **Site delineation and implementing arrangements:** The 427.05 ha area preliminarily designated for upland agriculture will be surveyed to determine actual usable area. Riparian buffer exclusion areas (25 and 10 m vegetative buffers on both sides of perennial and seasonal streams, respectively)

will be removed from the total available land. The site will then be subject to certification and the PLUP process, as per Section 4.3.3, below;

- **Site preparation:** Vegetation will be removed early in the dry season, prior to rainy season crop planting. Site preparation will require UXO surveys and development of erosion and sediment control facilities, refer to IEE for HSRA (ES, 2015). If required, soils will be ploughed following UXO clearance;
- **Soil improvement:** A robust soil improvement program is required to reach target values for key parameters (refer to below); and
- **Crop Selection:** Crop selection will be determined by PAPs, with input from NNP1 regarding the results of the demonstration farm pilot activities, cash crop analyses, and soil monitoring.

### **Home Gardens**

All households relocating to the HSRA will be supported by NNP1 in allocating plots for a home garden for self-sufficiency. NNP1 is providing adequate land next to each residence, livelihood training for interested PAP (with a focus on women and those less able to go to the fields), and fruit tree saplings.

### **Monitoring and enforcement**

The monitoring framework for the AMP should incorporate the following key measures:

- Agricultural plots should be inspected to ensure that they are consistent with allocated land certificates and that riparian buffer prohibition zones are adhered to;
- Annual sampling of soils should be undertaken in cropping areas for laboratory analysis of parameters measured for the HSRA IEE (2015). At a minimum, the samples should be analysed for pH, macro / micronutrients, and organic matter to inform soil amendment requirements to improve crop yields (refer to Section 4.6); and
- Periodic (e.g. annual) monitoring of the presence / extent of non-native invasive plant species, pests and diseases should be carried out within cropping areas to inform requirements of the invasive weed and integrated pest and disease eradication and control programs (refer to Section 7 for the EHVP).

## **4.3 Plantations**

### **4.3.1 Context**

Cultivated trees provides a significant source of cash income for villagers in the Upper Reservoir Area (Zone 2UR), Lower Reservoir Area (Zone 2LR) and the main hydropower project construction area (Zone 3), with approximately 27.5%, 1.9% and 9.6% of income reportedly generated from cultivated trees from these respective zones where PAPs will relocate from. NNP1 will provide a minimum of 0.1 ha of plantation per relocated individual, with the household allocation determined by the number of people per household. Approximately 330 ha is required for plantations, based on 750 households with approximately 3,300 relocated (NNP1, 2014).

Preliminary land use zoning for HSRA plantations includes approximately 262.1 ha of plantation land. An additional 282 ha of the Resettlement Development Site has not yet been allocated. This unallocated land is next to the plantation zone, as well as the residential area. The unallocated land will ensure that adequate plantation land is available. The GOL encourages and promotes tree planting on degraded forestlands (Directive No. 0234/MAF). The allocated land and unallocated land in the HSRA RDS meets these criteria.

Viable commercial tree plantation operations are currently conducted in the region (including rubber, citrus, Teak, Agarwood, and Eucalyptus). Other species offer equal or greater returns in the short and long term. One such alternative is Yang Bong, a tree with fragrant bark for making incense sticks which already has a market (NNP1, 2014). The Agro Biodiversity Initiative (TABI) project in Lao PDR has carried out research

on propagation, processing and marketing this tree. The project is currently considering Yang Bong for PAPs, but will conduct more detailed research to determine the current marketability, limitations, and opportunities (REDP). Another species currently being assessed by NNP1 is *Moringa Leifera*. There are a number of uses for components of the tree (medicinal, food, fodder, fuel). Similarly, NNP1 is assessing the viability of such an operation.

Agroforestry has also been considered. A number of agroforestry models exist in Lao PDR, some of which are proving to be commercially viable for both timber / pulp and interspaced crops.

The HSRA communities will decide (during the PLUP process) land usages for commercially productive trees. NNP1 will provide respective expertise and extension programs to support and align with decisions made by the PAPs during the PLUP (NNP1, 2014).

### 4.3.2 Key Risks and Impacts

Key risks and impacts for plantations include:

- Soil acidity and soil fertility inhibiting plantation yields;
- Establishing plantations without sufficient market value; and
- Potential diseases and pathogens affecting crops (refer to Section 7).

### 4.3.3 Management

Much of the management regime will depend upon species selection. The following management measures will be implemented, regardless of the species selection:

- NNP1 will work with the Village Agricultural Group (VAG) and the Village Forest Committee (VFC) during PLUP to register the plantation areas, requiring the following documentation: certificate of land ownership, land tax declaration, letter of application, and certificate of residence of the owner – for submission to the District Agriculture and Forestry Office for site verification;
- NNP1 shall pay the fee for the registration of tree planting parcels. For parcels with <5 ha, the head of DAFO shall approve and sign the certificate and for parcels >5 ha, the head of Provincial, Vientiane municipal and Special zone Agriculture and Forestry office shall approve and sign the certificate based on the study and recommendation of the District Agriculture and Forestry Office;
- Stocking requirements in the Directive of the Minister concerning the registration of tree planting parcels shall be adhered to, including at least:
  - » 2,000 trees per ha for 2 x 2 m spacing;
  - » 1,325 trees per ha for 3 x 2 m spacing;
  - » 880 trees per ha for 3 x 3 m spacing; or
  - » 800 trees per ha for 5 x 2 m spacing.
- Plantations must have a survival rate of at least 80% of saplings planted (or re-stocking is required);
- Trees must reach 5 m for fast-growing species or 3 m for slow growing species prior to harvest; and
- During site preparation, riparian buffers will be maintained (i.e. no vegetation clearing adjacent streams / wetlands).

The following should be consider:

- Trees should be planted in rows that align to horizontal contours, to minimise erosion and sediment transport; and
- Agroforestry plantations may be implemented, whereby tree rows are planted at 10 m spacing to allow upland crop production (e.g. rice during the first year, cassava during year two) in between rows.

### ***Monitoring and enforcement***

Plantation areas should be monitored as per the monitoring regime described for cropping, including including for invasive weed, pest and disease control and eradication. In addition, plantation trees should be monitored for stocking and annual growth.

## **4.4 Livestock**

### **4.4.1 Context**

NNP1 is committed to providing grassland for livestock in the HSRA. Approximately 587 ha (refer to Figure 2-1) in two locations have been preliminarily zoned for livestock grazing / grassland. According to the Project's REDP, a limit of large livestock to be introduced / resettled will be five (5) cattle or buffalo per household. However, this figure may be revised based on the actual number of households to be resettled. It is estimated that the 587 ha will serve approximately 2,400 head of beef cattle and 1,200 head of buffalo. The estimate of five (5) head of livestock per household is based on existing assets in communities that will be resettled and on the assumption the cattle will produce at least three (3) offspring per year, allowing one (1) head of livestock to be consumed per year and another two (2) to be sold.

The land planned for pasture is currently comprised of primarily Fallow Forest, with isolated patches of highly disturbed Mixed Deciduous Forest. The selection of livestock grazing areas was primarily based on minimising impacts to HSRA habitat, though access / proximity to the settlement is also considered. It is anticipated that the pastures will be completed in late 2016, during the second phase of HSRA construction.

### **4.4.2 Key Risks**

Key risks and impacts for livestock include:

- Potential pathogen inputs to water sources if livestock are allowed upstream of domestic water intake;
- Acidity / infertile soils inhibiting productivity of fodder;
- Losses of feed crops if grazing areas are not adequately isolated from cropping; and
- Disease may lead to large scale losses of livestock (refer to Section 7).

### **4.4.3 Management**

Key livestock management measures for the HSRA include:

- Collaborate with VAG on livestock requirements and support the HSRA in implementing a management program;
- Develop grazing areas with grass / fodder of sufficient quality for health and vitality of livestock;
- Fence-off the livestock grazing areas to prohibit encroachment into domestic water supply and the PFA. Provide access to either irrigation channels or provide drinking water ponds in grazing areas;
- Manage grazing land soils as per Section 4.6, ensuring they are capable of supporting target vegetation for grazing;
- Those using animal medicines must strictly adhere to rules and regulations and use them in compliance with their intended purpose, including the storage of such substances, to ensure that there is no danger to health or to the lives of people or animals (Law on Agriculture, 1998); and
- NNP1 must comply with the Ministry of Agriculture and Forestry' rules and regulations regarding prohibited animal medicines, import, transport, distribution, storage, and other activities related to animal medicines to ensure that they are of good quality.



### ***Monitoring and enforcement***

Livestock should be monitored for disease control and eradication; grazing areas monitored for yields, pests and diseases; and soil quality monitored (refer to below) to ensure the productive capacity of livestock grazing areas.

## **4.5 Aquaculture**

### **4.5.1 Context**

NNP1 has identified aquaculture as a viable means to supplementing dietary needs for HSRA villagers. Villagers in rural Lao PDR depend on fish as a staple for consumption, and construction / operations of the hydropower project and HSRA will likely impact the availability of native fish stock in the Nam Ngiep River and its tributaries.

NNP1 is committed to providing a viable aquaculture scheme in the HSRA Irrigation Pond (i.e. the northern fish pond identified in the REDP). NNP1 will collaborate with PAPs on sustainable community based management of the aquaculture pond. The development of the fish pond does not deprive PAP's from their entitlement to privately held replacement fishponds for their loss in current communities nor does it prohibit HSRA development of additional fish ponds

### **4.5.2 Key Risks and Impacts**

The following key risks and impacts are associated with the aquaculture scheme:

- Low dissolved oxygen concentrations from the Re-regulation Reservoir may diminish water quality for aquaculture in the Irrigation Reservoir (with water sourced from the Re-regulation Reservoir);
- Non-native fish may escape that may impact native fish populations downstream;
- Effluent from the fish pond may be high in nutrients, impacting downstream water quality (or fertilising paddy fields); and
- Improper management of the facility may lead to disputes amongst residents of the HSRA.

### **4.5.3 Management**

Key management measures for the aquaculture scheme include:

- Implement and endorse the VAG to include aquaculture management;
- Assess the Irrigation Reservoir at Minimum Operating Level to determine the number / species of fish suited to the pond. Investigate the most desirable species, with respect to suitability for inhabiting the pond and desirability for consumption;
- Work with VAG to identify fair communal rights to resources – ensuring the aquaculture facility is beneficial to all families in the HSRA (e.g. maximum allowance for fish extraction from the reservoir per family);
- During detailed design, ensure the Irrigation Reservoir is suitable for aquaculture, with respect to hydrology (water volume, pending frequent inputs from Re-regulation Reservoir and release for irrigation of paddies) and water quality (e.g. dissolved oxygen);
- Stock the pond with fish species native to the Nam Ngiep basin. As this pond will be hydrologically connected to the Houay Soup Noi, Houay Soup Ngai, the Nam Ngiep River and each of its tributaries downstream of the Nam Ngiep 1 Hydropower Project re-regulation dam, exotic species must be prohibited;

- Conduct an education campaign regarding the potentially detrimental impacts of introducing non-native species to the pond (i.e. predation, use of habitat / spawning grounds, potential declines in species richness, etc.);
- Use high quality feeds and efficient feeding practices for aquaculture in the irrigation pond to mitigate potential elevated nutrient concentrations in effluent;
- Ensure adequate aeration and circulation of irrigation water to maintain high dissolved oxygen concentrations, enhancing the appetite of fish encouraging feed conversion;
- Train village members in aquaculture management to ensure the pond maximises yield per resident; and
- Monitor the effectiveness of aquaculture establishment, productivity, species, consumption and trading, annually.

In addition, NNP1 should consider the following:

- Consider developing additional, smaller ponds with no hydrologic connectivity to natural streams or irrigation canals (including in the event of massive storm events) to prohibit the potential for fish escape. The addition of supplementary ponds would:
  - » Allow for breeding of alternate / potentially more favourable species native or already common to the area (e.g. villagers have experience with Tilapia).
  - » Further reduce the need for overfishing the HSRA streams and depleting populations / species diversity.
  - » Prohibit effluent from fish ponds from impacting downstream habitat / water resource users.

### ***Monitoring and enforcement***

Aquaculture plots should be inspected to ensure that they are consistent with allocated land certificates and that riparian buffer prohibition zones are adhered to. In addition, aquaculture facilities should be monitored annually for stocking, fish growth, fish species, pond water quality, and community allocation of aquatic resources.

Monitoring of water quality should include the Re-regulation Reservoir and the Fish Pond to ensure dissolved oxygen concentrations are above 6 mg/L (at a minimum) and additional parameters favour fish vitality.

## **4.6 Soils**

### **4.6.1 Context**

Assessment of soil samples from 16 sampling sites in the HSRA (2011 and 2015) confirmed that the physio-chemical makeup of the soils in the HSRA will not be very productive without implementation of a soil improvement program (refer to Appendix A and HSRA IEE). HSRA soils were uniformly (across all sampling sites) acidic (e.g. pH 4.0 – 4.7); low in plant available nutrients (particularly phosphorous, potassium, magnesium, and calcium); with moderately low cation exchange capacity (CEC) and organic matter.

A pilot demonstration farm and soil improvement program has been established within the HSRA since 2014, and experiments have indicated that harvests can be improved significantly through a soil improvement program (NNP1, 2014).

### **4.6.2 Key Risks and Impacts**

The following key risks and impacts are associated with the aquaculture scheme:

- Acidic soils (and associated aluminium toxicity) inhibiting crop yields;

- Soil infertility inhibiting crop yields; and
- Inadequate long-term commitment to soil improvement programs following NNP1 involvement in the programs (e.g. through funding issues).

### 4.6.3 Management

The following should be considered to enhance soil productivity in lowland and upland agricultural areas and plantation areas (though management may differ in some respects per agricultural activity) to meet target values (NNP1, 2014) for key soil parameters (refer to Table 4-3):

- Application of dolomitic limestone to raise pH levels to target levels, minimising aluminium toxicity (< pH 4.5) and providing substrate more amenable to nutrient uptake. Dolomite is recommended as it provides magnesium and calcium fertilisation along with raising pH (as opposed to calcium carbonate which will not provide  $Mg^{2+}$ ). Annual or bi-annual soil sampling and laboratory test work should be undertaken to determine the frequency of dolomite application requirements;
- Planting of a nitrogen fixing crops (e.g. legumes) during construction of paddy fields will increase plant available nitrogen with minimal cost, effort, and readily accessible inputs (NNP1 2014);
- Nutrient analysis of agricultural / plantation soils prior to planting the first rotation to determine inorganic fertiliser requirements (likely NPK, with micro-nutrients as required), and application of appropriate inorganic fertiliser rates (with due consideration to timing of application);
- Annual or periodic analysis of soil fertility will be required (pending duration of crop cycling) to determine effective inorganic fertiliser application rates / frequency of application. Broad-scale applications of manure and other types of organic fertilisers should be avoided to prevent potential surface water pollution in the nearby Nam Ngiep River and its tributaries;
- Incorporation of further soil improvement techniques should be considered for the soil improvement program, including the application of either:
  - » Biochar produced from agricultural and food wastes as well as thinned wood after charring. Soil mixed with biochar becomes soft, porous, permeable and then suitable for plants to grow well. Moreover, it improves biological activity (i.e. microbes) due to its porous medium, which then supply plant nutrients such as nitrogen, potassium, phosphorus. The Project is exploring the option of biochar development with a research institute based in Chiang Mai, Thailand (NNP1, 2014); or
  - » Effective microorganisms (EM), which are predominantly anaerobic organisms such as lactic acid and fermenting bacteria. Research at the Houay Soup pilot farm has shown environmental destruction caused by symptomatic treatment, e.g. agrichemicals for plants damaged by blight, insects, and antibiotics for farm animals, in which microbes so called 'good bacteria' participate and decay organic matter. When EM is applied into the above conditions, various anti-oxidation materials and nutrients are produced, moreover it will stop organic matter from decaying, which creates suitable conditions for plants and animals (NNP1, 2014).
- Villagers will be informed of appropriate application rates for nutrients / dolomite through the NNP1 Livelihoods Support Program training. This training should be conducted annually for the initial years following agricultural plot establishment, as soil fertility will change over time and it is expected that ongoing monitoring of crop yield vs. nutrient application rates will refine the soil improvement program.

**Table 4-2 Target value of soil improvement**

Parameter	Paddy field	Upland Agriculture	Fruit farm
pH (H <sub>2</sub> O)	5.5-6.0	6.0-6.5	5.5-6.0
pH (KCl)	5.0-5.5	5.5-6.0	5.0-5.5
Effective phosphoric acid (mg/100 g)	More than 10	More than 20	More than 20

Parameter	Paddy field	Upland Agriculture	Fruit farm
CaO (mg/100 g)	More than 200	200-300	100-200
MgO (mg/100 g)	More than 25	20-40	25
K <sub>2</sub> O (mg/100 g)	More than 15	15-30	15-25
CEC (me / 100 g)	More than 20	More than 20	More than 20
CaO / MgO	Less than 6	Less than 6	Less than 6
MgO / K <sub>2</sub> O	More than 2	More than 2	More than 2
Base saturation (%)	60-80	80	40-60

Source: NNP1, 2014.

## 4.7 Implementing Arrangements

### 4.7.1 Institutional Arrangements

Implementing arrangements for agricultural activities will be guided by NNP1 and the Provincial Resettlement and Livelihood Restoration Committee, both of which are comprised of representatives from various GOL line agencies for the Nam Ngiep 1 Hydropower Project (e.g. MONRE, DAFO/PAFO, MAF, etc.). In addition, NNP1 will support the following institutional arrangements:

- The MAF along with its district and provincial government agencies (i.e. DAFO and PAFO), which are responsible for the registration, implementation, and inspection of agricultural production operations (including crops, commercial plantations) within the HSRA;
- The Land Use Planning and Land Allocation Committee (LUP-LA), which is responsible at provincial and district levels to inspect HSRA land before agricultural or animal based production operations are established; and
- The Village Agricultural Group and the Village Forest Group, which share responsibility for coordinating with district authorities on the management of crops, plantations, livestock, and aquaculture schemes.

NNP1 in collaboration with the PRLRC/RMU and relevant district authorities (i.e. DAFO, DONRE) will facilitate the completion of the participatory land use planning process (PLUP) with resettled villagers for the establishment of crops, plantations, livestock and aquaculture schemes.

### 4.7.2 Summary of Targets, Actions and Responsibilities

A summary of targets, actions and responsibilities for the implementation of the FMP is provided below and in Table 9-2.

Key targets include:

- Establishment of the Village Agriculture Group;
- Endorsement of the Agriculture Management Plan (AMP);
- Development of agreements with relevant Village committees regarding proposed agricultural management agreements;
- Finalisation of the Agricultural area certification and titling;
- Review and implementation of the soil improvement program;
- Development and implementation of relevant commercial plantation management sub-plans and registration;

- Education campaign focussing on improving the community understanding of agricultural and animal production based livelihoods (e.g. soil improvement, aquaculture farming, pests and diseases, etc.); and
- Monitoring and enforcement framework to ensure issues with agriculture production, soil fertility and aquaculture schemes are managed appropriately.



## 5 FOREST MANAGEMENT

### 5.1 Introduction

The Forest Management Plan (FMP) has been developed to provide a framework for sustainable management and enhancement of forest ecosystems and ecosystem services, with a focus on the PFA, within the context of HSRA resource requirements.

Forest resources to be managed under this plan include:

- Terrestrial habitats and flora;
- Terrestrial fauna; and
- The ecosystem services that maintain the growth and survival of terrestrial biological resources (i.e. water and soils).

#### 5.1.1 Background

Preliminary zoning of land and forest resources within the HSRA is outlined in Section 2.2.2.

The majority of village forest zones are located within the PFA and are intended to provide the full range of ecosystems services to resettled villages (i.e. provisioning, supporting, regulating and cultural).

The majority of the RDS will be used for settlements (refer to Section 3) and intensive agriculture (refer to Section 4). Riparian forest buffer zones will be established to protect waterways and may also serve as wildlife corridors and will enhance aesthetics. Plantations will also be established in the RDS – in either specific agroforestry / plantation zones or upland agriculture areas.

#### 5.1.2 Objectives

The overall aim of the FMP is to ensure that forests and biological resource within the HSRA will remain rich and productive and will be enhanced through conservation, protection and sustainable management practices.

The objectives of the Plan are to:

- Promote the sustainable development, management and use of forest and forest resources within the HSRA to support livelihoods and enhanced ecosystem health and vitality;
- Promote collaboration between and strengthened capacity of the local community and relevant government authorities responsible for managing the forests and forest resources; and
- Ensure that forests and forest resources within the HSRA are managed in accordance with GOL policy and statutory requirements as well as international best practices.

## 5.2 Forest Habitats and Flora

### 5.2.1 Context

#### ***Forest Habitats***

The HSRA is covered by natural and modified habitat types (according to ADB definitions<sup>1</sup>). Natural habitats include forests that are typified by a canopy of native trees, a mid-canopy of smaller trees and shrubs and an understorey of herbs, vines, small shrubs, fallen logs and leaf litter. These forests are relatively species rich and will be protected and managed to maintain their structural integrity and species diversity. Modified habitats that retain a forest-like structure and are composed of mostly native species can be managed to be utilised for their resources, or rehabilitated to better resemble natural habitat.

There are five (5) natural forest habitat types (subjected to varying levels of disturbance / modification) in the HSRA, including:

- Upper Mixed Deciduous (UMD) forest;
- Upper Mixed Deciduous / Bamboo mosaic (UMDB) forest;
- Bamboo forest;
- Riparian forest; and
- Grassland.

Significantly modified forest habitat includes:

- Old fallow – left to regenerate > 8 years; and
- Young fallow – left to regenerate < 8 years.

#### ***Protected Forest Area***

The majority of the PFA forests have been subjected to varying levels of selective timber harvest, leaving natural forest communities intact, though modified from their historic species distribution. Each of the forest types listed above occur within the PFA. Forests range in quality from moderately disturbed to pristine. Pristine forests exist only along the northern-most boundary of the PFA, where large granite boulders / outcrops prohibited historic road construction / vehicular access.

#### ***Resettlement Development Site***

Land conversion for shifting agriculture has significantly impacted the vegetative communities of the RDS (leaving primarily fallow forest). There are only a few patches of moderately to highly degraded UMD and UMDB forest in the south of the RDS. Similarly, riparian forest along Houay Soup and its tributaries in the RDS is patchy and highly degraded with an abundance of invasive plant species. No bamboo forest or grassland remains in the RDS. Overall, natural forest cover is low and modified habitat cover is extensive.

For a more detailed description of habitats and flora refer to the IEE.

#### ***Significant Flora Species***

##### ***Protect Forest Area***

Nine conservation important species were identified in the PFA and six of these are considered to be globally threatened (i.e. IUCN status of Vulnerable, Endangered or Critically Endangered). Most of these

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<sup>1</sup> Natural Habitat, as defined by the ADB Safeguard Policy Statement (2009) refers to “Land and water areas where the biological communities are formed largely by native plant and animal species, and where human activity has not essentially modified the area’s primary ecological functions.”

species are economically important species, and thus susceptible to harvest. Each of the threatened species were exclusively found within UMD and UMDB in the PFA.

Priority species (according to Ministry of Agriculture and Forestry (MAF) and research centre coalition Asia Pacific Forest Genetic Resources Programme (APFORGEN; Phongoudome et al. 2004)) for Lao PDR also occur in the PFA. These species are defined by the following: a) indigenous to Lao PDR, b) economically important now or in the near future and c) threatened as a result of over-use or destruction of natural habitats. It is highly likely that other species of conservation and/or economic importance grow within the forests of the PFA and therefore a precautionary approach should be taken in considering other species listed by the MAF.

No significant invasive species were identified within the forested habitats of the PFA, though a few indigenous species have regenerated rapidly and dominate some previously disturbed areas (e.g. bamboo species).

#### *Resettlement Development Site*

Species richness was significantly lower in surveyed plots of the RDS (~50 species) than the PFA (~85 species). Non-indigenous and invasive species are common and few threatened and conservation species were present. Three of the world's most invasive species were identified within the RDS (*Chromolaena odorata*, *Imperata cylindrica*, *Mimosa pigra*) and each were common wherever they occurred, particularly along the riparian zones of permanent and ephemeral waterways.

### **5.2.2 Key Risks and Impacts**

Historical and existing threatening processes in the forest habitats and flora include:

- Shifting cultivation and logging – Vegetation clearance for the development of agricultural land (e.g. cropping, livestock) and residences has resulted in the loss, degradation and fragmentation of natural habitats in the HSRA and surrounds;
- Over-exploitation of forest resources – Forest habitats and flora located in the HSRA and surrounds are threatened by over exploitation of trees and woody species for fuel, other domestic uses, and commercial harvest;
- Fire as a management tool – Use of fire for the clearing of land for agriculture has likely been extensive in the RDS. Altered fire regimes have been known to change habitat and flora composition, including changes to microclimate, soil quality and soil stability;
- Invasive and introduced species – These species are aggressive competitors and are capable of dominating areas of natural habitat following disturbance.
- Riparian degradation – Degradation of riparian vegetation and erosion of banks by agricultural land clearing has increased the sediment and nutrient load of the Nam Ngiep and its tributaries, reducing water quality.

Future risks to, and adverse impacts on, the forest habitats and flora are likely to include a continuation and intensification of the above impacts due to a significant increase in the number of people in the HSRA.

### **5.2.3 Management Measures Protected Forest Area**

The management of the forest zones within the PFA will differ from the forest management zones within the RDS and therefore these are separated in the following sections.

#### **Total Protection Zone**

##### *Protection Forest Zone*

The TPZs / Protection Forests have the highest management restrictions and should be strictly enforced. The following management measures will govern forest management in these areas:

- Vegetation will not be cleared, harvested, or otherwise disturbed;
- Seeds and fruits cannot be collected from protected species (refer to Protection Forest Zone);
- Seeds and fruit of non-protected species can be collected in a sustainable manner;
- Firewood or other flora collection will be prohibited;
- Removal of leaf-litter, logs, ground cover, etc. will be prohibited;
- Road construction is not permitted through TPZs or to within 500 m of TPZ boundaries to minimise the potential for illegal harvesting in the TPZ.

### ***Controlled Use Zone***

#### *Conservation Forests*

Conservation Forests within the PFA will be managed to avoid impacting the biodiversity value of habitat. This zone must be protected in a similar manner as the village protection forests but allows villagers to collect non-prohibited NTFP in accordance with the management plan. Other activities allowed within the zone are eco-tourism, scientific research and recreation. It is recommended that if some areas are partially degraded, active rehabilitation should be considered.

Management will be conducted accordingly:

- Disturbance to vegetation and the forest structure is prohibited (e.g. no clearing, harvesting);
- TFP, firewood and other material collection is prohibited;
- Permits/permission for species collection can be obtained from the MAF (e.g. scientific research);
- The local community can collect non-prohibited NTFP in a sustainable manner within the village boundary (refer to Appendix B);
- Seeds and fruits cannot be collected from protected species. Harvesting of other TFP fruits and seeds will be allowed;
- If rehabilitation activities are conducted, only indigenous species of local provenance should be planted;
- Rare and threatened species should be monitored and if necessary, restocked.

#### *Utilisation Forest*

Utilisation Forests within the PFA will be classified for utilisation of resources in a sustainable manner to minimise impacts to the environment and ecosystems in that area. This zone allows villagers to use non-prohibited TFP and NTFP in accordance with the management plan.

Management will be conducted accordingly:

- Logging will only be conducted for non-protected species where stocking of trees has reached > 75 m<sup>3</sup> per hectare of trees with > 20 cm DBH (diameter at breast height);
- Logging or harvesting will be restricted to less than 10% of the standing volume of that particular species with > 20 cm DBH;
- Logging or harvesting of protected species will be prohibited (excluding fruits, seeds); and
- Removal of firewood, leaf litter and other ground covers should be conducted in a way to maintain a relatively continuous ground-layer (if present).

#### *Spirit or Sacred Forest*

Spirit or Sacred Forests will be selected and managed according to traditional management regimes for spirit forests, cemetery forests, and divine forests (and additional cultural values, as apply). It is recommended that, if possible, these forests be as close to villages as practical to minimise disturbance on TPZs.

## 5.2.4 Management Measures: Resettlement Development Site

### *Water Source Protection Forest*

Water resources in the RDS will be protected with the implementation of a riparian exclusion zone that will extend from 25 m from the natural perennial streams / springs (bank crest) and wetlands (high water mark). Ephemeral streams will be similarly protected with a 10 m buffer (each side) from the bank crest. Water Source Protection Forests will be managed accordingly:

- Vegetation clearing, vegetation harvesting / removal, and additional vegetation disturbance will be prohibited;
- NTFP extraction will be permitted, but will not include the harvest of entire plants (e.g. fruit and mushroom collection is not considered vegetation removal / disturbance);
- NNP1 will be responsible for rehabilitating and revegetating riparian buffer zones following construction;
- Rehabilitation and revegetation should involve using indigenous species of local provenance, especially rare and threatened species; and
- Should invasive species (e.g. *Mimosa pigra*) become widespread, an eradication program should be implemented during rehabilitation activities.

### *Utilisation Forest*

Utilisation Forests will be managed for utilisation of resources will minimising impacts on the environment and ecosystem services (e.g. livelihoods) through sustainable practices. These zones will be managed in a similar manner as the Utilisation Forests in the PFA, but allows villagers to collect all TFP and NTFP in accordance with the management plan.

Management will be conducted accordingly:

- Logging will only be conducted for non-protected species where stocking of trees has reached > 75 m<sup>3</sup> per hectare of trees with > 20 cm DBH (diameter at breast height);
- Logging or harvesting will be restricted to less than 10% of the standing volume of that particular species of > 20 cm DBH:

### *Regeneration Forests*

Regeneration forests have less than 75 m<sup>3</sup> per hectare of trees with > 20 cm DBH, but are comprised of native species regenerating toward 'Utilisation Forest' status. Regeneration Forests will be managed accordingly:

- Regeneration forests will be managed for rehabilitation to Utilisation Forest status:
  - » Regeneration forests will not be harvested. Rehabilitation forests may be managed to convert to Utilisation Forest for eventual harvest (i.e. the standing volume of trees > 20 cm in diameter reaches 75 m<sup>3</sup> per hectare);
  - » Indigenous species of local provenance will be used in rehabilitation activities, including rare and threatened species (some included above);
  - » Regeneration forest will not be converted to forest plantation or agricultural land;
  - » Following development of management plans for a Regeneration Forest Area (in collaboration with the FMU), clearing of invasive species is permitted, and planting with indigenous tree species is encouraged; and
  - » Regeneration forests must be surveyed before its status if formally changed to Utilisation Forest (i.e. reaches 75 m<sup>3</sup> per hectare of trees with > 20 cm DBH), however tree harvest will not be conducted until the standing volume of trees > 20 cm in diameter reaches 85 m<sup>3</sup> per hectare of trees with > 20 cm diameter.



- An invasive species eradication program should be implemented during rehabilitation activities and in highly disturbed areas.

#### *Spirit or Sacred Forest*

Spirit or Sacred Forests will be managed according to traditional management regimes for spirit forests, cemetery forests, and divine forests (as discussed in above sections).

#### *Plantation Forest Zone*

The Plantation Forest Zone will be managed for the production of timber or byproducts of commercial value. Management measures will be specific to the forest type, species utilised and the silvicultural application desired. Management measures for plantation forests are provided in Section 4.3.

#### *Degraded Forests*

Degraded forest is a forest that is considered unlikely to regenerate to a Utilisation Forest within 45 years due to the historic logging activities that have reduced the standing volume to less than 30 m<sup>3</sup> per hectare (consistent with ADB nomenclature for Young Fallow / Old Fallow). The following management regime applies:

- Timber harvesting / logging is not permitted (until formal conversion to Utilisation Forest or Plantation Forest Zone is approved by the FMU);
- Soil amendments should be applied if the intended outcome is Plantation Forest;
- To promote establishment of Utilisation Forest, clearing of fallow vegetation and planting with target native tree species may be conducted, with approval from the FMU.

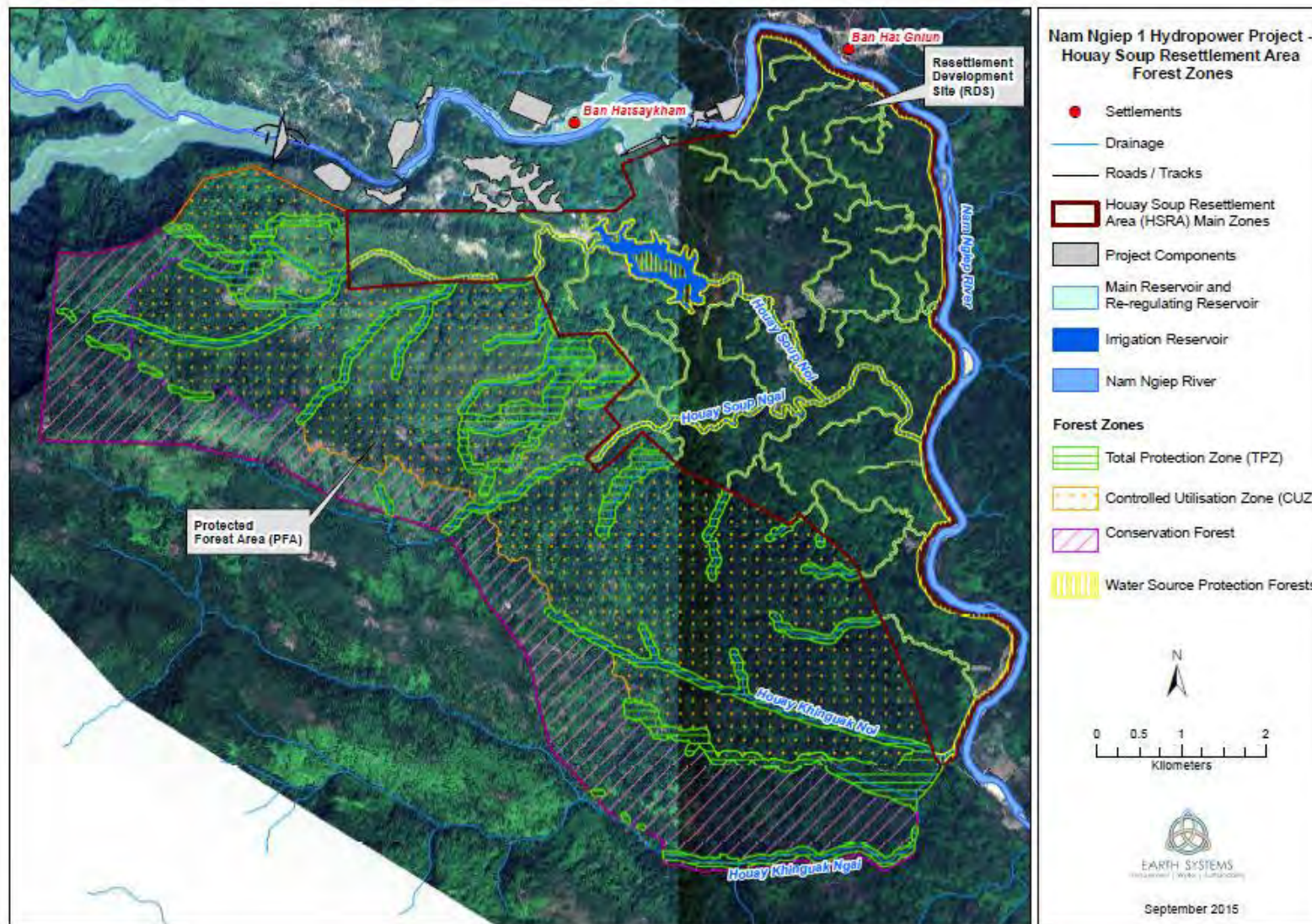


Figure 5-1. HSRA Forest Land Use Designations

## 5.3 Implementation Arrangements

### 5.3.1 Institutional Arrangements

Responsibility for the management of forests within HSRA is shared between the government and village authorities. NNP1 will support these institutions.

- The MONRE and its provincial and district line agencies (including District Forestry Units) are responsible for the management of PFAs;
- MONRE and the MAF and relevant provincial and district line agencies are responsible for forest management (outside PFAs); and
- Village forest organisations (i.e. forestry unit and forestry group) are responsible for coordinating with district authorities on the management of village forests. The VFO has the authority to develop the rules on the customary use of forest resources within their village boundary. These rules will be incorporated into the sub-forest management area management plan.
  - » Village Forestry Committee within the village to participate in the management of the forest under the responsibility of the village with the village chief(s) as the chairman / chairmen.
  - » Village Forestry Groups jointly manage forest land use and forest resource allocation / protection.

### 5.3.2 Summary of Targets, Actions and Responsibilities

A summary of targets, actions and responsibilities for the implementation of the FMP s provided below and in Table 9-2.

Key targets include:

- Establishment of village forest groups;
- Review and endorsement of the forest management plan by the GOL;
- Development of village forest management agreements;
- Delineation of forest zones;
- Implementation of a forest rehabilitation program;
- Implementation of an invasive species eradication program;
- Development and implementation of commercial tree plantation management sub-plans;
- Environmental education and awareness (forestry) of resettled communities; and
- Monitoring and enforcement of village forest management agreements.

## 6 WATER AND AQUATIC HABITAT MANAGEMENT

### 6.1 Introduction

The *Water and Aquatic Habitat Management Plan* (WAHMP) has been developed to ensure the sustainable use and management of water and aquatic habitat within the HSRA. The HSRA IEE (ES, 2015) includes further evaluation of potential impacts to downstream receptors.

These resources include:

- Surface and groundwater; and
- Aquatic habitat, including streams and wetlands.

#### 6.1.1 Background

##### ***Resettlement Development Site***

NNP1 will utilise surface water from the Houay Soup Noi and Houay Soup Ngai for lowland agriculture and domestic water supply, respectively.

The Houay Soup Ngai will be dammed and water piped to a water treatment plant. Treated water will then be conveyed to a water storage tank in the residential infrastructure area and then supplied to households via a gravity fed closed pipe system.

The Houay Soup Noi will be dammed to create a small reservoir (67 ha) which will hold water for release to conduits for subsequent conveyance to paddy field via a system of irrigation canals. Water will also be gravity fed from the Project Re-regulation Reservoir to the Irrigation Reservoir to supplement Houay Soup Noi surface water for four (4) hours per day. Four irrigation pumps will move water from the northern HSRA irrigation canals to the southern HSRA irrigation canals.

The remaining perennial and ephemeral streams (and tributaries of the Houay Soup downstream from HSRA water abstraction infrastructure) in the RDS will not be altered for HSRA operation. This will include establishment of riparian forest buffer zones on both sides of perennial (25 m) and ephemeral (10 m) streams to protect aquatic habitat.

##### ***Protected Forest Area***

Water and aquatic resources located within the PFA will be protected via implementation of the 'Total Protection Zone', which prohibits vegetation clearance and infrastructure development of any kind within 50 m from the bank crest of streams/springs and high water mark of wetlands.

#### 6.1.2 Objectives

The overall aim of the WAHMP is to ensure that water resources and aquatic habitat within the HSRA remain of high quality and can sustainably be managed to ensure adequate volume of water for domestic and irrigation water supply, while maintaining productive aquatic habitat through conservation, protection, enhancement, and sustainable management practices.

The objectives of the Plan are to:

- Promote the sustainable development, management, and use of water resources within the HSRA to support livelihoods and enhanced aquatic ecosystem health and vitality.



- Promote collaboration between and strengthened capacity of the local community and relevant government authorities responsible for managing the of water, fisheries and other aquatic resources within the HSRA; and
- Ensure that of water, fisheries and other aquatic resources within the HSRA are managed in accordance with GOL policy and statutory requirements as well as international best practices.

## 6.2 Surface Water Hydrology Management

### 6.2.1 Context

The HSRA is located across two (2) main sub-basins of the Nam Ngiep River Basin including the Houay Soup and Houay Khinguak (refer to Figure 6-2). These streams and their tributaries (listed below) are described in greater detail in the HSRA IEE (ES, 2015). The perennial streams in the HSRA currently provide for fishing, bathing, washing, drinking water, etc. for current users. It is anticipated that each stream will remain important for these practices (with bathing, fishing, drinking likely required during field activity) and fishing conducted throughout viable fisheries in the HSRA.

The primary HSRA water resource infrastructure (refer to Figure 6-1) will be as follows:

- Rice paddy irrigation water will be supplied from a reservoir constructed on the Houay Soup Noi. Water inputs to the reservoir will include natural Houay Soup Noi inflow and gravity fed water from the Nam Ngiep River Re-regulation Reservoir.
- Domestic water will be supplied via an intake / gravity feed systems from the Houay Soup Ngai, with supplementary water pumped from the Houay Soup Noi Irrigation Reservoir to meet dry season requirements.



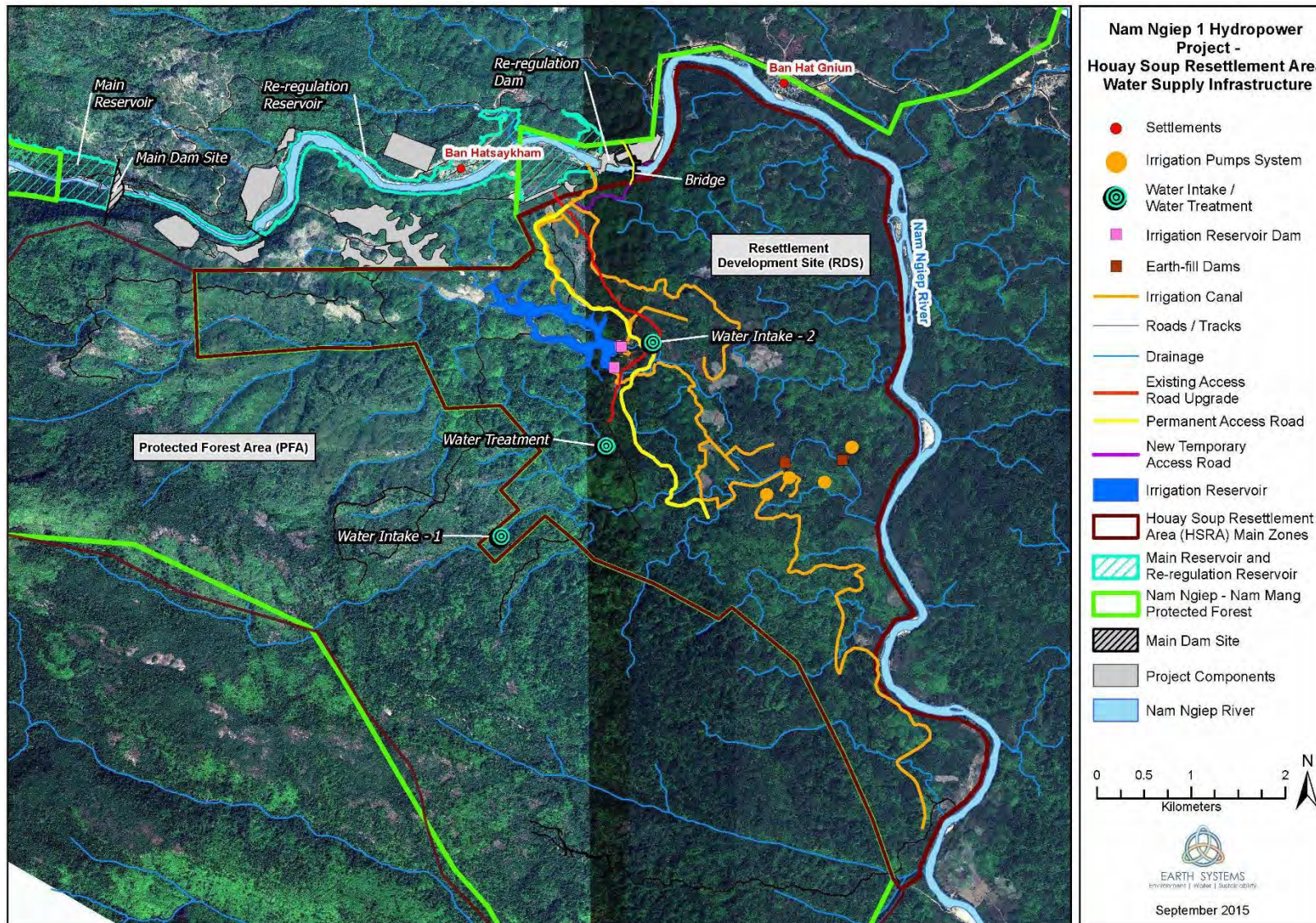


Table 6-1 HSRA Streams and Water Resource Infrastructure



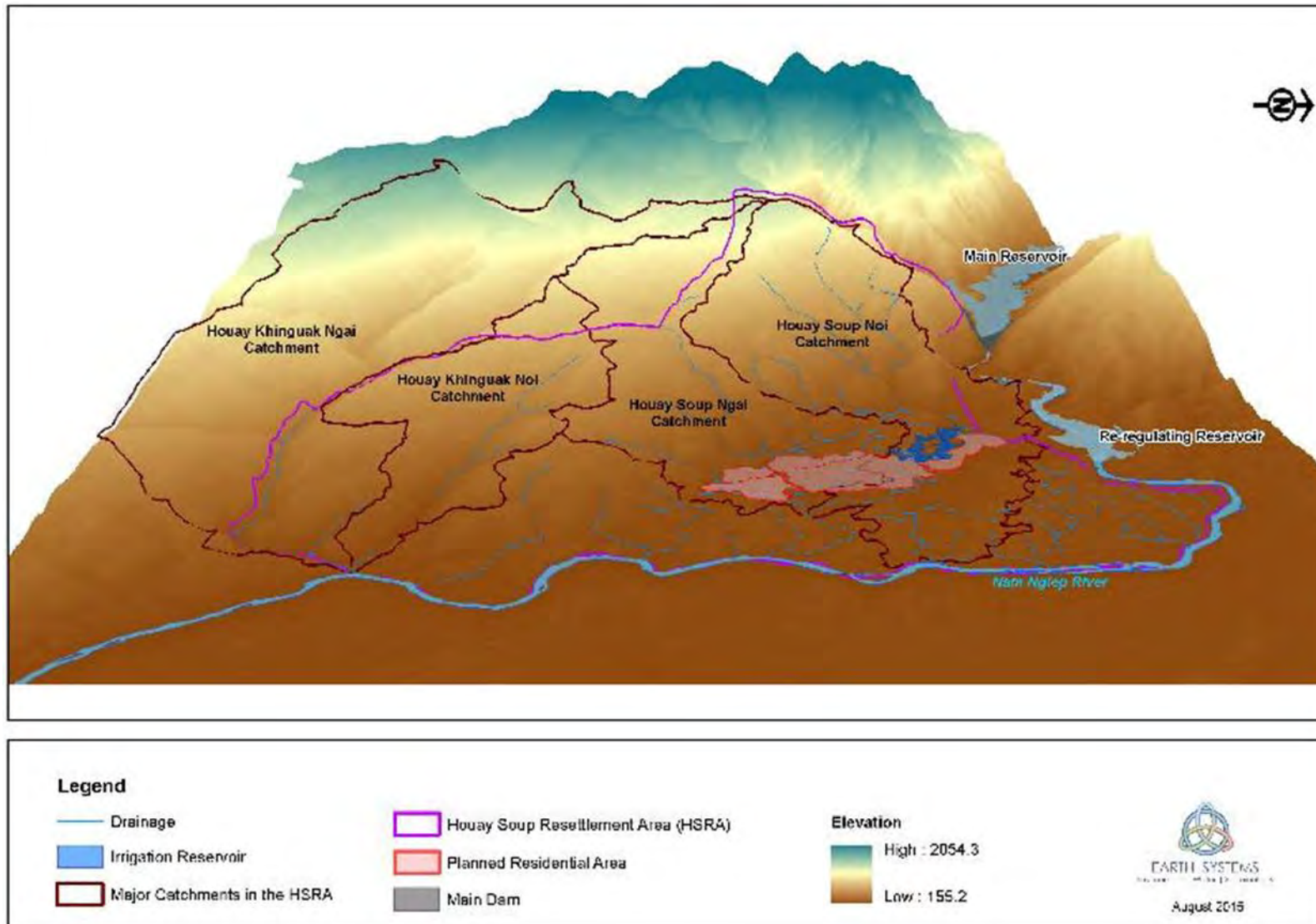


Figure 6-2. Topographic Digital Elevation Model projection - HSRA, Irrigation Reservoir and Catchment Boundaries Source: Earth Systems 2015

### ***HSRA Streams and Wetlands***

There are five primary perennial streams in the HSRA, including: Houay Soup Ngai; Houay Soup Noi; Houay Khinguak Ngai; Houay Khinguak Noi; and Houay Dhakong. Other waters resources in the HSRA and outside the two major catchments include: Houay Kheehia (ephemeral); Houay Liang (ephemeral); Houay Tamdin (ephemeral); Nong Pa wetland; and Nong Da (Honda) wetland. These streams are described in detail in the HSRA IEE (Section 4.5).

Each of the perennial and ephemeral streams / wetlands listed above will require protection to maintain hydrology and aquatic habitat, with the majority of management and monitoring required for the Houay Soup Ngai and Houay Soup Noi (refer to the HSRA IEE, Section 7.1.2).

## **6.2.2 Key Risks and Potential Impacts**

### ***Resettlement Development Site***

- Unless mitigated, water abstraction from the Houay Soup Ngai for domestic water supply may dry up the perennial stream during the dry season, significantly impacting aquatic habitat below the HSRA intake. Water intake is designed for 14 L/s and dry season flow has been estimated at 6 L/s;
- Unless mitigated, damming of the Houay Soup Noi for the Irrigation Reservoir will significantly reduce downstream flow, with potential impacts during the dry season including the loss of aquatic habitat and aquatic species downstream of the dam. A reduction in rainy season flow will alter habitat, potentially hindering fish migration from the Nam Ngiep River; and
- Vegetation removal in the RDS riparian areas (during HSRA construction) may impact the quality of aquatic habitat.

### ***Protected Forest Area***

- Each of the perennial streams are sourced from the PFA, with the greater majority of their catchments within the boundary. These streams are thought to be entirely spring fed during the dry season. With implementation of the 'Total Protection Zones' in the PFA (refer to FMP, Section 5), no impacts to hydrology are anticipated within the PFA.

## **6.2.3 Management Activities**

### ***Resettlement Development Site***

The following surface water management activities should be conducted to protect water resources in the RDS, minimising impacts to hydrology and aquatic habitat:

- An environmental release program will be employed for the Houay Soup Noi and Houay Soup Ngai. The environmental release conduits will allow 100% of the dry season flow for the respective streams to flow through to the downstream reaches for the respective streams;
- A spillway will be constructed on the Houay Soup Noi dam to protect the structure and may provide increased flow during the rainy season, when activated;
- The domestic water supply holding facility should be appropriately sized to retain enough water sourced during rainy season months to supply 750 households with at least 100 litres of water per person per day throughout the year;
- Buffer areas will be enforced, whereby forest and riparian vegetation will not be removed or otherwise disturbed in designated areas (25 m on each side of perennial streams and 10 m on each side of ephemeral streams); and

- Water diversion and abstraction from the Houay Khinguak Ngai, Houay Khinguak Noi, Houay Dhakong, Houay Tamdin, Houay Liang and additional small ephemeral tributaries of the Nam Ngiep River will be prohibited.

#### ***Protected Forest Area***

- Instream construction, water abstraction / diversion will be prohibited for all perennial / ephemeral streams in the PFA, including Houay Soup Ngai and Houay Soup Noi;
- Water diversion / abstraction and construction within 50 m from seasonal and perennial wetlands (i.e. Nong Honda and Nong Pa) will be prohibited; and
- Buffer areas will be enforced, whereby forest and riparian vegetation will not be removed or otherwise disturbed in designated areas (50 m on each side of the bank crest of streams in the PFA).

## **6.3 Water Quality**

### **6.3.1 Context**

The results of water quality monitoring indicate that surface water quality in the HSRA is good, with the exception of elevated total coliform and faecal coliform. Comprehensive water quality results are provided in the HSRA IEE (Section 4.6).

The Houay Soup and its tributaries will provide for 100% of the HSRA water resource requirements (beyond incidental bathing, drinking, washing, etc. when in the field).

### **6.3.2 Key Risks and Potential Impacts**

Key risks and potential impacts to water quality associated with the proposed HSRA are summarised below.

#### ***Resettlement Development Site***

- As domestic water will be treated prior to its supply to households, the quality of water for the settlement is not a key concern. However, the roughing filters (and other infrastructure) will require ongoing maintenance to remain effective;
- Vegetation clearing for HSRA construction and agriculture may lead to erosion and sediment loading / deposition in HSRA streams, potentially impacting the quality of downstream receiving waters; and
- Unless access is restricted, livestock may impact water quality in the catchment (PFA) or HSRA water holding facilities (e.g. pathogens).

#### ***Protected Forest Area***

- With the absence of construction in the PFA and the enforcement of 'Total Protection Zones', water quality draining the PFA will not be impacted.

### **6.3.3 Management Activities**

#### ***Resettlement Development Site***

The following will be implemented in the RDS to protect water quality:

- Enforce the riparian buffer (vegetation removal exclusion zones) on each side of perennial watercourses (25 m) and ephemeral watercourses (10 m) in the HSRA RDS. Rehabilitate impacted riparian vegetation from construction activity;
- Limit construction activity in riparian buffers to that absolutely required for HSRA implementation (e.g. bridges, transmission line corridors, etc.). Implement robust erosion and sediment control measures

(refer to the HSRA IEE) during HSRA construction and maintain facilities throughout the concession period;

- Ensure the Houay Soup Ngai water treatment facility will eliminate pathogens from drinking water and will reduce applicable water quality parameters to meet Concession Agreement requirements for drinking water;
- Ensure livestock grazing areas are appropriately fenced, or PFA / HSRA water holding facilities are fenced-off to prohibit livestock encroachment and associated input of pathogens into HSRA waters;
- Routinely monitor water quality in Houay Soup Ngai and Houay Soup Noi upstream and downstream of the HSRA water infrastructure facilities and in the Irrigation Reservoir; and
- Collaborate with village management groups and relevant GOL authorities to develop a long-term maintenance program for HSRA water resource infrastructure. The program will identify management measures and funding mechanisms to ensure water quality standards remain within target concentrations. Considerations for the maintenance program will include method / frequency of water treatment facility maintenance (e.g. roughing filters), irrigation canals, reservoir and associated facilities, and all water conveyance and erosion and sediment control facilities.

### **Protection Forest Area**

The following will be implemented in the PFA to protect water quality:

- All streams and wetlands in the PFA will fall within the Total Protection Zone (buffer area a minimum of 50m from the bank crest of streams/spings and high water mark of wetlands). Vegetation clearance, timber harvest and any land / vegetation disturbance will be prohibited in the TPZ of the PFA and no infrastructure will be constructed;
- Livestock pens / holding facilities and adequate livestock watering areas will be provided in in the Resettlement Development Area to reduce livestock intrusion into PFA TPZ and subsequent impacts to water quality (pathogens);
- Inspect access roads in the PFA and implement erosion and sediment control facilities. Consider rehabilitating historic logging roads in the PFA (i.e. ripping, grading and planting with native vegetation); and
- Monitor water quality upstream of the HSRA development area to identify baseline conditions or potential pollutant contamination. Consider additional measures if water quality is trending down (e.g. livestock fencing for exclusion from water sources, road rehabilitation for contribution of sediment, etc.).

## **6.4 Aquatic Habitat**

### **6.4.1 Context**

#### **Resettlement Development Site**

The Houay Soup Noi, Houay Soup Ngai, Houay Khinguak Noi and Houay Khinguak Ngai have been significant fisheries for villagers of Ban Hatsaykham, Ban Hat Gniun, Ban Somseun, Ban Songkhone and Ban Nampa. The lower / middle reaches of the perennial streams (i.e. including the reaches below proposed Houay Soup Ngai domestic water intake and Houay Soup Noi Irrigation Reservoir) are comprised of high value habitat for resident and migratory fish and other aquatic habitat, with an abundance of aquatic vegetation, moderately deep pools, snags / boulders and other refugia, and forested cover (shade and presumably insect / food production). The water is reportedly much less turbid than the Nam Ngiep and all water quality parameters from June 2015 indicated good water quality for fish.

A seasonal wetland exists within the RDS, created by overbank flooding of the Houay Soup Noi. This seasonal wetland reportedly provides refugia and spawning habitat for resident and / or migratory fish.



### ***Protected Forest Area***

The upper reaches of the perennial streams in the PFA are comprised of high to moderately high gradient streams with pools between rapids that flow through and over large granite boulder, providing habitat for juvenile migratory and resident fish.

Two wetlands occur in the PFA, one perennial (Nong Pa) and one seasonal (Nong Ha). Nong Ha was visited during field surveys in late June, 2015. Both wetlands provide habitat for frogs, insects, and likely migratory / resident birds while Nong Pa has a number of small fish.

## **6.4.2 Key Risks and Impacts**

### ***Resettlement Development Site***

The impact to aquatic habitat in the RDS will occur from decreased flow in the Houay Soup Noi and Houay Soup Ngai and sediment loading following vegetation clearing. Key risks are the same as for surface water hydrology (Section 6.2.2) and water quality (6.3.2).

### ***Protected Forest Area***

As watercourses occur within delineated 'Total Protection Zones' in the PFA (refer to Section 5), the majority of impacts to aquatic habitat are not anticipated. However, infrastructure on Houay Soup tributaries may hinder fish migration.

## **6.4.3 Management Activities**

### ***Resettlement Development Site***

Refer to management activities for hydrology (Section 6.2.3) and water quality (6.3.3).

### ***Protected Forest Area***

Management measures for surface water hydrology (section 6.2) and water quality (section 6.4) will minimise / avoid impacts to aquatic habitat in the PFA.

Key measures for maintaining habitat capable of supporting aquatic biodiversity will include:

- Streams / springs and wetlands and a forested / vegetated buffer area will be included in the Total Protection Zone (i.e. no disturbance to riparian vegetation or waters); and
- NNP1 in collaboration with GOL will implement an education campaign to inform villagers of the demarcation of prohibited activities and to inform them of the benefits of minimising impacts to water resources.

## **6.5 Monitoring**

Monitoring for hydrology, water quality, and aquatic habitat will differ for HSRA construction / post-construction phases. Monitoring requirements for each during construction is specified in the NNP1 HPP ESMMP-CP (ERM, 2014) and the HSRA IEE (ES, 2015).

Post-construction (throughout HSRA operations) the following framework is recommended:

### ***Hydrology***

- Ensure infrastructure provides for continuous base flow for the Houay Soup Noi and Houay Soup Ngai;
- Monitor environmental flow conduits to prevent / remove blockage;

- Monitor Irrigation Reservoir depth / water volume to ensure diversion from the Re-regulation Dam is adequate for continued environmental flow, irrigation of rice paddies, and aquaculture in the facility;
- Monitor water resource infrastructure for maintenance requirements; and
- Monitor the extent of flooding during the rainy season to inform adaptive management measures, where required.

### ***Aquatic Habitat***

Streams and wetlands in the HSRA should be monitored annually to ensure that buffer areas identified in this INRMP are adhered to and to ensure the environmental flow regime is providing for perennial flow in Houay Soup Noi and Houay Soup Ngai.

### ***Water Quality***

- Monitor treated domestic water to ensure it meets Project and Lao drinking water quality guidelines. Monthly monitoring should include the following parameters: pH, TSS, Total coliform, Faecal coliform, E. Coli, Nutrients, BOD and COD.
- Annual monitoring of domestic water should include all Bacteriological Parameters, Priority Parameters, and Health Significant Parameters identified in the Concession Agreement for drinking water (CA, Appendix 3, Section 1.8)
- Monthly monitoring of water quality in the Irrigation Reservoir and upstream / downstream of the facility for the following parameters: pH, Dissolved oxygen, Nutrients (NN-NO<sub>3</sub>, N-NH<sub>3</sub>, Total N, Total P), BOD and COD;
- Annual monitoring of water quality in the Irrigation Reservoir, and upstream / downstream of the irrigation reservoir for applicable parameters listed in the Concession Agreement for ambient water quality and effluent (CA, Appendix 3, and Section 1.11).

## **6.6 Implementing Arrangements**

### **6.6.1 Institutional Arrangements**

Responsibility for the management of water resources across the HSRA is shared between the government and village authorities. NNP1 will support these institutions.

### **6.6.2 Implementation**

Responsibility for the management of forests within HSRA is shared between the government and village authorities. NNP1 will support these institutions.

- The MONRE / WRCC are responsible for coordinating line agencies for water resource management;
- MAF and relevant provincial and district line agencies are responsible for management and use of water and water resources for agriculture;
- Ministry of Public Health (MPH) is responsible for the management and use of water for rural domestic consumption;
- Village forest organisations (i.e. Village Water Users Group and Village Forest Committee / Village Forest Unit) are responsible for coordinating with district authorities on the management of water resources.

### **6.6.3 Summary of targets, actions and responsibilities**

A summary of targets, actions and responsibilities for the implementation of the WAHMP is provided below and in Table 9-2.

Key targets include:

- Establishment of Village Water Users Group and Village Forest Committee / Unit;
- Review and endorsement of the WAHMP by the GOL;
- Development of village water management agreements;
- Design and implementation of environmental flow conduits / regime for Houay Soup Noi and Houay Soup Ngai;
- Development of a water resource infrastructure maintenance program;
- Ensure management and mitigation measures identified above and in the HSRA IEE for hydrology, water quality, and aquatic habitat are incorporated into contractor CEMPs and SS-ESMMPs and ensure these management measures are contractual obligations;
- Environmental education and awareness campaign for water resource management and protection;
- Monitoring and enforcement of WAHMP management agreements; and
- Development and implementation of water quality and hydrology monitoring regime.

## 7 ECOSYSTEMS HEALTH AND VITALITY

### 7.1 Introduction

The HSRA is currently subject to a range of human pressures potentially affecting ecosystem health and vitality. Major threats include: altered fire regimes for shifting cultivation; invasive weed spread; commercial logging; and exotic pests and diseases that impact native fauna and flora. Climate change may also exacerbate these pressures as climate extremes may lead to mortality caused by drought, and increased impacts from bushfires, weeds, pests and plant diseases.

Management of the HSRA has the potential to enhance overall ecosystem health and vitality within the area. The *Ecosystems Health and Vitality Management Plan* (EHVMP) aims to protect and enhance the health and vitality of ecosystems in landscapes and water resources across the HSRA.

The EHVMP covers the following aspects:

- Fire management;
- Invasive species management;
- Pest and disease control; and
- Climate change.

#### 7.1.1 Objectives

The overall aim of the EHVMP is to protect and enhance health and vitality of terrestrial and aquatic ecosystems across the HSRA.

The objectives of the Plan are to:

- Promote the management of fire, invasive species, pests and diseases, and climate change impacts within HSRA landscapes to support livelihoods and enhance ecosystem health and vitality;
- Promote collaboration between and strengthened capacity of the local community and relevant government authorities responsible for managing fire, invasive species, pests and diseases, and climate change impacts within the HSRA; and
- Ensure that fire, invasive species, pests and diseases, and climate change impacts within the HSRA are managed in accordance with GOL policy and statutory requirements as well as international best practices.

### 7.2 Fire regime

#### 7.2.1 Context

In 1999 it was estimated that up to 90% of forest fires in Lao PDR were due to shifting cultivation, with the rest attributed to hunting (Bouaket, 1999). Fire is a prevalent disturbance in the HSRA. The extent and frequency of fires have not been recorded, but has likely occurred on a periodic basis for agricultural site preparation. Other reported human burning activities undertaken by villagers within the local area include regular burns to grow fodder, disposal of wastes, improving movement, and for hunting purposes (Kansai et al, 2012).

## 7.2.2 Key Risks and Impacts

The use of fire in the HSRA (e.g. for slash and burn agriculture or waste disposal) may lead to uncontrolled or escaped fires and cause adverse impacts to ecosystem health and vitality including:

- Health and safety of local residents;
- Destruction of forests and biodiversity values within the PFA; and
- Destruction of commercial plantations.

## 7.2.3 Management Activities

A fire management program is recommended to reduce the risk and impacts of bushfires within the HSRA. The implementation of this program will include elaborating the following in consultation with the Resettled Community and local governmental agencies:

- NNP1 will discourage swidden agriculture through provision of permanent upland agricultural areas, with soil improvement undertaken to allow annual production;
- NNP1 should work with the village authority to establish and define key responsibilities (e.g. forest fire management committees) and alarm/warning protocols for responding to emergencies when forest fires occur, in collaboration with provincial and district government agencies (i.e. PAFO and DAFO);
- NNP1 will support in provision of adequate fire-fighting equipment and fire suppression water supply;
- NNP1 will strengthen community understanding and involvement in fire management by encouraging villagers to plan and implement fire prevention and control strategies as appropriate (refer below to further details);
- NNP1 will assist villagers to proactively undertake fire risk prevention and control measures, where practical, including:
  - » Install and regularly maintain fire breaks around protected forests and plantations containing fire prone species (e.g. *Eucalyptus sp.* and *Acacia sp.*); and
  - » For plantations containing fire prone species, also consider the application of agroforestry model, whereby wide row spacing will likely reduce the spread of fire (e.g. trees are spaced 10 m apart).
- NNP1 will actively discourage burning waste.

### **Protected Forest Area**

In Total Protection Zones and Controlled Use Zone of the PFA, local villagers will be strictly prohibited from conducting activities such as shifting cultivation, burning, cutting or harvesting trees.

## 7.3 Invasive Weed Species

### 7.3.1 Context

The majority of the lowlands within the HSRA consist of highly modified and degraded land previously cleared for agriculture or collection of TFPs and NTFPs by nearby communities. Much of this land is heavily degraded due to shifting cultivation, such as slash and burn, agriculture plantation, fallow land, and rice paddy land uses. Invasive plant species have established significant portions of disturbed areas (refer to HSRA IEE, 2015).

The PFA vegetative communities are much less disturbed than in remnant RDS forests and very few invasive plants have established. Management should consider the protection of intact forested areas in addition to minimising the introduction / spread of non-native invasive plants in the RDS.



### 7.3.2 Key Risks and Impacts

There is potential for proposed activities to adversely impact on ecosystems and vitality by introducing or causing an outbreak of invasive species within the RDS/PAA, which may potentially spread to the PFA, through the following means:

- Invasive weed introduction and / or spread into the PFA; and
- Less productive agricultural activity / grassland due to weed infestation.

### 7.3.3 Management Activities

The risk of invasive weed spread within the HSRA may be effectively managed through the implementation of a weed control program containing the following measures:

- PAFO and DAFO will work collaboratively with the Resettled Community to identify priority weed species for management;
- NNP1 will conduct an environmental education and awareness program for the Resettled Community, which should include dissemination of information to help with identification of invasive weeds of significance and eradication methods;
- Weed control and eradication methods should be suitable for the surrounding environmental and human receptors (i.e. herbicides must be appropriately selected and applied); and
- Weed control protocols identified in the HSRA IEE shall apply for NNP1 construction contractor.

#### ***Resettlement Development Site***

Additional measures for preventing invasive weed spread in the HSRA include:

- The VAC / VFC will select plantation and agricultural species which are non-invasive;
- The VFC will take appropriate steps to control the spread of plantation species beyond plantation boundaries into adjacent native vegetation; and
- Appropriate management of non-native weed species (refer to HSRA IEE, 2015 and ESMMP-CP, 2012) will be incorporated into the FMP and AMP.

#### ***Protected Forest Area***

Key measures for PAFO/DAFO to prevent the spread and introduction of invasive species within the PFA and protection forests in collaboration with the Resettled Community include:

- Inclusion of weed management measures identified in the HSRA IEE (2015) and the NN1HP ESMMP-CP 2012) into the FMP;
- Ongoing surveillance and assessment of priority weed species;
- Active prevention and eradication activities to prevent the spread of priority weeds; and
- Strict prohibition on the import or transport of material potential contaminated with priority weed species seeds/root systems.

## 7.4 Pests and diseases

### 7.4.1 Context

#### ***Plants and crop diseases and pests***

Plant pest species include animal and invertebrate species which may pose a threat to plant ecosystem health and vitality, biological diversity and productive capacity of land. Tree and plant diseases are often the result of an introduced pathogen (e.g. viral, fungal or microbial agent), which can cause mass mortality

/ die back, declined health, or reduced productive capacity. This in turn increases the vulnerability of impacted areas to invasion by weeds and other damaging agents (e.g. pest species).

According to recently published studies in Lao PDR, the following major plant diseases and pests are widely known to cause damage in crops and plantations potentially relevant to the HSRA and PFA:

- The most important pest species of economic importance for Teak (*Tectona grandis* L.) plantations are the *Hyblaea puera* (popularly known as teak defoliator) and *Eutectona machaeralis* (also known as teak skeletonizer) (Leuangkhamma et al, 2003);
- For *Acacia* plantations in Lao PDR, major pest species include *Ericeia* sp. (larvae), *Helopeltis* spp. (Mosquito bugs), *Phalera grotei*, and *Pteroma plagiophelps* (Bag worm); and pathogens include *Ceratocytis* spp., Root and Heart Rot (Dell et al. 2012);
- For *Eucalyptus* plantations, major pests include *Aristobia* sp. (long-horned beetles), *Macrotermes* sp., and *Xylotrupes Gideon*; and pathogens include *Teratosphaeria destructans* (leaf and steam disease), *Cylindrocladium* spp., and *Puccinia psidii* (Guava rust) (Dell et al. 2012); and
- Pathogens such as *Corticium salmonicolor* (Pink disease) and *Phytophthora* can also cause serious damage in a wide range of fruiting trees including mango and citrus trees (Dell et al. 2012).

Major aquatic pests that may occur in the HSRA include the Golden Apple Snail (*Pomacea canaliculata*), which invades rice paddy fields and greatly affects irrigated rice crops (MWBP/RSCP, 2006).

### **Animal diseases and pests**

Frequent outbreaks of disease and pests in buffalo, cattle, chickens, pigs and fish have been documented in the Bolikhamxay province and Bolikhan district, including instances of foot-and-mouth disease virus in ruminants and pigs, classical swine fever virus, and avian influenza virus in bird populations (including poultry) (ACIAR, 2015a). These highly contagious diseases spread readily if not adequately managed, and pose a threat to farmers in the region as well as to the local biodiversity (via cross-species transmission). Outbreaks are generally found to be the result of the introduction of infected stock, the localised movement and trade of infected animals and plants, and possibly through the importation of contaminated products (ACIAR, 2015a).

Moreover, parasitic infections are often difficult to identify but may lead to liver fluke disease (parasitic worm *Fasciola gigantica*), toxocariasis (parasitic roundworm *Toxocara vitulorum*), and chronic dermatitis in buffaloes and cattle populations (ACIAR, 2015b),

Common diseases and pathogen species reported by fish farmers include bacterial infections such as epizootic ulcerative syndrome in catfish and snake fish and red spots (reported in shallow water where there is excessive fertiliser application), as well as parasite infestations such as trematode (e.g. metacercaria) and *Lernea* (an anchorworm) (FAO, 2002).

### **Rodent pests**

Rodent pests such as rats and mice have been reported to pose a significant problem for crop production as agricultural pests (particularly for rice cultivation), by eating newly planted crops as well as pre- and post-harvest grains. This can result in significant economic and livelihood losses for cultivators if rodent populations are not adequately controlled (ACIAR, 2015c; ES Surveys, 2015).

In addition, rodent pests are also a potential carrier host for a number of contagious diseases and pathogens affecting humans, domestic animals and native wildlife, such as the plague (*Yersinia pestis*), rat-borne typhus, neuro-angiostrongyliasis, hantaviruses, arenaviruses, and leptospirosis (Mills, 1999).

## **7.4.2 Key Risks and Impacts**

Without careful management of animal and plant pests and diseases, the primary impacts to the HSRA and PFA, including the resettled villagers, include:

- Health risks to local villagers from contagious zoonotic (human transmissible) diseases;
- Reduced yield and losses in crops and plantations;
- Losses in livestock, poultry and fish farm production;
- Potential impacts on the livelihoods of local households;
- Cross-species transmission to local native fauna and flora; and
- Uncontrolled outbreaks of animal and plant pests and diseases in new areas.

### 7.4.3 Management Activities

An integrated pest and disease management approach should be adopted for the HSRA, with the support and involvement of NNP1, PAFO/DAFO and Department of Livestock and Fisheries (DLF), as applies. The following should be considered for application:

- Clearly demarcate areas of known infection / infestation, and develop appropriate protocols for these areas to limit the spread of pests and pathogens in and outside the HSRA;
- Establish pest and disease prevention and eradication programs based on international standards, recommendations and guidelines appropriate to the situation, including establishment of movement restrictions; good bio- and phytosanitary practices; proper disposal of infected/infested material; prohibition of the import or movement of infected material; vaccination; and employing appropriate treatment via chemical, biological or manual control methods;
- Employ an integrated management approach combining different chemical (via fumigation or spray), biological (via introducing natural predators) and manual control methods and techniques which have been proven effective for managing pests and diseases;
- If pesticides are used, prohibit the use of banned pesticides listed in Annex 1 of the Regulation on the Control of Pesticides in Lao PDR (2010, No. 2860/MAF) and select appropriate pesticides that will not harm non-target receptors / habitat;
- Properly manage and dispose of all potential sources of pests and pathogens (e.g. diseased vegetation and animal material) by incineration or other suitable disposal means to avoid re-contamination or introduction into new areas;
- Select crop and plantation species that are specifically adapted to local growing conditions and resistant to pests and diseases (e.g. pest and disease resistant lowland rice cultivars);
- Obtain stock for plantations, crops, animal, and fish farm productions from confirmed disease free sources. Local government agencies (e.g. PAFO and DAFO) are responsible for identifying disease free seeds and/or seedlings, developing disease free and protection zones, and establishing an organisation for certifying the production, distribution and use of disease free plant varieties (Department of Forestry, 2003);
- Ensure livestock and poultry is appropriately vaccinated, parasite infections are treated as necessary, and good husbandry practices are followed in coordination with district animal health staff (i.e. district administrative office of the Department of Livestock and Fisheries) (ACIAR, 2015b);
- Implement good fish farming practices to control aquatic diseases and infestations, such as by keeping stock densities low and sourcing fingerlings from native waters;
- Develop and implement control measures and strategies for managing rodent pests (i.e. rats), including periodic eradication programs targeting primary source habitat at key times and maintain proper hygiene and waste management around the HSRA;
- Plantation growers should be trained and supported through the Livelihoods Support Program for the Project by NNP1 to recognise early signs of plant deficiencies via foliar analysis as a diagnostic tool to prevent plant disorders and disease;

- Develop and disseminate key information about pests, diseases, and invasive weeds and provide an identification key. Training material should be provided outlining the legal obligations, duties and procedures in pest and disease management suitable for village use; and
- Establish a formal surveillance and detection system for the community to report and monitor new occurrences (e.g. visual observations) and trends relating to priority pests and diseases compatible with those used by the local government, with processes in place to immediately take appropriate actions against the spread of alien invasive species and exotic pathogens. MONRE and MAF are responsible for investigating the origins and spread of disease and insect pests and organising and coordinating protection and control in the HSRA and PFA areas for which they are responsible; and

## 7.5 Climate change

### 7.5.1 Context

A detailed climate change impact assessment was undertaken in 2015 by NNP1 to assess the impacts and vulnerability of proposed NN1HP development to climate change (including physical infrastructure, equipment, hydropower processes, and land use) (ICEM, 2015). The study included undertaking detailed hydrological and hydrodynamic modelling and a sensitivity assessment of the probable maximum flood to climate change.

A number of land uses sensitive to climate change have been identified within the HSRA, including irrigated paddy rice fields, upland agricultural areas and commercial tree plantations. These land uses will be sensitive to increases in temperature, rainfall, and flood risk.

### 7.5.2 Key Risks and Impacts

The predicted impacts to the region and province identified in the climate change study (ICEM, 2105) most relevant to the HSRA are summarised as follows:

- Increases in air temperatures would have implications for other local climatic conditions such as evaporation, evapotranspiration, humidity and precipitation, which are all expected to increase. The optimal growing conditions for target crops in the HSRA may decrease over time;
- Peak rainfall events may increase in magnitude and frequency. Projected changes in precipitation are expected to be further exacerbated by an increasing frequency of cyclone and extreme storm events hitting the catchment (which were not modelled) leading to a potential increase in the frequency and magnitude of flood events / over-bank flooding in the region. While much of the flood risk will be regulated by the operation of the Main Dam and Re-Regulation Dam for the NNP1 HPP, the HSRA may be inundated by Houay Soup waters;
- Increases in rainfall intensity may increase in erosion rates; and
- Climate change may reduce dissolved oxygen (DO) levels and water quality of dam releases from increased air temperatures and stratification of reservoir water. As such, the water conveyed from the Re-regulation Reservoir to the HSRA Irrigation Reservoir / aquaculture facility may be impacted;

### 7.5.3 Management Activities

A number of recommended adaptations and management actions for implementation identified in the ICEM Study (2015). Key measures for the HSRA should include:

- Surface water monitoring in the Re-Regulation Dam and HSRA Irrigation Reservoir to identify trends in dissolved oxygen concentrations;
- Establish a coordinated Early Warning System for the HSRA to ensure there is an adequate flood response in the event of an emergency using real-time information available;

- Review and refine hydrological models used for operating and planning releases for the dams on an annual basis to ensure they are release and incorporate the latest regional and local climate data available taking into account published climate change projections; and
- Provide assistance and adequate flood protection measures to villagers for damaged rice paddy fields and farming infrastructure directly downstream of the dams, where necessary.

## 7.6 Implementation Arrangements

### 7.6.1 Institutional Arrangements

MONRE and MAF in coordination with their provincial and district level agencies (including District Forestry Units) and relevant village group authorities are responsible for the management of fire, invasive species, pests and diseases, and climate change impacts within the HSRA.

NNP1 will support the responsible institutions as per the institutional arrangements described in the Agricultural Management Plan (Section 4), Forest Management Plan (Section 5), and Water and Aquatic Habitat Management Plan (Section 6).

### 7.6.2 Summary of Targets, Actions and Responsibilities

A summary of targets, actions and responsibilities for the implementation of the EHVMP is provided below and in Table 9-2.

Key targets include:

- Development and implementation of community-based programs to manage the EHVMP within the HSRA (i.e. inclusion in FMP, AMP, WAHMP);
- Endorsement of a fire management program, invasive weed management program, and integrated pest and disease management program based on management measures described in the HSRA IEE (ES, 2015) and this INRMP, as well as Lao PDR and international best practices; and
- Implement community awareness and education programs focusing on the management of fire, invasive weeds, pests and diseases, and impacts of climate change effects within the HSRA.



## 8 CULTURAL HERITAGE

### 8.1 Introduction

The *Cultural Heritage Management Plan* (CHMP) has been developed to ensure the identification and management of cultural heritage within the HSRA including tangible and intangible assets and values of cultural, pre-historical, historical, archaeological, and natural significance.

#### 8.1.1 Objectives

The overall aim of the CHMP is to ensure that cultural and natural resources within the HSRA are identified, protected and sustainably managed.

The objectives of the Plan are to:

- Promote the sustainable development, management and use of cultural and natural resources within the HSRA to support livelihoods and enhance cultural and natural heritage values;
- Promote collaboration between and strengthened capacity of the local community and relevant government authorities responsible for managing the of cultural and natural heritage resources within the HSRA; and
- Ensure that of cultural and natural resources within the HSRA are managed in accordance with GOL policy and statutory requirements as well as international best practices.

### 8.2 Sites of cultural significance

#### 8.2.1 Context

##### ***Cultural Heritage***

Cultural heritage sites may include archaeological, anthropological, monumental and architectural places which are of significance from the point of view of culture, history, and science or technology.

Community surveys conducted in Ban Hat Ngiun, Ban Hat Saykham, and Ban Somseun indicated there are no archaeological and culturally significant sites of national and regional importance within the HSRA (Kansai et al, 2012; ES, 2015). However, the greater area was found to be rich in sites of archaeological, historical, cultural and natural beauty significance.

One local culturally significant site was identified within the HSRA: a sacred rock near Houay Thamdin. Anecdotal evidence indicates that the site is considered an important place respected by local villagers as it was believed a hermit monk meditated in a small cave called Thamdin (Din cave). The cave has collapsed long ago and only sacred rocks remain. No grave sites or cemeteries were identified in the HSRA during the surveys. One cemetery in Ban Hat Gniun was identified in the north east corner of the HSRA.

Other cultural sites and artefacts identified in the vicinity of the HSRA include:

- A polished shouldered axe/adze in stone found in the Nam Ngiep River during fishing 2006, which provides evidence of Neolithic human occupation during the late stone age; and
- An ancient Buddhist temple cave located approximately 6 km from Ban Hatsaykham, upstream and on the right bank of the Nam Ngiep. The cave is approximately 200 m further inland, at the foothill of Phu Hong, a mount that belongs to the Phu Kata range. Three bronze statues have been moved to the Buddhist temple in Ban Gniun (10 km away) for improved security.

## Natural Heritage

Natural heritage is strongly linked to physical and biological features of the natural environment which are of significance from a scenic, aesthetic, scientific or ecological perspective, such as conservation forests and biodiversity protected areas, mountains, waterfalls, caves, waterbodies, and wetlands.

There are no natural sites of international or national significance in the HSRA. However, during field and village studies for this report, the following natural sites of local significance or aesthetic value were identified:

- Major streams including Houay Soup Noi, Houay Soup Ngai, Houay Khinguak Noi, and Houay Khinguak Ngai (which all occur within the HSRA) and a number of wetlands;
- A historical Tham Nong Da (Nong Da Cave) or Mr. Xeng's Cave (refer to Plate 10-2), located on the south-west border of the HSRA. Mr. Xeng, who was a local revolutionary movement leader, used this cave as a stronghold site during the Vietnam War. Currently, local residents still use the cave as a sleeping camp during hunting and collection of NTFPs; and
- A seasonal waterfall on Houay Khinguak Ngai along the border of the HSRA. The waterfall is located about 3 km upstream from its confluence to Nam Ngiep River. The waterfall is 8-10 meter in height with water flowing from July to October.



**Plate 8-1 Nong Da (seasonal wetland) in the south west of the HSRA**



**Plate 8-2 Tham Nong Da (Nong Da Cave) located on the south-west border of the HSRA**

## 8.2.2 Key Risks and Impacts

There is potential for proposed activities to cause adverse impacts to sites or places of cultural heritage value within the HSRA, including:

- Potential disturbance or damage to chance finds (i.e. artefacts or burial site) during activities involving ground disturbance. If disturbance is unavoidable, the cultural heritage asset *in situ* may require removal or relocation; and
- Indirect disturbance to sites or places of natural and cultural heritage value (i.e. bushfires, invasive weed spread, etc.).

The protection of cultural heritage values within the HSRA will be achieved through avoidance of known sites, a duty of care under the Law on National Heritage (2013), and application of procedures for dealing with chance finds, which are further described in the following sections.

## 8.2.3 Management Activities

In accordance with Lao PDR Legislation, a range of mitigation measures should be implemented to preserve and protect the physical cultural heritage resources identified within the HSRA, including:

- Documentation and mapping of known cultural heritage sites within the HSRA and appropriate consideration given to their protection and conservation or appeasement;
- Establishment of official channels and systems for notifying, reporting and coordinating with the government (i.e. Ministry of Information and Culture, district and provincial government authorities, relevant Village Committee) for any chance finds and discovered cultural heritage sites;
- The discovery of new archaeological artefacts or sites should be reported immediately, including details of the location, condition, and threats according to existing databases, procedures, and processes set up by the local administrative offices of the Ministry of Information and Culture; and
- Improve community understanding and participation in cultural heritage management by adhering to a chance finds procedure (refer to further details below).

Furthermore, NNP1 has committed to the following mitigation measures for the Resettled Community regarding the loss or damage to identified cultural heritage sites and assets (NNP1 2014):

- For temples, spirit houses and other historical, cultural and religious structures: dismantling, relocation and reconstruction shall be conducted in a culturally acceptable manner and in a location agreed with PAPs;
- Replacement of temples, shrines and other religious structures shall be of equivalent appearance and configuration, and both not less than the same size and not less than the same value, and in any event acceptable to the community;
- Provision for all appropriate rituals and acceptable arrangements for relocation of movable items and their reestablishment at new site shall be provided by NNP1; and
- Provision for appropriate rituals and ceremonies for cemeteries, holy sites, and other immovable cultural landmarks prior to Resettlers' relocation, and establishment of analogous replacement cultural resources wherever possible of at least equivalent size (e.g. new cemetery appropriately sited).

### ***Cultural heritage awareness and education program***

A program on cultural heritage education and preservation should be included in social awareness campaigns conducted by NNP1 in the resettled community and other villages carrying out activities in the HSRA. This program should focus on enhancing community understanding on the importance of conserving cultural heritage assets and values within the local area, chance finds procedures, and to collect additional information that is pertinent to cultural heritage, where available. The program should also encourage villagers to report on and prohibit looting and selling of archaeological artefacts.

### ***Chance finds procedure***

A chance find procedure should be applied in the event that cultural heritage artefacts are discovered within the HSRA. The following steps should be implemented to minimise unnecessary damage or disturbance to a discovered artefact (adapted from NNP1's chance finds procedure):

- Villagers shall immediately stop any potentially damaging activities (e.g. digging, ploughing, burning, etc.) and inform the nominated Village Authority (familiar with cultural resources);
- The nominated Village Authority (VA) shall consult with the Village Chief and established government channels (i.e. local government authorities and Ministry of Information and Culture) to obtain specific advice regarding the next steps;
- Fencing and proper signs may be installed around the perimeter to ensure that the site is visible and to minimise public access into the area;
- Villagers shall not disturb the chance find until an assessment is made by competent professionals (if required), and appropriate actions have been determined and approved by the Ministry of Information and Culture via an official notification; and

- In the event of a chance find of a cultural heritage site or burial site, the villagers should be given primary responsibility for the relocation of any cemeteries or other sites of cultural significance such as stupas and burial urns (if required), with the support of NNP1. The relocation of discovered burial sites / ceremonies shall be undertaken in a culturally acceptable manner and to a location agreed upon by the PAPs (NNP1, 2014).

## 8.3 Implementation Arrangements

### 8.3.1 Institutional Arrangements

The institutional arrangements in place and their key functions for the conservation and management of cultural heritage values within the HSRA and PFA are briefly described as follows:

- The Ministry of Information and Cultural is the central agency responsible for administering the Law on National Heritage (2013) and managing cultural heritage on a national level. The agency will be responsible for advising local government authorities on the management of cultural heritage values within the HSRA in accordance with GOL legislation;
- The District Information and Culture Office (district authority) and Division of the Information and Culture (provincial authority) will be jointly responsible for endorsing, coordinating and collaborating with Village Authorities to develop appropriate cultural heritage management procedures, establish official reporting protocols and systems, and provide official notification of management activities for responding to new chance finds within the HSRA; and
- Cultural Heritage Village Authority (e.g. village chief or person familiar with cultural resources), who will be responsible for collaborating with GOL to identify and protect sites and places of cultural heritage value as well as implementing cultural heritage management activities at the community level.

### 8.3.2 Summary of Targets, Actions and Responsibilities

A summary of targets, actions and responsibility for the protection and management of physical cultural heritage resources within the HSRA is provided below and in Table 9-2.

Key targets include:

- Establishment of relevant Village Authority (VA) – an individual responsible for cultural heritage management;
- Review and endorsement of the Cultural Heritage Management Plan (CHMP), including the established chance finds procedure;
- Community awareness and education of resettled communities on cultural heritage management; and
- Monitoring and enforcement by responsible authorities for the ongoing management of identified natural or cultural heritage assets/sites.

## 9 PLAN IMPLEMENTATION AND MANAGEMENT

### 9.1 Implementation Period

The INRMP will be implemented across the following phases:

- *HSRA construction phase* (October 2015 to late 2018) when the resettlement village will be constructed and agricultural lands developed. This phase will also include the the relocation of Ban Hatsaykam (April 2016). During the construction phase, preparatory PLUP and resettlement / livelihood restoration activities will be implemented by NNP1 in coordination with the GOL (see Section 9.2 and 9.3).
- *HSRA post construction phase* (late 2018 to December 2024) which will commence after the relocation of PAPs from 2LR villages and continue until NNP1 has completed the resettlement and livelihood restoration program. During the post construction phase, PLUP activities will be implemented and monitored by the GOL with support from NNP (see Section 9.2 and 9.3).
- *HSRA 'operation' phase* (January 2025 until end of concession) which will commence after the completion of the resettlement and livelihood restoration program and run until the end of the project concession period. During the operation phase, monitoring of the HSRA will continue (see Section 9.2 and 9.3)

### 9.2 Institutional Arrangements

The implementation of the INRMP will be led by NNP1 in coordination with the GOL and village authorities.\

Specific institutional requirements for the implementation of INRMP sub-plans (i.e. settlements; agricultural lands; forests and forest resources; water resources; ecosystem health and vitality; and cultural heritage) are outlined within each sub-plan (refer to Sections 3 to 8 above).

#### 9.2.1 Government Institutional Arrangements

##### ***Provincial Resettlement and Livelihood Restoration Committee***

A Provincial Resettlement and Livelihood Restoration Committee (PRLRC) was established in 2014 and will operate until 2021 (or three (3) years after COD). PRLRC is the lead organization in approving policies and plans, entitlements, and activities, and supervising and monitoring the implementation of social measures, including resettlement, public involvement, compensation, and for the expression and resolution of grievances. The PRLRC's mandate also includes overseeing GOL agencies roles in the management and use of agricultural lands, forests, water and NTFPs (including terrestrial and aquatic flora and fauna).

The PRLRC has established a number of coordinating committees (district and village) to ensure effective oversight of the resettlement and livelihood restoration program. The PRLRC has also established a Resettlement Management Unit (RMU) to coordinate with the NNP1 Social Management Office (SMO) on the implementation of the resettlement and livelihood program.

The PRLRC will coordinate with the WMC on the implementation of the INRMP during the construction and post construction phases of the HSRA development. The PRLRC's committees at the district and village (Houay Soup resettlement community) will be utilised. The RMU will provide on-ground implementation support. The PRLRC (and its sub-committees and management unit) will monitor the adequacy and sustainable management of the HSRA's natural resources for livelihood restoration and economic development of resettled communities.



### ***Environment Management Unit***

MONRE will set up an Environmental Management Unit (EMU), comprised of relevant district and provincial authorities to collaborate with NNP1, the WMC, PRLRC and RMU and to act as the counterpart of the NNP1 EMO.

The EMU will have a role in environmental management and monitoring in the HSRA during construction and operations, including independent oversight of construction monitoring and ongoing monitoring of environmental protection during HSRA operations (e.g. waste management). The EMU and EMO will report to MONRE on a monthly basis to ensure that mitigation measures are implemented according to the Project Concession Agreement, EIA (2014), ESMMP-CP (2012), and the HSRA IEE (2015)..

### ***Provincial and District Government Agencies***

#### ***Provincial and District Natural Resources and Environment***

PONRE and DONRE are the lead agencies responsible for the management of natural resources within the HSRA. These agencies will coordinate with the WMC, PRLRC and NNP1's ESD (refer to below) on the implementation of the participatory land use planning process with the Houay Soup resettlement village authority and NRM groups; and the management of the PFA section of the HSRA.

#### ***Provincial and District Agriculture and Forestry***

The Provincial Agricultural and Forestry Office (PAFO) and the District Agricultural and Forestry Office (DAFO) are the lead agencies responsible for the management of agriculture and productive forest resources within the HSRA. These agencies will coordinate with the WMC, PRLRC and NNP1's ESD (refer to below) on the implementation of the participatory land use planning process with the Houay Soup resettlement village authority and NRM groups; and the management of the RDS (agricultural zones) of the HSRA.

## **9.2.2 Village Authority and Community NRM Groups**

### ***Village Authority***

A village authority for the Houay Soup resettlement village will be established after the construction phase of resettlement is completed (i.e. resettlement of households from 2LR villages). The village authority will be responsible for coordinating with relevant GOL committees and agencies on the implementation of the INRMP at the village level.

### ***Village NRM Groups***

In coordination with district authorities, the village authority will establish a number of village NRM groups to lead management of the village's settlement, agricultural, forest, water and biological resources. A number of these groups are outlined in relevant sub-plans above (refer to Sections 3 to 9).

## **9.2.3 Nam Ngiep 1 Power Company**

### ***Environmental and Social Department (ESD)***

NNP1 has established an Environmental and Social Department which is responsible for implementing the Project's environmental and social management and monitoring program in compliance with the NN1HP Concession Agreement

1. Social Management Office (SMO NNP1) which is (in part) responsible ensuring that the company's social commitments are met through the implementation of the social management and monitoring measures outlined in the REDP (NNP1, 2014) and other Social Development Plans in coordination with the GOL during the construction and post construction phases of the HSRA; and

2. Environmental Management Office (NNP1 EMO) which is responsible for ensuring that the company's environmental commitments are met through the implementation of environmental management and monitoring measures outlined in the IEE HSRA, ESMMP-CP and other related plans).

## 9.2.4 Other Monitoring Institutions

Other institutions involved in environment and social monitoring of the HSRA development include:

- Ministry of Natural Resources and Environment (MONRE);
- MONRE's Environmental Monitoring Unit;
- Resettlement Management Unit;
- Independent Monitoring Agency; and
- Asian Development Bank Monitoring Team.

## 9.3 INRMP Activities Plan, Schedule and Monitoring

A summary of targets, actions and responsibilities for the implementation of the INRMP is provided in Tables 9-1 and 9-2. The schedule for implementation is indicative only, and will depend on the duration of phased construction. Many of the activities will not commence until resettlement is complete, while some may be initiated with resettled villagers from Ban Hatsaykham in approximately April 2016, and will continue throughout phased resettlement.

**Table 9-1 INRM Activities Plan: Targets, Actions and Responsibilities for Land Use Planning and Zoning**

#	Target	Action	Schedule / Frequency	Responsibility	
				Implementation	Monitoring
Overarching PLUP Process (also refer to sub-plans below)					
1.1	Complete land and forest zoning	Confirm HSRA boundaries including the PAA and any potential boundary extensions	Q4 2015 / once-off	Village groups, NNP1 and MONRE	PRLRC, EMU & ADB
		Conduct orientation meetings with resettlement communities to familiarise them with the PLUP process and present preliminary land use zones;	2015 (all) / Q2 2016 (Hatsaykham)		
1.3		Conduct detailed land and forest use planning sessions with resettlement communities to identify specific village land and forest use zones.	2018 / Following completion of resettlement		
1.4		Prepare revised / detailed village land and forest allocation maps.			
1.5		Conduct village meetings to share results of participatory land and forest zoning.			
1.6	Completion of the PLUP process	Establish interim village land and forest management groups	2018	Village groups, NNP1 & RMU	PRLRC, EMU & ADB
1.7		Complete village agriculture and forest management plans (refer to Sections 4 and 5)	2018 / once-off		
1.8		Prepare land and forest management use agreements with villagers and submit to GOL for endorsement (refer to Sections 4 and 5)	2018 / once-off		
1.9		Conduct land registration and titling for individual land and community land	2018 / until complete		
1.10		Provide relevant land and forest data to village, district and provincial authorities and ensure appropriate storage.			
1.11	Monitoring of the PLUP process	Participatory review of PLUP implementation	2020	Village groups, NNP1 & RMU	PRLRC, EMU & ADB

**Table 9-2 INRM Activities Plan: Targets, Actions and Responsibilities for INRMP Sub-Plans**

#	Target	Action	Schedule / Frequency	Responsibility	
				Implementation	Monitoring
Sub-plan 1: Settlement Area Management					
1.1	Establishment of Village representative (VR) for collaborative management	Identification of appropriate village representative	2018 / once-off	NNP1 SMO / EMO, DONRE, DAFO	PRLRC, ADB and EMU
1.2		Development of TORs for scope and administration of VSMP	2018 / Following completion of resettlement		
1.3	Verification of draft VSMP with VR				
1.4	Revision of VSMP based on consultations				
1.5	Submission of VSMP to district and provincial government for endorsement				
1.6	Environmentally Sensitive Planning and development	Integrate environmentally sensitive management into land use planning and all VSMP sub-plans	2018 / ongoing		
1.7	Effective Village Waste Management	Implementation of solid and liquid waste management programs avoidance of burning domestic or green waste	Q2 2016 / ongoing	Village Authority, NNP1, SMO / EMO, DONRE, DAFO	PRLRC, ADB and EMU
1.8		Promotion of good waste management practices (i.e. recycling) and discouragement of bad waste management practices (i.e. burning domestic or green waste)			
1.9	Environmental Education and Awareness	Develop and conduct environmental education and awareness programs to improve the understanding of the importance of village management as well as waste management in residential environments			
1.10	Monitoring and Enforcement of Management Plans	Monitoring of waste monitoring and water source protection to ensure that Project and Lao PDR guidelines for waste management and water source protection are upheld			
1.11		Ensure construction minimises impacts to residential area and surrounds and that any required rehabilitation is undertaken after completion of the construction stage			
Sub-plan 2: Agricultural Landscapes Management					
2.1	Establishment of Village Agriculture Group	Establishment of Village Agriculture Group	2018 / once-off	NNP1, RMU & District Forest Unit (DONRE); DAFO	PRLRC, EMU & ADB

#	Target	Action	Schedule / Frequency	Responsibility	
				Implementation	Monitoring
2.2		Development of TORs for implementation, monitoring and enforcement of the AMP and agreement.		NNP1, RMU, District Forest Unit (DONRE) & VAG	
2.3	Endorsement of the Agriculture Management Plan (AMP)	Verification of draft AMP with VAG / VFC		NNP1, RMU & DAFO	
2.4		Revision of AMP based on consultations		NNP1	
2.5		Submission of AMP to district and provincial government for endorsement		NNP1, RMU & DAFO	
2.6		Consultations with Village committees to verify proposed rules and agreements applying to each agricultural activity		NNP1, RMU, DAFO, PAFO	
2.7	Consultations with HSRA communities regarding proposed agricultural management agreement				
2.8	Development of Agriculture Management Agreements	Finalisation of AMP and consolidation into broader Land and Forest Management Agreement	2018 / once-off	NNP1, RMU, DAFO, PAFO, MAF	
2.9		Submission of the LFMA to the District Governor for endorsement			
2.10	Agricultural Area certification and titling	Work with RMU and DAFO to acquire preliminary land use certificates for agricultural areas (three years), including cropping areas, plantation areas, and livestock grazing areas.	Q2 2016 / ongoing until complete		
2.11		Consult with Provincial authorities to achieve long-term land use rights for certified agricultural areas	2018-2021	NNP1, RMU, DAFO, PAFO, MAF	PRLRC, EMU & ADB
2.12	Soil Improvement Program	Implement soil improvement program as defined by AMP, in accordance with the HSRA IEE	Q4 2015 / annually	NNP1, VAG, VFC	PRLRC, EMU & ADB
2.13		Develop long-term monitoring framework to determine annual / periodic rates and frequency of soil amendment application.			
2.14	Plantation sub-plans and registration	Develop and implement commercial plantation management plans	Q4 2016 - 2018 / as needed	NNP1, VAG, VFC	PRLRC, EMU & ADB
Sub-plan 3: Forest Management					
3.1	Establishment of Village Forest Groups	Establishment of Village Forest Unit and Village Forest Committee	2018	NNP1, RMU & District Forest Unit (DONRE)	PRLRC, EMU & ADB



#	Target	Action	Schedule / Frequency	Responsibility	
				Implementation	Monitoring
3.2		Development of TORs for implementation, monitoring and enforcement of the FMP and agreement.	2018	NNP1, RMU, DONRE & VFU	
3.3	Endorsement of the Village Forest Management Plan	Verification of draft FMP with VFU / VFC	2018 / once-off	NNP1, RMU, DONRE	PRLRC, EMU & ADB
3.4		Revision of FMP based on consultations	Q4 2018 / once-off	NNP1	
3.5		Submission of FMP to district and provincial government for endorsement	Q4 2018 / once-off	NNP1, RMU & DONRE	
3.6	Development of Village Forest Management Agreements	Consultations with VFU / VFC to verify proposed rules and agreements applying to each forest zone and develop proposed sanctions / enforcement framework	2018 / once-off	NNP1, RMU & DONRE	PRLRC, EMU & ADB
3.7		Consultations with HSRA communities regarding proposed village forest management agreement		>NNP1, RMU, DONRE & VFU	
3.8		Finalisation of VFMA and consolidation into broader Land and Forest Management Agreement			
3.9		Submission of the LFMA to the District Governor for endorsement			
3.10	Delineation of Forest Zones	Ensure delineation and location of forest zones are clearly defined and understood by local villagers (e.g. signs, maps)	Q2 2016 / ongoing	>NNP1, RMU, DONRE & VFU	PRLRC, EMU, EMU
3.11		Conduct environmental education and awareness programs to ensure adherence to permitted uses and restrictions requirements	2016 / annually		EMU and EMO
3.12	Forest Rehabilitation Program	Revegetate and implement planting in forest zones with an emphasis on riparian zones	2016 / annually	NNP1, Contractors, VFC	EMU and EMO
3.13		Incorporate rare and threatened and indigenous species into planting programmes	2016 / annually	NNP1 / VFU / VFC	PRLRC, EMU & ADB
3.14	Invasive species eradication	Implement an eradication program to remove existing and new introduced and/or invasive species, as well as continuously checking existing disturbed areas and newly disturbed areas for seedlings	2018 / annually	>NNP1 / VFU / VFC	PRLRC, EMU & ADB
3.15		Conduct community awareness raising and training activities regarding introduction of invasive species			

#	Target	Action	Schedule / Frequency	Responsibility	
				Implementation	Monitoring
3.16	Development and implementation of Plantation management sub-plans	Develop and implement commercial plantation management plans	2016 - 2018 / annually	NNP1, RMU, DONRE & VFU	PRLRC, EMU & ADB
3.17	Environmental Education Awareness	Develop and conduct environmental education and awareness programs to improve the understanding of the importance of forest resources, and ensure that the prohibitions and penalties regarding the collection of forest resources in the PFA etc. are widely known	2018 / annually	NNP1, RMU, DONRE & VFU	PRLRC, EMU & ADB
3.18	Forest Monitoring and Enforcement of the FMAs	Ensure FMP monitoring is undertaken and forest zoning adhered to.	2016 - 2018 / monthly	NNP1, RMU, DONRE & VFU	EMU and EMO
Sub-plan 4: Water and Aquatic Habitat Management					
4.1	Establishment of Village Water Users Group	Establishment of Water Users Group, Village Forest Unit and Village Forest Group	Q2 2016 - 2018 / Until resettlement is complete	NNP1, RMU	PRLRC, EMU & ADB
4.2		Development of TORs for implementation, monitoring and enforcement of the WMP and agreement.	Q3 2016 - 2018 / once-off		
4.3	Review and finalise Water Management Plan for endorsement by applicable GOL authorities	Verification of draft WMP with VWUG / VFU / VFG	Q4 2016 - 2018 / once-off	NNP1, RMU	PRLRC, EMU & ADB
4.4		Revision of WMP based on consultations		NNP1	
4.5		Submission of WMP to district and provincial government for endorsement		NNP1, RMU	
4.6	Development of Village Water Management Agreements	Consultations with VWUG / VFU / VFG to verify proposed rules and agreements applying to waters of the PFA and perennial / ephemeral streams in the RDS and develop proposed sanctions / enforcement framework	Q4 2016 - 2018 / once-off	NNP1, RMU	PRLRC, EMU & ADB
4.7		Consultations with HSRA communities regarding proposed village water management agreement		NNP1, RMU, VWUG	

#	Target	Action	Schedule / Frequency	Responsibility	
				Implementation	Monitoring
4.8		Finalisation of VWMA and consolidation into broader Land and Forest Management Agreement		NNP1, RMU, VWUG	
4.9		Submission of the LFMA to the District Governor for endorsement		RMU	
4.10	Environmental Release Program	Ensure the environmental flow conduits provide for continuous release of base flow (at a minimum) for the Houay Soup Noi and Houay Soup Ngai.	Detailed design / once-off	NNP1	NNP1, PRLRC, EMU, ADB
4.11		Ensure structures allow for fish passage, particularly for the Houay Soup Noi.			NNP1, PRLRC, EMU, ADB
4.12	Implementation of an Water Infrastructure Maintenance Program	Develop a maintenance program for water resource infrastructure (e.g. roughing filters, canals, reservoir, intake, irrigation pumps, etc.) and delineate roles and responsibilities for NNP1, VWUG, and the GOL.	Q2 2016 - 2018 / once-off	NNP1; RMU; VWUG	NNP1, PRLRC, EMU, ADB
4.13	Construction Phase Management and Mitigation	Ensure management and mitigation measures identified above and in the HSRA IEE for hydrology, water quality, and aquatic habitat are incorporated into contractor CEMPs and SS-ESMMPs and ensure these management measures are contractual obligations.	2015 – 2018 / ongoing	NNP1, Contractors	NNP1, Contractors
4.14	Environmental Education Awareness	Develop and conduct education and awareness programs to improve the understanding of the importance of protecting water resources and aquatic habitat, and ensure that the prohibitions regarding encroachment on water resources and riparian habitat in the PFA and RDS are widely known	Prior to resettlement and annually	NNP1 / VWUG	EMO and EMU
4.15	Water Resource / Habitat Monitoring	Monitor water quality in the Irrigation Reservoir, upstream of the reservoir, and upstream / downstream of water treatment plant to ensure that Project and Lao PDR guidelines for effluent, ambient water quality, and drinking water are met, where applicable.	Monthly	NNP1 and EMU	EMO and EMU
4.16		Ensure construction minimises impacts to riparian vegetation and rehabilitate impacted riparian vegetation	Detailed design / Monthly during construction	NNP1	EMO and Contractors
4.17		Enforce riparian buffer zones	Ongoing	RMU / VFU / VFG	PRLRC, EMU, ADB

Sub-plan 5: Ecosystems Health and Vitality						
5.1	Endorsement of the fire management program	Review and implement the fire management program and procedures, subject to government and village consultation.	HSRA construction phase / once-off	NNP1, VA, RMU PAFO/DAFO, DLF	EMU, ADB	
5.2		Phase out slash and burn methods and other activities involving human fires within the HSRA, where possible.	Ongoing			
5.3	Endorsement of the invasive weed management program	Review and implement the weed management program and procedures as necessary, subject to government and village consultation.	HSRA construction phase / once-off			
5.4	Endorsement of the integrated pest and disease management program	Review and implement the integrated pest and disease management program and procedures as necessary, subject to government and village consultation.	At the onset of village agricultural and animal production / once-off			
5.5	Community awareness and education	Develop a community awareness and education program in collaboration with local government agencies that focuses on understanding how to prevent, detect and control spread of fires and invasive species of weeds, pests and plant diseases.	HSRA post-construction phase / annually			
5.6	Monitoring and enforcement framework	Establish the reporting, monitoring and warning frameworks described by the EHVMP for the management of fires, invasive species, pests and diseases.	HSRA post-construction phase / once-off			
5.7		Define key responsibilities and formal warning / reporting protocols for detecting and responding to fires, invasive species, pests and pathogens as described in the EHVMP, in consultation with relevant local government agencies.	HSRA post-construction phase / once-off			NNP1, VA, District Forestry Unit, PAFO/DAFO, DLF
5.8	Coordinated flood response and management	Formal Early Warning System established in the HSRA between NNP1, relevant government agencies, the local community, and other hydropower project operators within the Nam Ngiep River basin.	Prior to HSRA post-construction phase / once-off			NNP1, VA
5.9		Review and update relevant hydrological models based on latest regional and local monitoring results taking into account the latest published climate change projections.	HSRA post-construction phase / annually			NNP1
5.10	HSRA adaptation to climate change	Integrate relevant climate change measures and additional design capacity for the Main Dam and Regulating Dam structures to manage effects of climate change (if required) in the HSRA.	HSRA post-construction phase / as needed			NNP1, GOL

5.11		Adopt best practice methods to increase the resilience of village agricultural and animal production systems within the HSRA from climate change effects (if required).	HSRA post-construction phase / as needed	NNP1, VA, PAFO/DAFO	PRLRC, ADB
Sub-plan 6: Cultural Heritage					
6.1	Establishment of applicable VA	Identification of VA (individual) responsible for cultural heritage management within the HSRA.	HSRA post-construction phase / ongoing	NNP1, DICO, DIC, VA	PRLRC, EMU, ADB
6.2	Endorsement of the Cultural Heritage Management Plan (CHMP)	Review and implement the CHMP, including the chance finds procedure, subject to government and village consultation.	HSRA post-construction phase / ongoing		
6.3	Cultural heritage awareness and education	Incorporate a cultural heritage awareness program into social awareness campaigns in the resettled community and other villages carrying out activities in the HSRA and PFA.	HSRA post-construction phase / annually		
6.4	Monitoring and enforcement framework	Set up monitoring framework as defined in the CHMP to monitor for instances where identified natural or cultural heritage sites/assets have been encroached on, destroyed or damaged by human or natural causes.	HSRA construction phase / ongoing	DICO, DIC, VA	PRLRC, EMU, ADB

Source: Earth Systems 2015



## 9.4 Environmental and Social Management Plans

NNP1 is responsible for implementing the following environmental and social management plans in coordination with GOL agencies.

### 9.4.1 Environmental Management and Monitoring Plans

Activities required for the development of the HSRA (construction and post-construction phases) have the potential to impact natural resources within the HSRA. Management and mitigation measures to protect natural resources during these phases are outlined in the IEE HSRA (ES 2015) and the Environmental Management and Monitoring Plan for the Construction Phase (ESMMP-CP, ERM 2014). It is also anticipated that post-construction management and monitoring measures outlined in the IEE HSRA (ES 2015) will be incorporated into the ESMMP for the Operations Phase (ESMMP-OP) which is yet to be developed.

### 9.4.2 Resettlement and Ethnic Peoples Development Plan

A Resettlement and Ethnic Peoples Development Plan (REDP) was prepared by NN1HP in 2014. The REDP was prepared to address social compliance of NNP1 during the construction and operation phases of the Project.

The REDP includes:

- Entitlement Policy and Eligibility Matrix;
- Livelihood and Income Restoration Plan;
- Ethnic Peoples' Development Plan; and
- Public Consultation, Participation and Disclosure Plan.

NNP1 will maintain the grievance redress mechanism established Project-wide for community residents in the HSRA to submit any complaints (e.g. noise, dust, etc.) or grievances during the construction and post construction phases.

### 9.4.3 Social Development Plan

A Social Development Plan was prepared by NNP1 in 2014. This plan includes:

- Public Health Action Plan;
- Labour Management Plan;
- Community Development Plan;
- Gender Action Plan;
- Youth and Children Action Plan; and
- Cultural Awareness / Heritage Preservation Action Plan.

## 9.5 INRMP Review and Update

The construction and operations of the HSRA will be a dynamic process, occurring over a number of phases of construction / resettlement. Changes to Project configuration, the results of stakeholder engagement and further investigations may lead to the need for refinement in resource management planning.

This INRMP will be a dynamic document, subject to periodic review and update. The plan should be reviewed and updated every three (3) years or following a significant change to resettlement timeframe, construction design, etc. with associated updates to management planning for each of the resources considered in the INRMP.

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# APPENDICES

# APPENDIX A. NATURAL RESOURCE CAPABILITY ASSESSMENT

A resource capability assessment was conducted in the HSRA (and surrounding areas) to inform the zoning and land use planning process. This included:

- Livelihood and Income Restoration Requirements;
- Land use and vegetation analysis;
- Soil analyses;
- Slope analysis; and
- Water resources analyses.

The results of this assessment are outlined below.

## 1.1.1 Livelihood and Income Restoration Requirements

### *Settlement and Agricultural Development*

Livelihood and income restoration requirements outlined in the Project's Livelihood and Income Restoration Plan (REDP 2014) include:

- Poverty Elimination: raising households above the national poverty line;
- Maintaining Economic Parity: a living standard of at least pre-project level for every household; and
- Net Income Improvement: increase of average community net income by 200% within 10 years from Commercial Operations Date (COD) from what will be measured in the baseline socioeconomic survey, to be carried out after cut-off-date close to the effective date.

Priority on-farm livelihood restoration strategies derived from the Project's Livelihood and Income Restoration Plan include:

- Establishment of lowland (irrigated) rice cultivation areas;
- Livestock development including allocation of cattle grazing areas, improvement of fodder and improved breeding and rearing practices; and
- Soil improvement in agricultural / plantation areas to support permanent cultivation – lessening dependency on swidden agriculture.

Table A-1 summarises land allocation commitments for each livelihood strategy (REDP 2014) and total land requirements for the revised resettlement plan.

**Table A-1 Land Uses and Livelihood Resotration Requirements**

Land use	Allocation for resettled household	Total Land Requirement for 750 HHs (Ha)*
Residential plots (including livestock pens and gardens)	Housing (no less than 800 m <sup>2</sup> for residential land for each household), community buildings and structures.	360
Lowland rice fields	Minimum of 0.1 ha per household member (value multiplied by the number of household members and combined into one land title). Household minimum of 0.3 ha and household maximum of 1.5 ha.	330



Land use	Allocation for resettled household	Total Land Requirement for 750 HHs (Ha)*
Cash crop and upland crop fields	minimum of 0.1 ha of plantation land per person (value multiplied by the number of household members and combined in one land title in the name of both heads of household)	330
Plantation	Minimum of 0.1 ha per household member (value multiplied by the number of household members and combined into one land title).	330
Grazing land	A limit of 5 cattle / buffalo per household is assumed (for a total of 2,400 cattle and 1,200 of buffalo).	586
Firewood	Minimum of 0.08 ha of designated forest per person (multiplied by the number of household members and combined in one land title). Assumes 1 m <sup>3</sup> of firewood is required per person per year).	264
Utilisation forest	Various NTFP (refer to INRMP)	3,702
Conservation forest		
Protection forest		
Cemetery	One or more cemeteries and / or cemetery forests pending PLUP.	N/A
<b>Total area</b>		<b>5,902</b>

\*Assumes all 750 households with approximately 3,300 people relocate. Source: REDP, NNP1 2014b

## 1.1.2 Slope Analysis

Detailed topographical information (5m contours) were sourced for the HSRA and a digital elevation model (DEM) developed to determine slope across the HSRA. The results are provided in Table A-2 and Figure A-1. Slope analysis is a key determinant in resource allocation. For example, construction of lowland rice paddies is suited to lowlands with gentle relief, upland agricultural plantations and plantations are suited to topography with low to moderate relief, and Total Protection Zones in Protected Forest Areas are required for land with >35 degree slopes (as per PM333).

Key findings include:

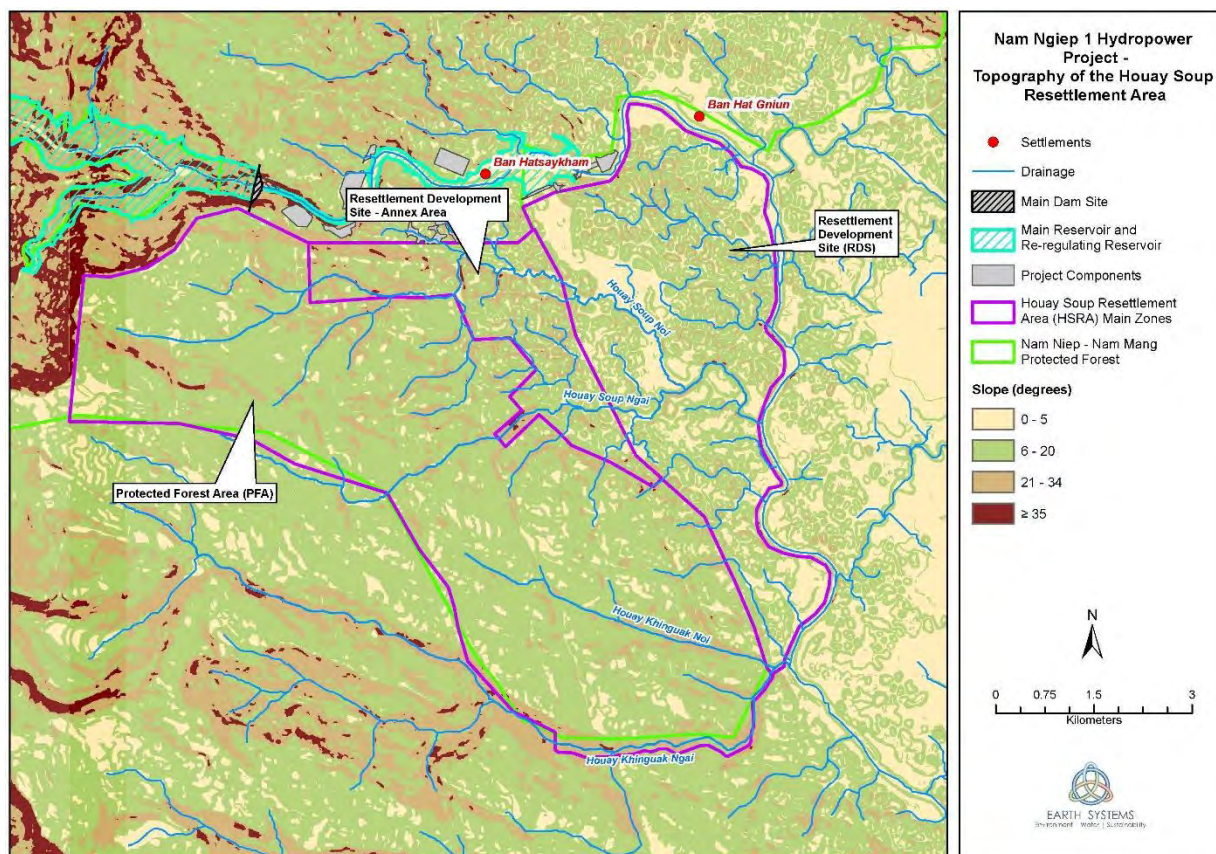
- The majority (75%) of the HSRA PFA consists of slopes between six (6) and 20 degrees. Very few areas within the HSRA / PFA were identified with slope above 35 degrees;
- The area directly to the west and outside the HSRA boundary (*Phu Hong* or Hong Mountain) is sloped above 35 degrees; and
- The RDS is fairly equally split between low sloped valley areas (39%) and moderately sloped hills (53%) whereas the majority (60%) of the RDS Annex Area consists of undulating hills with slopes between 6-20 degrees.
- Approximately 785 ha of land within the RDS was identified as having slopes between 0-5 degrees and is considered suitable for lowland agricultural development (given soil improvement requirements – refer to HSRA IEE).

**Table A-2 Slope profile of the HSRA**

Slope (degrees)	PFA		RDS		RDS Annex		Total	
	Ha	%	Ha	%	Ha	%	Ha	%
0 -5	453.1	12.2	682.3	39.1	103.2	15.9	1238.6	20.3
6 – 20	2800.3	75.3	941.7	54.0	387.3	59.7	4129.3	67.5
21 – 34	458.9	12.3	119.9	6.9	153.1	23.6	731.9	12.0

Slope (degrees)	PFA		RDS		RDS Annex		Total	
	Ha	%	Ha	%	Ha	%	Ha	%
≥ 35	8.4	0.2	0.9	0.1	5.1	0.8	14.4	0.2
<b>Total</b>	<b>3720.7</b>	<b>100</b>	<b>1744.8</b>	<b>100</b>	<b>648.8</b>	<b>100</b>	<b>6114.2</b>	<b>100</b>

Source: Earth Systems, 2015



**Figure A-1 Topography of the HSRA**

### 1.1.3 Land Use and Vegetation Analysis

A land use and vegetative habitat analysis of the HSRA was conducted using satellite imagery (January 2014) and information collected from ground-truthing exercises (June 2015). Land use and habitat types within the HSRA are outlined in Table A-3 and Figure A-2. A full description of the results of this analysis is provided in the IEE HSRA (ES 2015).

Key findings include:

- The PFA is dominated by Upper Mixed Deciduous / Bamboo Forest mosaic (UMD/B) (63%) with pockets of Upper Mixed Deciduous Forest (UMD) (4%) and Bamboo Forest (8%) occurring on the western, southern and south western borders of the HSRA. A number of grassland areas – some of which are seasonal wetlands (2%) and rocky outcrops exist within the PFA.
- The RDS (91%) and RDS Annex (80%) are dominated by fallow, cleared land and upland agriculture. These areas are predominately used for swidden agriculture. Small pockets of UMD forest (3%) and UMD/Bamboo forest (4%) remain – mostly in the south east of the RDS;
- There are a number of existing access roads in the HSRA. These tracks ensure relatively good access to agricultural fields throughout the RDS and provide limited access to the PFA; and

- A number of small streams, the majority with origins in the PFA, cross the HSRA and feed into the Nam Ngiep River (refer to Section 1.1.5).

**Table A-3. Land Use / Habitat HSRA**

Land use / Habitat Types	RDS		RDS Annex		PFA		TOTAL	
	HA	%	Ha	%	Ha	%	Ha	%
UMD Forest	57.96	3.3%	1.68	0.3%	163.05	4.4%	222.69	3.6%
Bamboo / UMD Forest mosaic	76.8	4.4%	117.27	18.1%	2325.63	62.5%	2519.7	41.2%
Riparian Forest	13.1	0.8%	1.56	0.2%	-	-	14.66	0.2%
Bamboo Forest			7.13	1.1%	284.05	7.6%	291.18	4.8%
Grassland	-	-	2.99	0.5%	81.83	2.2%	84.82	1.4%
Old Fallow	918.54	52.6%	185.55	28.6%	307.36	8.3%	1411.45	23.1%
Young Fallow	593.58	34.0%	307.09	47.3%	469.58	12.6%	1370.25	22.4%
Cleared Land	-	-	0.76	0.1%	-	-	0.76	0.0%
Upland agriculture	70	4.0%	21.13	3.3%	1.1	0.0%	92.23	1.5%
Rice paddy	8.27	0.5%	-	-	-	-	8.27	0.1%
Plantation	1.81	0.1%	-	-	-	-	1.81	0.0%
Roads / Tracks	2.84	0.2%	3.47	0.5%	10.92	0.3%	17.23	0.3%
Rock Outcrops	-	-	-	-	69.98	1.9%	69.98	1.1%
Settlement Area	0.96	0.1%	0.13	0.0%	-	-	1.09	0.0%
Water	0.9	0.1%			7.19	0.2%	8.09	0.1%
<b>Total Area (ha)</b>	<b>1744.76</b>	<b>100.0%</b>	<b>648.75</b>	<b>100.0%</b>	<b>3720.7</b>	<b>100.0%</b>	<b>6114.21</b>	<b>100.0%</b>



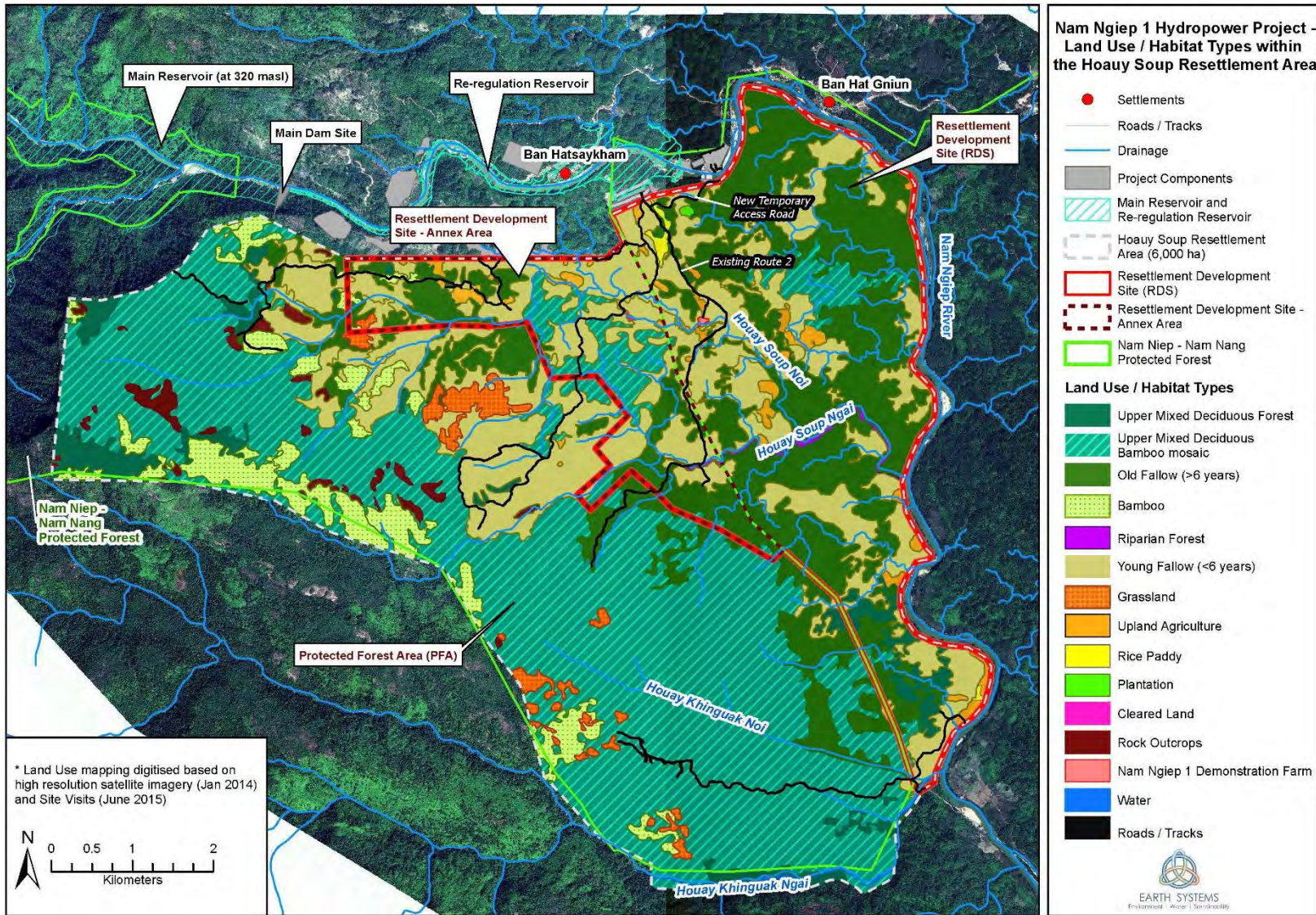


Figure A-2 Land Use and Habitat in the HSRA

### 1.1.4 Soil Analysis

Information on soils in the HSRA was obtained from the regional soil mapping database (NAFRI) and soil sampling exercise in the HSRA area by NAFRI in 2011 and 2015.

The regional soil mapping data indicates the HSRA and PFA occur on soils classified as Acrisols (AC), with the majority of infrastructure and proposed agriculture to be developed specifically on Haplic Acrisol in the low-lying areas adjacent the Nam Ngiep River (refer to Figure A-3) and Ferric Acrisols dominating the slopes of the PFA.

The results of laboratory analysis for topsoil / subsoil from six (6) sampling sites from 2011 and 10 sampling sites in 2015 are provided in Annex A of the HSRA IEE (Earth Systems, 2015) as is a more detailed assessment of soil character and fertility. In summary, soil surveys and physio-chemical analysis undertaken by NAFRI identified the following key elements:

- The soils sampled in 2015 have physical and chemical properties similar to profiles sampled in 2011. In general, they are acidic, low in plant available nutrients and have low to moderate organic matter content;
- Soil texture is predominately sandy loam and loam, with localised areas of sandy clay loam, clay loam, loamy sand, clayey loam, and sand;
- Soils are highly dispersible and therefore prone to wind and water erosion following vegetation removal (without adequate erosion and sediment control measures);
- Elevated aluminium concentrations may inhibit plant establishment / growth for more acidic soils (e.g. with pH levels <4.5). Median pH in the HSRA was found to be <4.5.
- Soil fertility is poor, with nutrient content very low or low for phosphorous, potassium, calcium, magnesium, and sodium, with moderately low to moderate nitrogen availability (phosphorous and potassium are likely growth limiting nutrients). Soil organic matter and cation exchange capacity are also low.

Proposed agricultural areas will require the diligent application of a soil improvement program to reach desired yields for crops and annual growth for plantation trees. Soil pH will have to be raised (through application of dolomite or limestone) and nutrient content elevated.



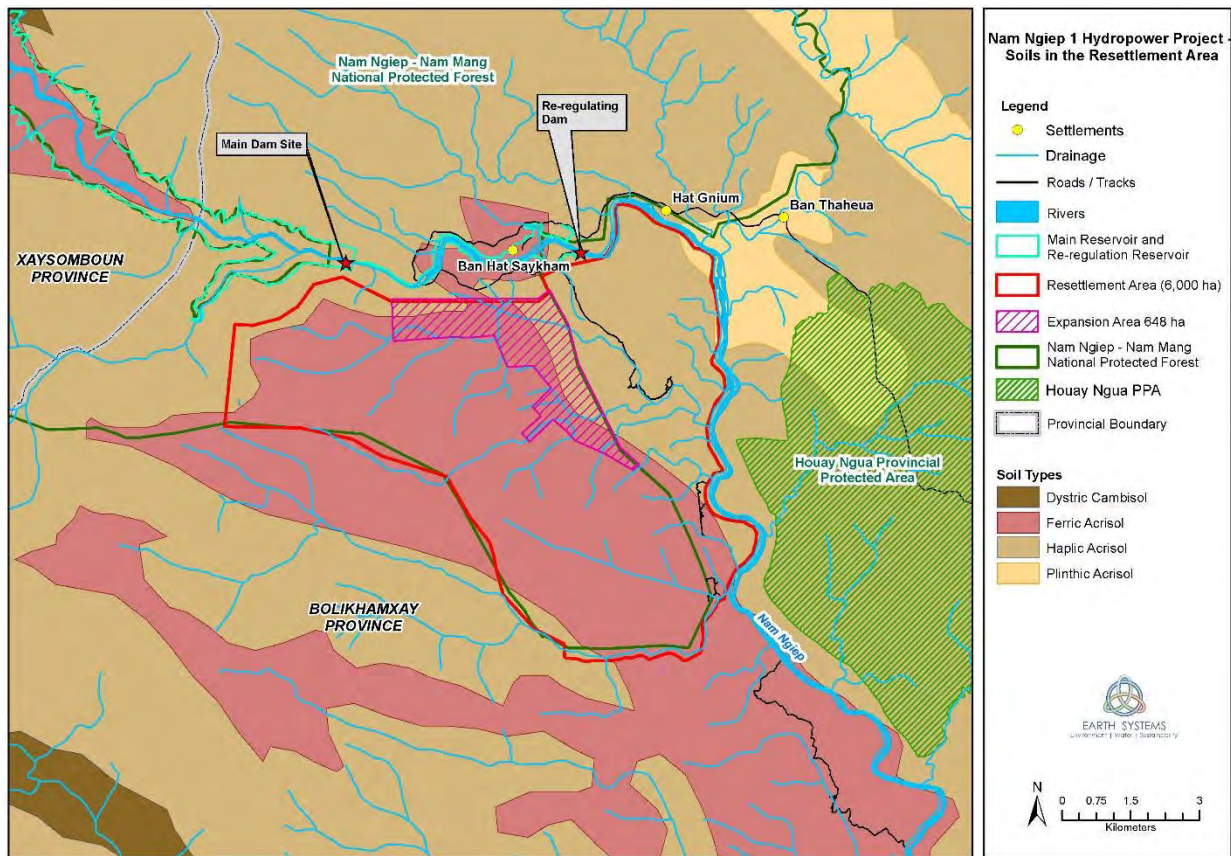


Figure A-3 HSRA Soil Mapping

### 1.1.5 Water resources analysis

An analysis of water resources within the HSRA was conducted. This included terrain analysis utilising a digital elevation model (TauDEM) to delineate stream flow lines, stream slope and catchment boundaries; and field observations of the most significant streams (with respect to surface water flow, aquatic habitat, and aquatic biodiversity) in the HSRA.

The results of this analysis are outlined in Table A-4 and Figure A-4

Table A-4 Catchment Areas in the HSRA

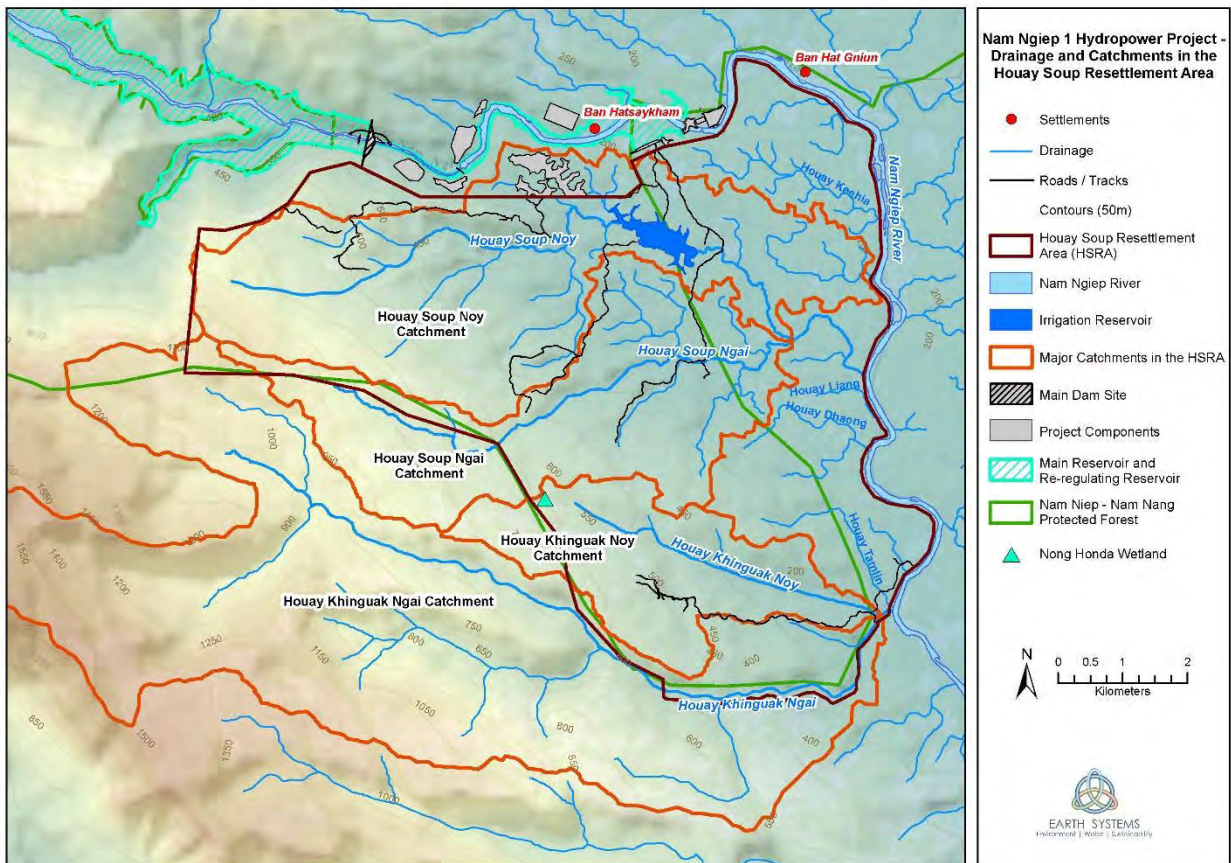
#	Sub-Catchment	Total Area (km <sup>2</sup> )	Area within HSRA (km <sup>2</sup> )	% Inside the HSRA	Maximum Flow (m <sup>3</sup> /s)	Median Flow (m <sup>3</sup> /s)	Base Flow
1	Houay Soup Noi	23.56	21.99	93.37	34.9	0.01	0.01
2	Houay Soup Ngai	16.43	11.76	71.61	72.0	0.21	0.01
3	Houay Khinguak Noi	9.44	8.12	86.03	19.41	0.01	0.01
4	Houay Khinguak Ngai	45.15	3.94	8.73	38.2	0.25	-

Source: ES 2015

Key findings include:

- The most significant streams (and catchments) in the HSRA include the Houay Soup Noi, Houay Soup Ngai, Houay Khinguak Noi and Houay Khinguak Ngai (from north to south), each of which are perennial.

- A number of smaller streams that drain directly to the Nam Ngiep River are located in the RDS. These streams include (from north to south), the Houay Liang (ephemeral), Houay Dhakong (perennial) and Houay Tamdin (ephemeral).
- A seasonal wetland and perennial wetland (Nong Hong Da and Nong Pa) were identified in the upper areas of the Houay Soup Noi and Ngai catchments.
- The HSRA development plan includes the utilisation of water resources from the Houay Soup Ngai (household water supply), and Houay Soup Noi (irrigation). Water from the Project's Re-regulating Dam (Nam Ngiep) will also be utilised for irrigation.



**Figure A-4 HSRA Catchments**

# APPENDIX B. NTFP MANAGEMENT FRAMEWORK

## 1.1 Introduction

This Non-Timber Forest Product (NTFP) Sustainable Management Framework has been prepared by Earth Systems for Nam Ngiep 1 Power Company (NNP1). The Framework provides background information and guidance for the development of a detailed *NTFP Species Inventory and Management Plan*, which will be used to manage and monitor NTFP use in the Houay Soup Resettlement Area (HSRA) for the Nam Ngiep 1 Hydropower Project (NN1HP).

The overall aim of NTFP management in the HSRA is to promote sustainable use of NTFP's while minimising potential impacts and risks to biodiversity values. The specific objectives of the NTFP Sustainable Management Framework are to:

- Summarise the legal context of NTFP management in the HSRA;
- Summarise available information on available species of NTFPs in the HSRA, their location by area, current condition and existing pressures;
- Summarise available information on NTFP collection by PAPs including timing of collection through the year, location, frequency, gender, utilization and commercial value of NTFP's collected;
- Consider a potential NTFP quota system for use amongst villages based on a 'sustainable yield';
- Provide a framework for a restocking program in areas of diminishing stocks;
- Outline options for supplementary domesticated NTFP gardens; and
- Provide a Terms of Reference (TOR) for a detailed *NTFP Species Inventory and Management Plan*, including a time schedule for implementation.

The scope of this report considers the entire HSRA, however, the majority of the NTFP collection will occur within the PFA as this is where the majority of the ecosystems supporting NTFPs are located. The focus of this report is therefore primarily on the management of NTFPs within the PFA, although areas outside the PFA are considered where appropriate.

## 1.2 Definition of NTFPs

Non-Timber Forest Products (NTFPs) are broadly defined in this report as all wild plant and animal products that can be harvested from natural ecosystems (Ros-Tonen et al., 1995; de Beer and McDermott, 1996; van Andel, 2000). This definition excludes the use of industrial timber, but includes the small-scale use of wood for canoes, crafts, house construction and fuel. Yields from plantations and cultivated gardens are not considered NTFPs, although wildlife may be hunted in these areas which are NTFPs.

Fish and other aquatic resources harvested from streams and wetlands within the HSRA are not included in this NTFP Management Framework, as aquatic biodiversity is covered separately by NNP1 in management planning.



## 2 LEGAL CONTEXT

### 2.1 Institutional Structures and Responsibilities

The key Government institutions responsible for the management of NTFPs in Lao PDR are:

- The Ministry of Natural Resources and Environment (MONRE) and its provincial and district line agencies (including District Forestry Units) which have primary responsibility for the management of PFAs; and
- Ministry of Agriculture and Forestry (MAF) and relevant provincial and district line agencies responsible for forest management. These institutions have primary responsibility for forest management outside PFAs, as well as the commercial use and sale of forest products.

At a local level, the MAF is in the process of organizing NTFP enterprise groups at the village cluster level and aims to:

- Allow NTFP producers to produce sufficient quantities and negotiate effectively with traders;
- Effectively manage NTFP at the village cluster level, which is the most appropriate level of management (e.g. through zonal land use plans); and
- Provide a platform for market information exchange.

### 2.2 Lao PDR Legislation Relating to NTFPs

There is no specific national legislation for NTFP use and management in Lao PDR. The statutory framework for NTFP management is provided under forestry and land use legislation including laws, decrees and regulations. Key legislation relating to NTFP management in Lao PDR is listed in Table 2-1 and summarised below.

**Table 2-1 Key Lao PDR Legislation Relevant to NTFP management**

Legislation	Year	Description
Constitution of Lao PDR	2003	<ul style="list-style-type: none"> <li>• The State protects the rights of ownership and ensures the right to use, transfer and inherit land owned by the national community</li> <li>• All organizations and citizens must protect the environment and natural resources – land, water, forests, fauna and atmosphere</li> </ul>
Forestry Law	2008	<p>Governs the management, preservation, development, and utilisation of forest resources and forest land; Governs the activities that may be conducted in Protected Forests, including:</p> <ul style="list-style-type: none"> <li>• Management of tree and NTFP plantation activities;</li> <li>• Promotion of tree and NTFP plantations;</li> <li>• Distribution of NTFP and wood products.</li> </ul>
Wildlife and Aquatic Law	2007	<ul style="list-style-type: none"> <li>• Aims to conserve biodiversity by protecting rare and valuable species and controlling the exploitation of other species.</li> <li>• The Law encourages habitat regeneration and preservation and captive breeding of selected species.</li> </ul>
PM Decree 81 Decree of Prime Minister Concerning Acceptance of List of Prohibited Terrestrial and Aquatic Animals	2008	Decree accepting lists of prohibited terrestrial and aquatic animals. Categories used are consistent with Wildlife and Aquatic Law.
PM Order 10 Management of Forests and Forestry Operations		<ul style="list-style-type: none"> <li>• Wood and forestry produce processing into export oriented finished and semi-finished products shall be strongly promoted (except in special cases approved by the government).</li> <li>• All types of rattan and sandalwood parts shall be processed into finished or semi-finished products before an export permit is issued.</li> </ul>

Legislation	Year	Description
PM Order 15 Management of Forest and Forestry Business		<p>Article 2</p> <ul style="list-style-type: none"> <li>It is prohibited to collect non-seasonal NTFPs (i.e. rattan, eaglewood, bamboo, resin, roots, vines, etc.) in closed season set by Province (31 May to 31 October).</li> <li>During closed season, forestry officials shall monitor NTFP collection</li> <li>Forestry officials shall organize an evaluation workshop to include program review (strong and weak points), lessons learned and review income from royalties and fees collected from timber and NTFP use...</li> <li>Wood processing factories that use NTFPs shall complete extension of permit by 9 September each year or they do not qualify for bidding procedures.</li> </ul>
PM Decree 169 on the Management and Use of Forests and Forest Land	1993	<ul style="list-style-type: none"> <li>Governs the management, use and conservation of all forests and forest land, and all activities pertaining to all types of forests and forest products;</li> <li>Aims to preserve forests, forest land, the environment, water sources and wildlife in view of meeting the requirements in national economic and socio-economic development and sustainable use of forests;</li> </ul> <p>There are sanctions within this decree for:</p> <ul style="list-style-type: none"> <li>Burning or destroying forests</li> <li>Felling or destroying protected tree species</li> <li>Killing or destroying protected animal species</li> <li>Exploiting, gathering or use of wood or forest produces in excess of the authorization</li> </ul>
MAF Regulation 221 Management and Use of Timber and Forest Products	2010	<ul style="list-style-type: none"> <li>To ensure that harvest of timber and forest products will be able to constantly supply the raw materials to the processing factory with satisfactory quality and appropriate techniques, support sustainable socioeconomic development, protect the environment, preserve forest regeneration and resources on a sustainable basis</li> <li>Forest Products are Non-Timber Forest Products (NTFPs) that are available in the natural forest. These are stem, climber, root, fruit, flower, leaf, shoot, bark of trees, seed, oil, resin, gum, mushroom, honey, etc.</li> <li>Non-seasonal Forest Products are NTFPs that can be collected in any season such as: rattan, bamboo, dipterocarp resin, pine resin, bark, climber, root, etc.</li> <li>Seasonal Forest Products are NTFPs that can only be collected during specific seasons such as: flowers, fruits, bamboo shoot, mushroom, etc.</li> </ul>
MAF Instruction 0822 on Land and Forest Allocation for Management and Use	1996	<ul style="list-style-type: none"> <li>Managing and using natural resources in general and the land, forest and watershed resources in effective and sustainable manners and ensuring the protection of the environment and natural resources;</li> <li>Reducing and progressing toward total termination of shifting cultivation by developing alternative agricultural-forestry systems that uplift livelihoods of those that practice shifting cultivation;</li> <li>Promoting higher production of food; and</li> <li>Promoting investment in commodity production thus generating additional income for households.</li> </ul>
MAF Decision 0054 on Customary Rights and the Use of Forest Resources	1996	<ul style="list-style-type: none"> <li>Details the customary use rights of the Lao multi-ethnic people regarding the use of the forests, forestland and forest products</li> </ul>
MAF Order 1848 Planting or Compensation Fee from NTFP Harvest		<p>Replant or payment of fee</p> <ul style="list-style-type: none"> <li>Harvesters/buyers of NTFPs for commercial purposes shall either plant or pay fees to State according to listed numbers and rates for: Rattan; Eaglewood; Aromatic Wood; Mai Khoun; Fire Wood; Swelling Wood; Fence Poles; Rubber; Resin; Shoots; Tubers; Roots; Bamboo and Creeper Plants.</li> </ul> <p>Payment of Compensation Fee</p>



Legislation	Year	Description
		<ul style="list-style-type: none"> <li>Harvester/buyers unable to conduct planting shall pay compensation planting fees pursuant to Article 1. 50% of the fee must be paid prior to carrying out the harvest, with the remainder amount being paid before issuance of permits for the transport of the NTFPs to market or processing factory.</li> </ul>
PM Decree 333 on Protection Forests	2010	<ul style="list-style-type: none"> <li>Defines the principles, procedures and management measures regarding the protection, conservation, development and sustainable use of the Protection Forest and Protection Forestry lands</li> <li>Protection forests are divided into two categories: the absolutely/total prohibited zone and the utilisation zone;</li> </ul>
MOF Order 111 Funds from Harvest of Timber, NTFPs		<ul style="list-style-type: none"> <li>Ensuring...utilization of funds generated by the collection of the duty from the harvest of...NTFPs in order to ensure the effective replanting of...NTFPs...</li> <li>Scope of works eligible for the utilization of the compensation funds</li> <li>Fees paid for NTFPs earmarked for export paid to central treasury.</li> <li>Fees paid for NTFPs earmarked for domestic markets paid to the Central Treasury in the Province</li> <li>MAF is responsible for elaborating an annual budget plan for replanting...NTFPs...</li> </ul>

### Forestry Law, 2008

The Lao *Forestry Law* outlines principles and responsibilities relating to all forest resources, including soil, flora, fauna, water, living and non-living resources. All forest land is owned by the State, which has the ability to give user rights to communities in return for sustainable management of the resource. The Law outlines a nationwide forest classification system, under the Ministry of Agriculture and Forestry, which demarcates land to reflect its values for preservation and development. Forests in Lao PDR are classified into three primary categories: protection forest, conservation forest, and production forest. This legislation is relevant to issues of forest use within the HSRA.

### Wildlife and Aquatic Law, 2007

The Lao *Wildlife and Aquatic Law* aims to conserve biodiversity by protecting rare and valuable species and controlling the exploitation of other species. The Law encourages habitat regeneration and preservation and captive breeding of selected species. A key aspect of the approach adopted to protect species at risk is the classification of terrestrial and aquatic wildlife into the following three categories:

- Wildlife and Aquatic Prohibition Category (I): Rare and/or valuable species which require a Government permit to utilise;
- Wildlife and Aquatic Management Category (II): Species economically, socially or environmentally beneficial. These species are important part of the livelihoods of the local people as well as scientific research and education. Use of such species is allowed but controlled Category II species may not be hunted / fished during breeding / spawning season; and
- Wildlife and Aquatic General Category (III): Common species which are not at risk of extinction but are very important for social and economic development. Species in this category may be utilised in a way that is legal and does not threaten the species or ecosystem.

Under this law it is prohibited to:

- Hunt Category I and II (seasonally) wildlife in protected areas, including wildlife conservation areas, reserve forests, protection forests, national production forests and other places where hunting is prohibited by the State;
- Use destructive gears or methods such as firearms, explosives, chemical, poison, electric shock and drift nets;

- Encroach upon and destroy wildlife habitats and conservation areas without an authorization;
- Trade or move any species of wildlife without authorization.

### **Regulation 221 Management and Use of Timber and Forest Products Prohibitions**

The MAF *Regulation 221 Management and Use of Timber and Forest Products Prohibitions* states the following prohibitions:

- “Any harvest that destroys an entire area of forest product;
- Bamboo less than 3 years old;
- Damage rattan by cutting all stems;
- Harvest of tree in order to gather product;
- Removing all bark from tree;
- Burn or chemical use to extract resin or oil; and
- Taking of entire shoots or roots at one time.”

### **Customary Use regulations (MAF Decision 0054)**

Customary Use Regulations (MAF Decision 0054) states that:

- “Villagers are exempt from natural resource taxes and NTFP sale is permitted provided that villagers form groups or associations for commercial collection and that activities;
- The right of collecting forest products for household consumption, e.g., collect firewood, mushrooms, wild vegetables, bamboo shoots, traditional herbal medicines or other non-timber forest products which are not prohibited in the agreement of the village forest management. The cutting of natural timber which are not prohibited species for house repair and renovation in the management and conservation area shall have to comply with the regulations of the Ministry of Agriculture and Forestry.
- The right of harvesting the forest products that are abundant in the non-prohibited area for commercial purpose must be within the extent that allows the forest products to be able to sustain and expand in that area, but must be approved by the forestry section with agreement from the district authorities.
- The right of hunting and fishing of non-prohibited species outside of the protected zone and in compliance with the laws and regulations.
- The right of using degraded forestland or barren forestland that have been surveyed and allocated in accordance with the village socio-economic development plan which agreed by the land forest allocation committee or the organizations that have the authority at district level.”

### **PM Decree 333 on Protection Forests**

Since the HSRA includes the PFA, the PM Decree 333 on Protection Forests is particularly relevant. Key articles from this Decree include:

- “The use of forests and forestry products in the management areas for the use of protection forest is particularly authorized for... the collection of NTFP, medicinal crops and plants, the trees for traditional family use. However, the implementation must be made in accordance with the allocation plans ... consistent with the forestry law and regulations to prevent the negative impact for the forest structures.
- Rehabilitating degraded forestry areas ... include the NTFP... in order to increase the rich condition, the high value to the protection forest and to make the equilibrium to the forest ecological system.
- The projects that create the impacts on and have profits from the protection forests and protection forestry lands directly and indirectly must contribute the funds for the forest and forestry resources development fund as stated in the agreement on the project development which shall be used in the management, maintenance and developments of the protection forests and protection forestry lands.”

## 2.3 Relevant Conventions and Strategies

The Lao PDR *Forestry Strategy to the Year 2020* (2005) is the official national guide the sustainable development and management of the forestry sector in line with national policies, strategies and priority programs for national socio-economic development and environmental conservation. Aspects of this policy relevant to NTFP use include:

- Current Trends in NTFP Availability and Use;
- Customary rights on NTFPs;
- Commercial harvesting; and
- NTFP harvesting plans and trade.

A vision statement was adopted by the GOL called *Vision 2020 - Sustainable Forest Management and Conservation in Lao PDR*. This vision statement identifies several priorities for NTFP management, including the following that are relevant to the HSRA:

- Develop viable alternatives to shifting cultivation and gradually decrease unsustainable upland farming;
- Allocate land to rural families and enterprises and encourage forest rehabilitation;
- Improve forest research:
  - » Increase income from NTFP-based industry and trade through product improvement and marketing;
  - » Provide alternative livelihoods to shifting cultivation through NTFP developments; and
  - » Provide incentives to local communities to conserve forests by increasing the social and economic benefits accrued to them from sustainable NTFP use.

## 3 NTFPS IN THE HSRA

The main NTFPs in the HSRA are plants and fungi, with terrestrial fauna are also hunted in the HSRA. The availability, location and current threats to each of these species groups is discussed in the sections below. A more comprehensive assessment of terrestrial flora and fauna is provided in the HSRA IEE.

### 3.1 Plants and Fungi

#### 3.1.1 Species and Availability

At least 125 species of plant and fungi NTFP are understood to be available within the HSRA (refer to Table C-2 for list). More than 10 species of mushrooms have been identified, which are generally available during the early rainy season and are predominantly used for food. At least three (3) species of ferns are available for use and their young shoots are usually used as food. While the remainder and majority of NTFPs are vascular plants and are used for a variety of uses, from household items, as decoration, in cooking as spices and thickening agents and as medicine.

Many of the species are available on a seasonal basis, especially the fruiting and vegetable species, while others may be used year-round (e.g. bark from trees). Fungi need the moist and humid conditions of the rainy season to grow and it is crucial to be able to identify poisonous species.

#### 3.1.2 Location

The highest species diversity is within the Upper Mixed Deciduous Forests (UMD) in the west and south-west of the HSRA, in the PFA. Many of the NTFPs identified were only found within the more remote areas of the UMD. Therefore not all of the species that are available may be utilised as these areas may be too far from villages to be access.

However, there are still relatively species rich fallow forests closer to the villages. Particularly the older fallow (>8 years), was found to be moderately species rich and therefore contains NTFPs. Although the older fallow is less diverse than the higher quality UMD, it is easier to access (closer and less dense) and still contains sufficient NTFP diversity to provide a relatively nutrient rich diet and supplement materials for households.

#### 3.1.3 Current Condition and Pressures

It is likely that most of the main mushroom and plant NTFPs in the HSRA are regionally common based on Lao PDR studies discussing commonly used rural NTFPs (e.g. Poffenberger 1999, Foppes and Dechaineux 2000, Foppes and Ketphanh 1997). However, it is unclear of the current local condition and pressures on most of the fungi and plants used as NTFPs, since their distribution and abundance have not been thoroughly investigated. Most species have not been assessed by regional or international experts for their current distributions (e.g. IUCN Red List of Threatened Species).

Local villagers indicated that all species are decreasing in abundance and distribution. Presumably if local villagers have identified that these species are declining, that species' abundances are decreasing in collections areas and local villagers are more likely to utilise other sources and/or travel further to collect these species (e.g. in the PFA).

The main anthropogenic pressures on these species are shifting cultivation, increased collection (from increased population), and increased logging / deforestation.

## 3.2 Terrestrial Fauna

### 3.2.1 Species and Availability

Over 100 terrestrial, semi-aquatic and aquatic amphibians, birds, mammals and reptiles may inhabit the HSRA and surrounds (Appendix C, Table C-3). This includes several threatened and locally rare species, but the majority are common to the region and South-east Asia. For example, the globally Vulnerable Asiatic softshell turtle (*Amyda cartilaginea*) was identified in the HSRA. The turtle's population is relatively secure and widespread in protected areas, but the consumption trade of tons per day is counteracting any gains achieved in protected areas.

The availability of these species does not equate to the number of species that are hunted. Many species are not used as they are prohibited by regulation, legislation, tradition, or are simply too difficult to capture. However, due to the diversity of species that are available, these NTFPs can supplement an otherwise protein-poor diet. Frogs, soft-shelled turtles and molluscs are very important sources of protein in the diet of local villagers. The junglefowl (*Gallus gallus*) are common in the HSRA, and are a useful source of protein. Other animals that provide protein in the diet include wild boar (*Sus scrofa*), a variety of deer species and squirrels.

### 3.2.2 Location

Similar to plant and fungi, terrestrial fauna are more diverse in the higher quality forests to the west and south-west of the HSRA. Disturbance-intolerant threatened and rare species have generally sought refuge in these higher quality and inaccessible forests to avoid being preyed upon by humans. Some occasionally move into the more accessible forests, such as the Asiatic black bear (*Ursus thibetanus*) that has been extensively hunted for use in Chinese medicine and the pet trade. However, mostly common species occur within the fallow forests, and will often move into agricultural and settlement areas.

### 3.2.3 Current Conditions and Pressures

Many of the species traditionally hunted for food have become scarce. Two species of softshell turtle occur in the area and both are globally and locally threatened. Asiatic and Chinese softshell turtles (*Pelodiscus sinensis*) are threatened due to overexploited for food, and although are somewhat secure in protected areas and are farmed commercially, their wild populations are still declining. The decline in populations is mirrored in at least five other species that have or were used for subsistence.

The main anthropogenic pressures on local fauna are habitat loss due to shifting cultivation and increased logging/ deforestation as well as increased hunting by local villages. Hunting and capture for the pet, meat and medicine trade, particularly with China, is contributing to declines in many mammal, bird, reptile and frog species.



## 4 CURRENT NTFP COLLECTION

This chapter summarises available information on NTFP collection by PAPs (including for the main species) including timing of collection through the year, location, frequency, gender, utilization and commercial value of NTFP's collected. Terrestrial NTFPs are considered separately, and information gaps are summarised in Section 4.2.

### 4.1 Terrestrial NTFPs

#### **Location, Frequency and Gender of Collection**

During Local Knowledge Surveys, more than 20 species of ferns, fungi and vascular plants were identified as species collected from the HSRA (Table 4-1). This included several species of mushroom used in cooking, a few ferns for cooking and making household items, while the majority were vascular plants. Few animals were reported to be caught, with wild boars, squirrels, black-crested bulbuls (*Pycnonotus melanicterus*) and *Quasipaa fasciculispina* most recently caught. The majority of NTFPs are consumed by villagers and this subsistence use comprises most of their livelihood.

The majority of NTFPs are collected within close proximity of villages. All fungi, ferns and vascular plants are collected within fallow, while some are available within bamboo and upper mixed deciduous forests. Animals are similarly caught within close proximity to the village.

Fungi are predominantly collected early during the rainy season when conditions are the best for mushroom growth. Mushrooms can continue to grow throughout the rainy season, and can provide a plentiful crop. Most NTFPs are collected on a daily or weekly basis, alternating depending on supply. One species, *Passiflora foetida*, is collected on a monthly basis.

#### **Commercial Value**

Some of the NTFPs identified have potential commercial value, regardless of whether these are sold by local villagers. The villages in HSRA sell few of their NTFPs, identifying that they sold *Oxytenanthera albociliata* (Nor mai lay, bamboo) and *Zanthoxylum rhetsa* (Mak khaen). These NTFPs are not particularly valuable, but are easy to grow, harvest and cultivate.

A few of the other NTFPs that are regularly collected have a high commercial value, but it is difficult to collect or cultivate these species in large volumes (e.g. mushrooms, Greijmans et al. 2006). Although villagers did not identify that they collected cardamom (*Amomum* sp.), there are several species of cardamom in the vicinity. Cardamom can be sold to China for more than 3,000 kip/kg (Foppes and Ketphanh 1997). Similarly there are other species identified in the area that are not currently collected and may be valuable in local or regional markets.

### 4.2 NTFP Use Information Gaps

Non-timber forest product collection is a complex practice. Species that are collected may be highly seasonal or are collected opportunistically and therefore the information discussed in the sections above provides only a snapshot of current NTFP collecting habits (at the time of the surveys). Additional information required to understand current NTFP use in the HSRA generally includes:

- A full list of NTFPs collected (as there are many available in the HSRA that have not been identified, refer to Appendix C, Table C-2);
- Frequency of collection;
- Gender ratio of collectors for each species;
- Location of NTFPs collected;

- Specific use of NTFPs (food, medicine, multi-use);
- Ratio of yield that is consumed in the village versus sold;
- Commercial yield of NTFPs; and
- Historic use compared to current use for terrestrial NTFPs (e.g. 5 years ago).

**Table 4-1 Fungus, fern and vascular plant NTFP collected by villagers within the HSRA**

Scientific Name	English Common Name	Lao Name (English)	Uses	Habitat/ Location	Frequency of Collection	Approximate Commercial Value
<i>Amanita princeps</i>	Head man slender caesa mushroom	Hed la ngok	Mushroom used in cooking	Fallow	Weekly	2,000 kip/kg
<i>Hirneola polytricha</i>	Cloud ear fungus	Hed hou nou	Food and potentially traditional medicine	Fallow	Weekly	2,000 kip/kg
<i>Xerocomellus chrysenteron</i>	Mushroom	Hed pheung	Edible mushroom	Fallow	Weekly	2,000 kip/kg
<i>Termitomyces robustus</i>	Mushroom termitomyces	Hed pouak	Edible mushroom	Fallow	Weekly	5,000 - 20,000 kip/kg
<i>Lentinus polychrous</i>	Mushroom lentinus	Hed bot	Edible mushroom	UMD, Fallow	Weekly	5,000 - 20,000 kip/kg
<i>Lentinus squarrosulus</i>	White rot fungus	Hed khao	Edible mushroom	Fallow	Weekly	5,000 - 20,000 kip/kg
<i>Schizophyllum commune</i>	Mushroom bee	Hed bee	Edible mushroom	Fallow	Weekly	5,000 - 20,000 kip/kg
<i>Diplazium esculentum</i>	Fern	Phak kood khao	Edible, young fronds are stir-fried as a "vegetable" or used in salads	Fallow	Weekly/Daily	
<i>Calamus spp.</i>	Rattan	Nor wai	Edible young shoot, used for furniture making	Fallow	Weekly/Daily	150-370 kip/stem
<i>Rhapis micrantha</i>	Rhapis	San	Leaves used for handcrafts, ornamental	Fallow	Weekly/Daily	
<i>Eleusine indica</i>	Eleusin grass	Ya khouay	Tuber can be eaten cooked; Medicinal plant	Fallow	Weekly/Daily	
<i>Irvingia malayana</i>	Irvingia	Mak ka bok	Edible roasted seeds, non-grade timber used in furniture and household items	UMD, Fallow	Weekly/Daily	
<i>Coscinium fenestratum</i>	Yellow vine	Khua haem	Edible fruit	Fallow, UMD	Weekly/Daily	10 kip/kg
<i>Antiaris toxicaria</i>	Antiaris	Yang mak nong	Lightweight hardwood, bark has a high concentration of tannins that are used in traditional clothes dyeing and paints, fruit is edible, used in traditional medicine	Fallow	Weekly/Daily	
<i>Helminthostachys zeylanica</i>	Kamraj fern	Ton teen hong	Roots and leaves used in medicine and sometimes as food	Fallow		3,000 kip/kg
<i>Passiflora foetida</i>	Passiflora	Phak bouang	Edible fruit, young leaves edible, leaves used for medicine	Fallow	Monthly	
<i>Cephalostachyum virgatum</i>	Bamboo	Nor mai hia	Young shoot eaten	Bamboo, Fallow	Weekly/Daily	200 kip/stem
<i>Oxytenanthera albociliata</i>	Bamboo	Nor mai lay	Edible shoots, furniture and farm tools	UMD, Fallow	Weekly	200 kip/stem
<i>Oxytenanthera parvifolia</i>	Bamboo	Nor mai sord	Edible shoots, furniture and farm tools	UMD, Bamboo, Fallow	Weekly	200 kip/stem
<i>Zanthoxylum rhetsa</i>	Zanthoxylum	Mak khaen	Bark, immature fruits, seeds are used as spice, edible fruits and leaves cooked, leaves used to brew a "beer", various plant parts used as medicine, moderately hard timber	Fallow, UMD	Weekly	400 kip/kg
<i>Centella asiatica</i>	Centella	Phak nok	Edible, leaf a traditional accompaniment to rice and curry, traditional medicine	Fallow	Weekly/Daily	

Key: UMD – Upper Mixed Deciduous

## 5 NTFP MANAGEMENT CONSIDERATIONS

The management of NTFPs within the HSRA will need to take into consideration:

- Permitted uses and restrictions of NTFPs in different Forest Management Zones within the HSRA, as outlined in Section 5 of the INRMP, and general prohibitions as per legislative requirements;
- An NTFP quota system;
- The potential for an NTFP quota system for use amongst villages based on a 'sustainable yield';
- A restocking program for NTFPs in areas of diminishing stocks; and
- Options for supplementary domesticated NTFP gardens.

Background information on each of these aspects is introduced in the sections below to provide a context for the TOR for a detailed *NTFP Species Inventory and Management Plan* outlined in Chapter 6.

### 5.1 Forest Zoning, Permitted Uses and Restrictions

In accordance with Forest Management Zones discussed in Section 5 of the INRMP, NTFP collection will need to be managed in conjunction with zoning regulations. Permitted uses and restrictions of NTFPs in different zones within the HSRA, and general restrictions, are summarised in the sections below.

#### 5.1.1 Permitted Uses of NTFPs in Different Zones within the HSRA

Permitted uses of NTFPs in different zones within the HSRA are summarised in Table 5-1.

**Table 5-1 Village and Forest Management Zones in reference to the use and restrictions of non-timber forest products (NTFPs) in the Houay Soup Resettlement Area**

Zone	Village and Forest Management Categorisation	Key NTFP Use and Restrictions
<b>Protection Forest Area</b>		
Total Protection Zones	Protection Forest Zone (including water source protection)	<ul style="list-style-type: none"> <li>• No planting or establishment of NTFPs</li> <li>• Collection of non-prohibited NTFP</li> <li>• Tree seed collection</li> <li>• No hunting or fishing</li> <li>• No release of animals</li> </ul>
	Controlled Use Zones	<ul style="list-style-type: none"> <li>• No planting or establishment of NTFPs</li> <li>• Non-prohibited NTFP collection</li> <li>• Species collection is allowed in consultation with the MAF;</li> <li>• No hunting and fishing</li> </ul>
	Utilisation Forest	<ul style="list-style-type: none"> <li>• Non-prohibited NTFP collection</li> <li>• Selective planting of indigenous NTFPs, especially conservation significant, prohibited and livelihood important species</li> <li>• Planting of non-indigenous species is prohibited</li> <li>• Non-prohibited NTFP seed and plant collection for propagation in community gardens</li> <li>• Hunting and fishing of common species;</li> <li>• Conservation significant species collection, hunting and capture should be prohibited</li> </ul>
	Spirit or Sacred Forest/s	<ul style="list-style-type: none"> <li>• NTFPs managed in accordance with traditional regimes</li> </ul>
<b>Resettlement Development Site</b>		
RDS	Water Source Protection Forests (as per Protection Forest Zone)	<ul style="list-style-type: none"> <li>• No planting or establishment of NTFPs</li> <li>• Non-prohibited NTFP collection</li> <li>• Tree seed collection</li> <li>• Minimise hunting in catchment areas</li> </ul>

Zone	Village and Forest Management Categorisation	Key NTFP Use and Restrictions
	Utilisation Forest	<ul style="list-style-type: none"> <li>• NTFP collection</li> <li>• Planting of indigenous NTFP, especially livelihood important species</li> <li>• Planting of non-indigenous species is prohibited</li> <li>• NTFP seed and plant collection for propagation in community gardens</li> <li>• Conservation significant species collection, hunting and capture should be prohibited or minimised</li> <li>• Harvesting of other species should be monitored and managed, if any animals are considered to have decreased in number, collection and/or hunting should be minimised until numbers increase</li> <li>• Pest eradication programmes should be considered for species such as wild boars (<i>Sus scrofa</i> Mou pah)</li> </ul>
	Spirit or Sacred Forest/s	As above
	Plantation Forest Zone	<ul style="list-style-type: none"> <li>• Extensive NTFP collection discouraged in commercial plantations unless removal does not impact on plantation crops (especially during seedling stages)</li> <li>• Planting of indigenous NTFPs, especially livelihood important species if agroforestry established</li> <li>• Planting of non-indigenous species is prohibited</li> <li>• NTFP seed and plant collection for propagation in community gardens</li> <li>• Hunting and fishing is discouraged</li> </ul>

### 5.1.2 General Restrictions

Regulations that apply to all Forest Management Zones state that NTFP collection is prohibited:

- During the closed season for rattan (e.g. *Calamus* spp.), eaglewood (e.g. *Aquilaria crassna*), bamboo (tribe Bambuseae), resin, roots and vines from 31<sup>st</sup> May to 31<sup>st</sup> October, adjusted to seasonal differences (PM Order 15); and
- By methods that destroy the forest, trees, bark, bamboo less than 3 years old, rattan stems or that uses fire or chemical to extract resin or oil (MAF Reg 221).

## 5.2 NTFP Quota System

The Constitution, MAF, Forestry Law and PM Regulations and Orders guarantee customary use of forest resources for villagers within village boundaries (refer to Table 2-1). Customary use includes the hunting of non-protected wildlife and gathering and sale of non-protected NTFPs. The exceptions to this quota are that hunting cannot be conducted in the closed season and NTFPs should be collected at a sustainable level identified in a management plan or local rules. Collection of NTFPs is restricted to villagers with legally recognised customary rights within the village boundary (customary use by villagers) or those with permits under an approved management plan (commercial use by individuals or organisations, Sigaty 2003). Customary use by villagers includes NTFP sale under a management plan authorised by the District. Commercial use is governed by timber harvesting regulations under an approved management plan.

It is currently uncertain if there is a current, local quota system being implemented in the region of the HSRA or more broadly in Bolikhamxay Province. Other provinces have complex systems of permits, quotas, fees and taxes involving three Government offices: agriculture, trade and finance (Foppes and Wanneng 2007). The official tax rate in Xiengkhouang Province is about 47%, while traders can reduce this by exporting more volume. The complex quota system Xiengkhouang Province reportedly has several disadvantages including being time consuming, there is no positive effect on sustainable management and there appears to be no benefit to the national tax revenue.



Harvesting quotas for individual NTFPs will differ for different species. For example, while some species are abundant and/or good regenerators (e.g. bamboo), other species (e.g. rattans, ferns) are slow growing and removal of part of, or the whole, plant may stop the regeneration process. Thus the quota for harvesting these slow growing species would be, for example much less per harvest and a greater time interval between harvests. Quotas will also depend on the rarity and abundance of the NTFP, with rarer items being harvested less. Furthermore, if NTFPs are restocked (refer to Section 5.3) then quotas may be increased once additional stocks are established.

**Table 5-2 Level of sustainability of example plant NTFPs (adapted from Foppes and Ketphanh 1997)**

Level of Sustainability	Criteria	Example NTFPs
Currently unsustainable, immediate danger	Destructively harvested Very slow regenerators Specific habitat characteristics and habitats	Orchids, rattans, <i>Dracaena</i> , eaglewood/agarwood ( <i>Aquilaria crassna</i> )
Currently unsustainable, under threat	Destructively harvested Good regenerators Specific habitat characteristics and habitats	Ferns (e.g. <i>Drynaria quercifolia</i> ), some vines/lianas (e.g. <i>Coscinium usitatum</i> )
Stocks being depleted, but could be replenished and actively managed	Destructively harvested Average to poor regenerators (4 – 6 years) Few specific habitat requirements	All barks e.g. paper mulberry ( <i>Broussonetia papyrifera</i> ), bong ( <i>Notaphoebe umbelliflora</i> )
Over harvesting, potentially sustainable	Potentially being overharvested during poor growing years	Sugar palm fruits ( <i>Arenga saccharifera</i> ), rattan fruits, malva nuts
Unsustainable if not managed	Stock being depleted through deforestation, shifting cultivation etc.	Yang oil (from <i>Dipterocarpus alatus</i> ), damar resin
Sustainable if restocked and appropriately managed	Destructively harvested Good regenerators Grows in any habitat	Bamboo, grasses for brooms (e.g. <i>Thysanolaena maxima</i> )
Sustainable if appropriately managed	Good regenerators Low harvesting pressure	Benzoin resin (from <i>Styrax</i> genus)
Sustainable if appropriately managed	Can be cultivated, or used in agroforestry No effect of harvesting on stand	Cardamom ( <i>Amomum</i> sp.)

### 5.3 NTFP Restocking

In general, NTFPs that would benefit most from restocking are those products that are heavily in demand, harvested in a destructive manner and are slow (or unable) to regenerate naturally (Foppes and Ketphanh 1997). A USAID Mekong Climate Change program explored restocking of NTFPs in the Lower Mekong Basin (ICEM 2014). The program suggested a rehabilitation program to replant NTFPs in the short, medium and long term. This program suggested that the “framework species method” should be employed as it is designed to restore diverse forest ecosystems of degraded land. Framework species are pioneering/primary successional species that grow rapidly, establish a dense canopy, outcompeting weeds and provide resources for wildlife, particularly birds and bats (e.g. good pollinators). The steps for implementing a restocking program would be to investigate which NTFPs could be used as framework species, especially species that are of local and conservation value.

A list of potential NTFPs for restocking is given in the Appendix C Table C-2. However, restocking should only be of indigenous species and/or species that are of local provenance (i.e. seeds/propagated from the local area). Priority should also be given to species that are most commonly used. Similarly, areas where villagers frequent for NTFP collection should be restocked, particularly the newly zoned Utilisation Forests. Based on available information, a list of species that could be considered as priority species for restocking is provided in Table 5-3.

Restocking activities and species to restock (including locations) should be detailed further once NTFP inventories are undertaken (see Section 6.3).

**Table 5-3 Local provenance plant NTFP that could be used for restocking activities from seeds collection**

Scientific Name	Lao Name (English)	Uses
<i>Diplazium esculentum</i>	Mak neng	Edible NTFP, young fronds are stir-fried as a "vegetable" or used in salads
<i>Drynaria quercifolia</i>	Mak ka bok	Edible young shoot
<i>Alpinia galanga</i>	Kheua Wai Din	Edible young shoot, rhizome is a common ingredient in Thai curries and soups, sometimes used as traditional medicine
<i>Alpinia malaccensis</i>	Khua haem	An oil is obtained from dried rhizome
<i>Alstonia scholaris</i>	Tin Pet	Softwood can be used for furniture and household items, sap and bark used in traditional medicine
<i>Anisoptera costata</i>	Khoy ngoo	Timber, fragrant oily re in
<i>Aquilaria crassna</i>	Ket Sana	Grade 3 timber, a resinous heartwood, used for perfume and incense
<i>Bambusa arundinacea</i>	Ka taeng pa lua	Edible young shoot, used for furniture making
<i>Calamus javensis</i>	Het pouak	Edible young shoot, used for furniture making
<i>Calamus tenuis</i>	Khar tar daeng, hua	Edible young shoot, used for furniture making
<i>Calamus spp.</i>	Kha pa	Edible young shoot, used for furniture making
<i>Caryota mitis</i>	Man pao' khao	NTFP palm
<i>Cinnamomum iners</i>	Phak kood khao	Timber is insect resistant and used for house building and cabinet work. The bark yields an inferior grade of cinnamon but oil distilled from it and from the leaves can be used for flavouring and for incense sticks. Various part plants used for medicines, including for fevers
<i>Coscinium fenestratum</i>	Narm thaeng, kok	Edible fruit
<i>Cratoxylum formosum var. prunifolium</i>	Ka tae tai' mai'	Medicinal plant, production of charcoal, edible young leaves, if grows tall enough, timber can be harvested
<i>Dialium cochinchinense</i>	Dua pong	Grade 1 timber, sweet pulp of the fruit is edible, brown dye is obtained from the bark
<i>Dipterocarpus alatus</i>	Harnng kwarng, dork	Timber, wood is much valued in construction and cabinetwork, when not exploited for its oily resin, bark of young trees is also used in traditional medicine
<i>Dipterocarpus costatus</i>	Yang Dong	Timber Grade 2 timber, resin is used particularly for the caulking of boats, and the preparation of torches, wood used for furniture
<i>Dipterocarpus obtusifolius</i>	Ton teen hong	Grade 2 timber, red brown wood is used in general construction, resin from the tree is used to make torches, drinking water obtained by cutting young stalks
<i>Dipterocarpus turbinatus</i>		Grade 2 timber, red brown wood is used in general construction, resin from the tree is used to make torches, may be used in traditional medicine and as decorative/perfume plant
<i>Dracaena angustifolia</i>	Hed hou nou	Edible young shoots, can be used for furniture making
<i>Engelhardtia spicata</i>	Hed bot	Timber, Ripe fruit can be eaten
<i>Gigantochloa albociliata</i>	Yang mak nong	Bamboo shoots that are an important food source in the rainy season
<i>Gmelina arborea</i>	Nor mai lay	Medicinal plant, leaves, fruit, roots and bark used for medicine, timber is reasonably strong
<i>Haldina cordifolia</i>	Nor mai sord	Decorative, bark is antiseptic and febrifuge, juice of the plant is applied externally to kill worms in sores, infusion of the roots is used in the treatment of diarrhoea and dysentery
<i>Helminthostachys zeylanica</i>	Phi sua louang	Roots and leaves used in medicine and sometimes as food
<i>Irvingia malayana</i>	Het sa nun	Edible roasted seeds, non-grade timber used in furniture and household items
<i>Melientha suavis</i>	Phak Van	Edible young shoots
<i>Oxytenanthera albociliata</i>	Mai Lai	Edible shoots, furniture and farm tools
<i>Oxytenanthera parvifolia</i>	Mai Sod	Edible shoots, furniture and farm tools
<i>Pentace burmanica</i>	Sy sied	Bark used for medicine and tanning hides
<i>Pometia pinnata</i>	Mai kuang daeng/kor ka	Edible fruit, timber

Scientific Name	Lao Name (English)	Uses
<i>Schima wallichii</i>	Mai Mee	Timber used in construction and furniture, young plants, leaves and roots are used medicinally, against fevers
<i>Wallichia gracilis</i>	Hed pheung	NTFP palm
<i>Zanthoxylum rhetsa</i>	Mak Khaen	Bark, immature fruits, seeds are used as spice, edible fruits and leaves cooked, leaves used to brew a "beer", various plant parts used as medicine, moderately hard timber

## 5.4 Domesticated NTFP Production

It is understood that some local villages have begun domestication trials. Several species that have been identified in the HSRA may be domesticated or considered for use in agroforestry. Three main factors should be considered regarding which species to cultivate and domesticate:

1. Ease of establishment / growth around the house, fields or in agroforestry;
2. Nutritional or medical value to the diet (refer to Table 5-4); and
3. Economic viability.

There are many avenues to explore in regards to domestication, however past experience and local knowledge should provide the foundation. A preliminary list of potential species groups that could be considered for domestication are described below.

### **Mushrooms**

Several edible mushrooms were identified in the HSRA, including some that were identified as currently being eaten by the local villagers. The mushroom species found around the HSRA could be cultivated in plantations, forest utilisation areas or around houses by spreading the spores of adult mushrooms on logs or at the bases of trees or building, in dark and moist conditions. To cultivate for sale, more intensive techniques would need to be used such as using indoor trays.

### **Bamboo**

Select bamboo species grow quite well in domesticated circumstances, to the extent that it has become an environmental weed in some countries. Bamboo is a good source of fibre and could be grown in agricultural and settlement areas to supplement NTFP collection. It would be unlikely that bamboo would be grown as a cash or commercial crop.

### **Cardamom**

Wild cardamom (*Amomum* sp.) grows abundantly in humid, disturbed forest. Its fruits are harvested around October, and can be sold to traders or within markets. Cardamom is particularly valuable as a traditional Chinese medicine and may therefore provide an additional source of income from sale. There are a few species of cardamom growing in the HSRA area which are used as a spice for common dishes.

### **Tubers**

At least one species of yam, purple yam (*Dioscorea alata*), grows locally and is both high in carbohydrates and starch. There are several other species found in the area that could be trialled as a domestic crop. It is unlikely that these tubers would be a particularly valuable cash crop, since significant quantities would need to be grown to be economically viable. However, purple yam is a distinctive tuber and may be considered for small sales if there is a local market for them.

### **Forest Animals**

Overall, domestication of large forest animals is unlikely to be viable considering the time and effort to capture, breed and maintain sufficient domestic populations. Some species may be encouraged to breed more frequently if their diet is supplemented. For example, food left for squirrels may increase litters and

they may be more likely to stay in the vicinity of the village. However, this may also create issues regarding pest species.

A summary of the nutrient and energy potential of main forest resources is provided in the table below.

**Table 5-4 Nutrient and energy potential of main forest resources (adapted from Foppes and Ketphanh 2004)**

Groups of Species	Calories/Energy	Nutrients	
	Carbohydrates, Protein, Fats	Vitamins	Minerals
Mushrooms	Carbohydrate and protein rich	Some Vitamin A and C	
Bamboo shoots	High in fibre, some carbohydrates and protein	Few vitamins – cooking leaches vitamins	
Plant leaves and stems (some flowers)	High in fibre, low in carbohydrates	Dark leaves can provide Vitamins A and C, some with folic acid (important for pregnancy)	Less metabolised iron (than animal) but some darker leaves can supplement iron
Tubers	Rich in starch and carbohydrates		
Honey	Rich in carbohydrates, especially simple sugars	Vitamin A	
Nuts	Carbohydrate, protein and fat rich		
Fruits, berries	Carbohydrate rich, some fibre	Vitamins A and C (some species higher than others)	Calcium, magnesium and potassium
Mammals, birds	Fat and complete protein	Intestines and organs high in nutrients Vitamin B	Iron
Frogs, crustaceans, molluscs	Complete protein, some fats	Vitamin B	Iron, some calcium
Insects – adults, larvae and eggs	Protein and fat	Vitamin A, some Vitamin B	Iron (small quantities)

## 6 TOR FOR A NTFP SPECIES INVENTORY AND MANAGEMENT PLAN

This chapter provides a Terms of Reference (TOR) for the development of a detailed *NTFP Species Inventory and Management Plan* (hereafter ‘the Plan’) for the HSRA. It is expected that this Plan would be developed by a qualified consultant with experience in NTFP management and stakeholder consultation.

The background regarding the current status of NTFPs and their use in the HSRA, and management considerations, is provided in the preceding Sections 0 to 5.

### 6.1 Plan Objectives

The overall aim of the *NTFP Species Inventory and Management Plan* is to promote sustainable use of NTFP’s in the HSRA while minimising potential impacts and risks to biodiversity values. The specific objectives of the Plan are to:

1. Establish an NTFP inventory for the HSRA;
2. Outline a detailed management plan for each Zone within the HSRA;
3. Outline a plan for a NTFP quota system for use amongst villages based on a ‘sustainable yield’;
4. Outline a plan for a restocking program in areas of diminishing stocks;
5. Outline a plan for a supplementary domesticated NTFP gardens;
6. Outline a monitoring and evaluation plan for NTFPs; and
7. Identify implementing arrangement for the Plan.

### 6.2 Plan Scope and Content Overview

The contents of the *NTFP Species Inventory and Management Plan* is expected to include the following aspects/sections:

- Introduction and Background;
- Legislation and Guidelines;
- NTFP Inventory;
- Sub-plans, including:
  - » Zone Management Plans;
  - » Quota System Implementation Plan;
  - » NTFP Restocking Plan;
  - » NTFP Domestication Plan;
  - » Species Specific Plans (where required);
  - » Monitoring and Evaluation Plan;
- Budget;
- Schedule;
- Implementing Arrangements:
  - » Institutional Arrangements;
  - » Implementation;



» Summary of Targets, Actions and Responsibilities.

- Appendixes.

The requirements for each of these aspects/sections is outlined in the sections below.

The spatial scope of the plan will be determined by the species inventory work, which will determine which areas the various aspects of the plan will focus on.

## 6.3 Introduction and Background

The Introduction and Background section of the *NTFP Species Inventory and Management Plan* should cover the following:

- Background;
- Project Overview and History;
- Plan Objectives and Scope; and
- Links to Other Plans and Reports (indicating how the plan fits into the overall management system for the project).

## 6.4 Legislation and Guidelines

This section should summaries relevant legislation and guidelines including:

- Relevant national legislation (refer Section 2);
- Conventions and Treaties ratified by Lao PDR (refer Section 2); and
- International guidelines for NTFP management.

The implications of each legislative document and guideline for NTFP management within the HSRA should be outlined.

## 6.5 NTFP Inventory

In order to develop an effective management plan for NTFPs, it is necessary to first establish the presence, current use, planned use, sustainability and community and ecological importance of NTFPs in the HSRA. A detailed inventory of species available for use as NTFPs is required as part of the Plan. The inventory should also establish a baseline for the current yields of NTFPs in the HSRA.

The Inventory should be developed based on a combination of techniques to identify NTFP availability, use, status and condition, which will form the basis for the development of a sustainable approach for use and domesticated NTFP production. The methodology for the forest inventory should be consistent with the Department of Forestry's *Guidelines on Participatory Forest Inventory, Number 2155*.

Key aspects of the methodology required and inventory objectives are outlined below.

### ***Inventory Objectives***

The NTFP Inventory should aim to achieve the following objectives:

- Identify the diversity, abundance and spatial distribution of NTFP with the proposed zoned areas in the PFA and HSRA;
- Identify the uses of NTFP, dietary importance and income from sale;
- Identify the availability of NTFPs per season and the time of year for collection / harvesting;
- Identify any threats and pressures to all NTFPs; and
- Develop a shortlist of high priority NTFPs, their productivity and condition within the proposed zones.

## **Methodology**

A combination of the following approaches should be used in conjunction with DOF Guidelines:

- Literature Review;
- Walkover Assessment; and
- Stakeholder Consultation and Yield Assessment.

Each of these methods is briefly outlined below.

### *Literature Review*

A review of publically available studies and data regarding NTFPs in the region will be undertaken with the aim of identifying available information regarding the use and abundance of key NTFPs species, collection and harvesting rates, growth and propagation requirements and productivity. This will include screening for the presence of any nationally and globally threatened species.

Data collected as part of the EIA and resettlement site IEE / INRMP should also be compiled and reviewed.

### *Walkover Assessment*

Walkover surveys of each zone in the HSRA should be conducted to develop a detailed inventory of NTFPs. This will need to be undertaken by biodiversity specialists with high levels of plant identification skills, with support from local villagers with knowledge of NTFPs. Walkover transect routes will be determined for each survey area prior to the commencement of field work through analysis of satellite imagery. Surveyors will navigate in the field using a handheld GPS with transect coordinates and a map of the transect routes and habitat types. NTFPs identified should be photographed. Surveyors should also visit important sites for the collection and harvest of key NTFPs based on local knowledge of the area.

The following parameters will be recorded by surveyors:

- NTFP species (common and scientific name<sup>1</sup>) and photographic record;
- Type/habit of species (e.g. grass, herb, vine);
- Location (recorded using a handheld GPS) and habitat type;
- Number / estimated coverage (m<sup>2</sup>);
- Tree diameter at breast height (DBH) – where appropriate; and
- Life stage (e.g. juvenile or adult and either vegetative (e.g. basal rosette), flowering or senescent).

If practical, the walkover survey should be timed with the season in which the most NTFPs would be able to be identified (e.g. late wet season).

### *Stakeholder Consultation and Yield Assessment*

In combination with the proposed field work, consultation should be undertaken with villagers to ascertain the species, usage, seasonal availability and current collection, harvesting techniques and harvesting times / rates of all NTFP species identified during the walkover survey. Villagers will also support the identification of any NTFP species not detected during the walkover surveys. The discussions will be led by the biodiversity specialists with assistance from residents in identifying species. Photographs and guide books will be used as prompts to identify key species.

With support from villagers, specialists will develop a list of high demand and highly valued NTFP species (priority species) that are of importance to villagers for domestic, economic, cultural and spiritual uses. The growth and propagation requirement of these species and site of potential domestic production will be discussed. Existing threats to key NTFPs will also be ascertained. This information will be used to assess levels of sustainability and whether these species can be managed effectively for future NTFP use.

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<sup>1</sup> Accepted scientific names according to the IUCN, Inthakoun and (2008) and Species 2000 & ITIS Catalogue of Life

Specialists will complete a questionnaire for each village or village group. Interviews will be conducted with village chiefs, village heads and key villagers with knowledge of flora located within the region and the use of natural resources. Yields and seasonal availability of each priority species should be determined via the surveys. Women should be actively encouraged to attend the consultations, since they play an active role in the collection of NTFPs.

Consultation will enable surveyors to gain an understanding of market demands, potential sites of domestic production, identify any knowledge and skills gaps and ascertain equipment requirements for domesticated production.

Key organisations will also be consulted where appropriate with regards to species, growth requirements, productivity and threats to NTFPs.

### **Reporting**

A detailed technical report outlining the methods and results of the Inventory should be produced that will inform the development of the *NTFP Species Inventory and Management Plan*, and should be attached as an appendix to the Plan. The report should include a distribution map of priority species and potential sites of NTFP restocking and/or domestication. A summary of the key findings should be included in the NTFP Inventory section of the *NTFP Species Inventory and Management Plan*.

The establishment of the inventory should be followed by calculation/determination of appropriate future yields, potentially including a quota system and rules determining use. In addition, NTFPs may need to be restocked and it may be possible to domesticate certain species (refer to Sections 6.7-6.9).

## **6.6 Zone Management Sub-Plans**

Separate sub-plans should be established for each of the Forest Management Zones/Categories discussed in Section 5 of the INRMP. Notably these zones and their management are expected to be confirmed and refined through the 'participatory land use planning' (or PLUP) process to be implemented as part of the INRMP.

Permitted uses and restrictions for NTFPs, and general restrictions, should be outlined in each of the sub-plans. These should be consistent with the regulations outlined in the INRMP, and additional permitted uses and restrictions should be outlined where required.

Based on the preliminary zones outlined in the INRMP, zone management sub-plans for NTFPs will be required for the following Zones/Categories for the PFA and RDS:

- Protection Forest Area:
  - » Protection Forest Zone (including water source protection)
  - » Conservation Forest Zone
  - » Utilisation Forest
  - » Spirit or Sacred Forest/s
- Resettlement Development Site:
  - » Water Source Protection Forests (as per Protection Forest Zone)
  - » Utilisation Forest
  - » Spirit or Sacred Forest/s
  - » Plantation Forest Zone

Where appropriate, some zones can be combined (e.g. Spirit or Sacred Forest/s can be combined for RDS and PFA).

## 6.7 Quota System Sub-Plan

An important factor in the development of the *NTFP Species Inventory and Management Plan* is ensuring sustainability of NTFP harvesting. Based on the findings of the NTFP Inventory a quota system should be developed for key species that may be threatened by overharvesting, which would be outlined in the Quota System Sub-Plan. Background information on quota systems is provided in Section 5.2.

The quota system for each key species should be developed based on the steps outlined by Peters (1994) which include:

Step 1. Yield Assessment (e.g. based on data from the NTFP inventory), including assessment of:

- The average yield of the highest priority species;
- The volume of resource (e.g. seed, fruit) that natural populations produce;
- Proportion of normal harvest of total population of seed produced annually;
- Assessment of whether typical harvesting methods will decrease regeneration of the species;
- Determination of plant productivity with respect to age / size (for seed / fruit);
- Estimation of sustainable yields for high priority species.

Step 2. Establish Sustainable Harvesting Rules

- Based on the yield assessment, establish rules (e.g. percentages/numbers of resources in set areas) that can be harvested sustainably;

Step 3. Assess Potential to Restock and Rehabilitate (refer also to Section 6.8):

- Stocking requirements for high priority species (versus natural regeneration);
- Identification of additional species that may be restocked in the future.

Step 4. Monitor, Maintain and Adjust Quotas (during implementation)

- Periodic surveys and harvest assessments (similar to above);
- Assess success of natural regeneration / stocking versus harvest to determine if the quota system should be maintained or adjusted.

## 6.8 NTFP Restocking Sub-Plan

A separate sub-plan should outline a plan for restocking particular areas, with reference to the quota system sub-plan described above. The NTFP Restocking Sub-Plan should focus on vascular plants, fungi and/or ferns, but if it is deemed viable to restock terrestrial and aquatic wildlife, a sub-section will be needed on captive breeding, capture and release and other activities necessary for animal restocking.

The NTFP Restocking Sub-Plan should include:

- An assessment of species and areas to be restocked;
- Where these species will be sourced from and how they will be propagated;
- Where the species will be planted and requirements for planting (e.g. soil amendments); and
- Monitoring plan for restocking activities.

As discussed in Section 5.3, NTFPs that would benefit most from restocking are those products that are heavily in demand, harvested in a destructive manner and/or slow (or unable) to regenerate (Foppes and Ketphaph 1997).

## 6.9 NTFP Domestication Sub-Plan

Similar to restocking activities, a separate sub-plan should identify plans for domesticating NTFPs, if this is determined to be a viable option. It is envisaged that only vascular plants, fungi and ferns will be domesticated.

As part of the development of the NTFP Domestication Sub-Plan, the species selection should be carefully considered and take into account preferences of the PAPs. A few types of NTFPs that could be considered for domestication are discussed in Section 5.4.

The viability of potential species to be domesticated should also be investigated by, for example:

- Literature reviews of species' cultivation elsewhere;
- Local villagers experience with the species;
- Effort needed to domesticate (e.g. time, money); and
- Consideration of materials, conditions and locations required.

The sub-plan should include provisions for trials of domestication (e.g. experimental plots), and ongoing activities for where trials prove successful. A plan for monitoring the success of trials should also be outlined.

## 6.10 Species-Specific Sub-Plans

Species-specific management sub-plans should be developed as part of the Plan where appropriate.

The highest priority NTFPs may be best managed under separate species-specific management plans. For example, bamboo and rattans are particularly important NTFPs and have high provisional/subsistence properties, but they are also marketable objects. The species-specific plans should detail the resource (using inventories), yield assessment, sustainable harvest rules, trading plans, restocking and monitoring. These species-specific plans should be developed in consultation with relevant district authorities and PAPs.

## 6.11 Monitoring and Evaluation Plan

The *NTFP Species Inventory and Management Plan* should include a detailed plan for monitoring and evaluation of the plan implementation.

Ongoing monitoring of NTFP resources and management activities at the village level will be necessary to determine that NTFPs are being sustainably harvested and that all villagers are benefiting from the management of NTFPs.

Two principal monitoring methods that should be considered either individually or in combination are:

1. An annual yield assessment (as conducted for initial yield determination) with an adjustment of harvesting rules and any restocking where necessary, as well as periodic villager questionnaires regarding use and sustainability of their resources.
2. Periodical assessment of a sub-sample selection of key NTFPs and areas of collection. In this method, key NTFPs (e.g. rattan, bamboo) are targeted and areas are delineated as "monitoring plots" to act as a sample of the greater resource (e.g. see Boissiere et al. 2014). If harvesting has been unsustainable or there is an excess of resources, harvesting rules should be altered/adapted and restocking considered.

An evaluation plan which allows ongoing assessment of the effectiveness of the overall Plan should be outlined, with provisions for regular reviews of the Plan.

The monitoring system should provide a means for villagers to report any incidences where they believe that resources are being unsustainably harvested and/or they have detected illegal practices. This may include references to the existing grievance mechanism for the Project where appropriate.



## 6.12 Budget

A detailed budget should be developed for the implementation of the Plan, in consultation with NNP1. The budget should include capital and operating costs. Costs for stakeholder engagement activities, as well as monitoring and evaluation of the implementation of the plan should also be included.

## 6.13 Schedule

The *NTFP Species Inventory and Management Plan* should include a detailed schedule for the implementation of the targets and actions outlined in the plan, including monitoring activities and Plan review. An indicative schedule for the initial development and review of the Plan is provided below, utilising a staged approach. This schedule will need to be adapted and agreed with relevant stakeholders prior to implementation.

### **Stage 1 (prior to resettlement of PAPs from Ban Hatsaykham):**

- a. Literature review and planning;
- b. NTFP Inventory fieldwork and consultations;
- c. Data analysis and preparation of NTFP Inventory technical report;
- d. Preparation of Draft NTFP Species Inventory and Management Plan;
- e. Stakeholder consultation regarding Draft Plan;
- f. Finalisation of Plan (Revision 1) based on consultation outcomes;
- g. Implementation of Plan (Revision 1).

### **Stage 2 (post resettlement of all PAPs):**

- a. Stakeholder consultation regarding Plan (Revision 1) with PAPs from lower reservoir villages;
- b. Finalisation of Plan (Revision 2) based on consultation outcomes;
- c. Implementation of Plan (Revision 2).

Following Stage 2 is expected that regular review and update of the Plan would be conducted by the GOL and communities with support from the NNP1.

## 6.14 Implementing Arrangements

The section on implementing arrangements should include:

- Institutional Arrangements – summary of relevant stakeholder groups including NNP1, Government authorities (National, provincial and district levels) and village organisations/committees etc.
- Implementation – Step by step outline of implementation process, including consultations required.
- Summary of Targets, Actions and Responsibilities – a table summary which clearly specifies actions required to achieve management targets, schedule for each action, and specific responsibilities for implementation and monitoring.

## 6.15 Appendices

Appendices to the *NTFP Species Inventory and Management Plan* could include:

- NTFP Inventory technical report (including methods, results, maps and yield assessment);
- Detailed species lists from NTFP Inventory;
- Standard operating procedures for monitoring;
- Other key relevant reference documents.

## 6.16 References

- Boissiere, M., Bastide, F., Basuki, I., Pfund, J. and Boucard, A. (2014). Can we make participatory NTFP monitoring work? Lessons learnt from the development of a multi-stakeholder system in Northern Laos. *Biodiversity and Conservation* 23(1): 149-170.
- de Beer, JH and McDermott, MJ (1996). The economic value of non-timber forest products in Southeast Asia. Amsterdam, Netherlands Committee for IUCN
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- ISSG (2015). Global Invasive Species Database. Auckland, Invasive Species Specialist Group, IUCN.
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- Ros-Tonen, M, Dijkman, W, Lammerts van Bueren, E (1995). Commercial and sustainable extraction of non-timber forest products. Towards a policy and management-oriented research strategy. Wageningen, The Tropenbos Foundation
- van Andel, T. R. (2000). Non-timber forest products of the North-West district of Guyana. Utrecht University, Tropenbos-Guyana Series.

## Appendix C: INRMP Tables

The following tables provide further detail on: (i) permitted uses of resources and restrictions for Village Forest Management Zones; (ii) plant and fungi existing in the HSRA and their utility; and (iii) terrestrial and aquatic fauna likely to inhabit the HSRA and surrounds. This information is intended to supplement that described in INRMP sub-plans and the NTFP Management Framework (Appendix B).

**Table C-1 Summary of permitted uses and restrictions for each of the Village Forest Management Zones**

Village and Forest Management Categorisation	Permitted Uses and Restrictions	
Protection Forest Area  Protection Forest Zone (including water source protection)	No activity that could disturb vegetation and landforms is prohibited, including:	
	<ul style="list-style-type: none"> <li>• Slash and burn cultivation;</li> </ul>	
	<ul style="list-style-type: none"> <li>• Agriculture of any kind;</li> </ul>	
	<ul style="list-style-type: none"> <li>• Logging;</li> </ul>	
	<ul style="list-style-type: none"> <li>• Burning;</li> </ul>	
	<ul style="list-style-type: none"> <li>• Tree removal;</li> </ul>	
	<ul style="list-style-type: none"> <li>• Wood charcoal supply collection;</li> </ul>	
	<ul style="list-style-type: none"> <li>• Livestock rearing</li> </ul>	
	No construction activities including drilling, rock / gravel extraction, mining and collection of forest products	
	Vegetation will not be cleared, harvested, or otherwise disturbed	
	Plant parts cannot be harvested (e.g. branches)	
	Seeds and fruits cannot be collected from the following species: <i>Aquilaria crassna</i> ; <i>Anisoptera costata</i> ; <i>Cunninghamia sinensis</i> ; <i>Dalbergia bariensis</i> ; <i>Dalbergia cochinchinensis</i> ; <i>Dalbergia cultrata</i> ; <i>Dipterocarpus costatus</i> ; <i>Dipterocarpus turbinatus</i> ; <i>Fagraea fragrans</i> ; <i>Garcinia frangeoides</i> ; <i>Hopea ferrea</i> ; <i>Mesua ferrea</i> ; <i>Sindora siamensis</i> ; <i>Syzygium chloranthum</i> ; and <i>Vatica cinerea</i>	
	Seeds and fruit of non-protected species can be collected in a sustainable manner	
	Road construction is not permitted through TPZs or to within 500 m of TPZ boundaries to minimise the potential for illegal harvesting in the TPZ	
	Conservation Forest	No livestock grazing, domestic animals should be restricted from entering TPZs
		Wildlife hunting should not be allowed in TPZs
There shall be no fishing within the permanent or ephemeral streams of TPZs		
Terrestrial fauna should not be disturbed in any way (e.g. recreation, ecotourism)		
Live wildlife collection or capture will be prohibited and animals will not be removed from these areas		
Lands will not be converted to plantations or Utilisation Forest within the PFA		
Slash-and-burn agriculture is prohibited		
Logging is not permitted		
TFP, firewood and other material collection is prohibited		
Species collection is allowed in consultation with the MAF		
The local community can collect non-prohibited NTFP in a sustainable manner within the village boundary		
Harvesting of TFP fruits and seeds will be allowed		
No hunting, poaching or fishing		
Scientific research, recreation, ecotourism and species collection may be undertaken in consultation with the MAF		

Village and Forest Management Categorisation	Permitted Uses and Restrictions
	<p>Conservation significant species collection and capture should be prohibited, including Dhole (<i>Cuon alpinus</i>) Ma chok; Hairy-nosed otter (<i>Lutra sumatrana</i>) Nak; Asiatic black bear (<i>Ursus thibetanus</i>) Mee; Sunda pangolin (<i>Manis javanica</i>) Lin; Greater slow loris (<i>Nycticebus coucang</i>) Ling lom noi; Pale-capped pigeon (<i>Columba punicea</i>) Nok Khao Kheo; <i>Quasipaa fasciculispina</i> Kop; King cobra (<i>Ophiophagus hannah</i>) Ngou Chong Ang; and Brown sweetlips (<i>Platysternon megacephalum</i>) Pou Lu</p> <p>Consideration should be given to upgrading the protected status to TPZ</p> <p>Ensure delineation and location of zones are clearly defined and understood by local villagers (e.g. signs, maps)</p>
Utilisation Forest	<p>Lands will not be converted to plantations within the PFA</p> <p>Slash-and-burn agriculture is prohibited</p> <p>Logging will be restricted to selective logging</p> <p>Harvest volumes must not exceed 20% of the standing volume of trees &gt; 20 cm in diameter</p> <p>The volume of any tree species to be harvested must not exceed 20% of the total standing volume of trees &gt; 20 cm DBH for that species</p> <p>The local community can collect non-prohibited NTFP in a sustainable manner within the boundary</p> <p>Logging or harvesting of the following species will be prohibited (excluding fruits, seeds) <i>Aquilaria crassna</i>; <i>Dalbergia bariensis</i>; <i>Dalbergia cochinchinensis</i>; <i>Dipterocarpus costatus</i>; <i>Dipterocarpus turbinatus</i>; <i>Cunninghamia sinensis</i>; <i>Hopea ferrea</i>; and <i>Vatica cinerea</i>.</p> <p>Logging or harvesting of the following species should be restricted to less than 10% of the standing volume of that particular species and less than 20 cm DBH (diameter at breast height) <i>Anisoptera costata</i>; <i>Dalbergia cultrata</i>; <i>Fagraea fragrans</i>; <i>Garcinia frangeoides</i>; <i>Mesua ferrea</i>; <i>Sindora siamensis</i>; and <i>Syzygium chloranthum</i>.</p> <p>Conservation significant species collection, hunting and capture should be prohibited, including Dhole (<i>Cuon alpinus</i>) Ma chok; Hairy-nosed otter (<i>Lutra sumatrana</i>) Nak; Asiatic black bear (<i>Ursus thibetanus</i>) Mee; Sunda pangolin (<i>Manis javanica</i>) Lin; Greater slow loris (<i>Nycticebus coucang</i>) Ling lom noi; Pale-capped pigeon (<i>Columba punicea</i>) Nok Khao Kheo; <i>Quasipaa fasciculispina</i> Kop; King cobra (<i>Ophiophagus hannah</i>) Ngou Chong Ang; and Brown sweetlips (<i>Platysternon megacephalum</i>) Pou Lu</p> <p>Harvesting of other species should be minimised, monitored and managed</p>
Spirit or Sacred Forest	<p>Spirit or Sacred Forests will be managed according to traditional management regimes for spirit forests, cemetery forests, and divine forests (and additional cultural values, as apply)</p> <p>It is recommended that, if possible, these forests be as close to villages as practical to minimise disturbance on TPZs</p>
<b>Resettlement Development Site and Proposed Annex Area</b>	
Water Source Protection Forests (as per Protection Forest Zone)	<p>Riparian exclusion zones of 25 m (either side) from the bank crest of natural perennial streams, springs and the Nam Ngiep River and high water mark of wetlands</p> <p>Ephemeral streams will be similarly protected with a 10 m riparian exclusion zone (either side),</p> <p>Vegetation clearing, vegetation harvesting / removal, and additional vegetation disturbance will be prohibited</p> <p>NTFP extraction will be permitted, but will not include the harvest of entire plants (e.g. fruit and mushroom collection is not considered vegetation removal / disturbance)</p> <p>Fishing and aquatic animal collection should be restricted to permanent water streams, as many ephemeral streams form migratory and breeding grounds</p>
Utilisation Forest	<p>Harvest volumes must not exceed 20% of the standing volume of trees &gt; 20 cm in diameter</p> <p>The volume of any tree species to be harvested must not exceed 20% of the total standing volume of trees &gt; 20 cm in diameter for that species DBH</p> <p>The local community can collect NTFP in a sustainable manner within the boundary</p>

Village and Forest Management Categorisation	Permitted Uses and Restrictions
	<p>Logging or harvesting of the following species should be restricted to less than 10% of the standing volume of that particular species and &gt; 20 cm DBH <i>Aquilaria crassna</i>; <i>Anisoptera costata</i>; <i>Dalbergia cultrata</i>; <i>Dalbergia bariensis</i>; <i>Dalbergia cochinchinensis</i>; <i>Dipterocarpus costatus</i>; <i>Dipterocarpus turbinatus</i>; <i>Cunninghamia sinensis</i>; <i>Fagraea fragrans</i>; <i>Garcinia frangeoides</i>; <i>Hopea ferrea</i>; <i>Mesua ferrea</i>; <i>Sindora siamensis</i>; <i>Syzygium chloranthum</i>, and <i>Vatica cinerea</i></p> <p>Timber logging and harvesting is not permitted in regeneration forests until approved for utilisation activities</p> <p>Regeneration forest will not be converted to forest plantation or agricultural land</p> <p>Regeneration forests must be surveyed before its status if formally changed to Utilisation Forest (i.e. reaches 75 m<sup>3</sup> per hectare of trees with &gt; 20 cm DBH)</p> <p>There are no strict restrictions on hunting and collection of species. It is recommended that the same restrictions apply to conserve conservation significant species</p> <p>Conservation significant species collection, hunting and capture should be prohibited, including Dhole (<i>Cuon alpinus</i>) Ma chok; Hairy-nosed otter (<i>Lutra sumatrana</i>) Nak; Asiatic black bear (<i>Ursus thibetanus</i>) Mee; Sunda pangolin (<i>Manis javanica</i>) Lin; Greater slow loris (<i>Nycticebus coucang</i>) Ling lom noi; Pale-capped pigeon (<i>Columba punicea</i>) Nok Khao Kheo; <i>Quasipaa fasciculispina</i> Kop; King cobra (<i>Ophiophagus hannah</i>) Ngou Chong Ang; and Brown sweetlips (<i>Platysternon megacephalum</i>) Pou Lu</p> <p>Harvesting of common species should be monitored and managed, if any animals are considered to have decreased in number, collection and/or hunting should be minimised until numbers increase</p>
Spirit or Sacred Forest	As above for PFA
Plantation Forest	<p>Plantations should be located where soils are of suitable quality or can easily be amended to be of suitable quality without compromising other environmental values (e.g. water quality). For example, dolomite is an effective amendment for raising soil pH, while adding nutrient value – calcium and magnesium</p> <p>Use of agroforestry with wide row spacing will likely reduce the danger of the spread of wildfire (e.g. intercropping trees planted at 10 m row spacing with upland rice or cassava (for 1-2 years following tree planting) and shade tolerant NTFP for additional years until the end of the rotation</p> <p>Livestock grazing may be considered in plantation areas when trees reach adequate height to prohibit damage, and may be considered for fertiliser addition from manure</p> <p>Degraded forest or bare land should be suitable for silviculture</p> <p>Timber harvesting / logging is not permitted in Degraded Forests until formal conversion to Plantation Forest Zone is approved by the FMU</p> <p>If soils are not considered favourable in Degraded Forests for plantation establishment, soil amendment should be applied</p> <p>Hunting and wildlife collection should be limited to common species</p> <p>Wildlife utilisation should be in accordance Utilisation Forest management</p>



**Table C-2 Plant and fungi NTFP likely available within the HSRA, including their potential uses**

Scientific Name	English Common Name	Lao Name (English)	Potential Uses
<i>Acacia pennata</i>		Chouang hom	Legume with edible pods and shoot
<i>Acacia pluricapitata</i>			Firewood, food for animals (e.g. sheep, goats and camels), charcoal production, and as herbal medicine
<i>Achyranthes aspera</i>		Ka fay, mak	Medicinal plant
<i>Adenanthera pavonina</i>	Red lucky seed	Pheuak	Leguminous tree, food, drink, traditional medicine and timber
<i>Agaricus integer</i>			Edible mushroom
<i>Ailanthus fauveliana</i>		Mai Yom Pha	Timber, Edible fruit
<i>Alpinia galanga</i>		Kheua Wai Din	Edible young shoot, rhizome is a common ingredient in Thai curries and soups, sometimes used as traditional medicine
<i>Alpinia malaccensis</i>		Khua haem	An oil is obtained from dried rhizome
<i>Alstonia scholaris</i>	Blackboard tree	Tin Pet	Softwood can be used for furniture and household items, sap and bark used in traditional medicine
<i>Amanita princeps</i>	Head man slender caesa mushroom	Kha, phak	Mushroom used in cooking
<i>Amanita vaginata var. alba</i>		Mai ti	Mushroom used in cooking
<i>Amomum aculeatum</i>		Mark naeng	Aromatic spice/herb
<i>Amomum avoideum</i>			Aromatic spice/herb
<i>Amomum villosum var. xanthioides</i>	Black cardamom seed	Mai tie khon	Aromatic spice/herb
<i>Ancistrocladus tectorius</i>		Sar am	NTFP, leaves used as roofing material
<i>Anisoptera costata</i>		Khoy ngoo	Timber, fragrant oily resin, Grade 2 timber
<i>Antiaris toxicaria</i>	Antiaris	Khee lek	Lightweight hardwood, bark has a high concentration of tannins that are used in traditional clothes dyeing and paints, fruit is edible, used in traditional medicine
<i>Aphanamixis polystachya</i>		Ta Sua	Bark can be used for chewing
<i>Aquilaria crassna</i>	Agarwood	Ket Sana	Grade 3 timber, a resinous heartwood, used for perfume and incense
<i>Aralia armata</i>		Mor Noi kheua	Edible fruit
<i>Auricularia polytricha</i>			Edible mushroom
<i>Bambusa arundinacea</i>		Ka taeng pa lua	Edible young shoot, used for furniture making
<i>Bauhinia racemosa</i>			Medicine
<i>Blumea balsamifera</i>		May Hia	Traditional medicine, primary uses are as a diuretic and treat common cold
<i>Bombax anceps</i>		May Xang	Medicinal plant
<i>Calamus javensis</i>	Rattan	Het pouak	Edible young shoot, used for furniture making
<i>Calamus tenuis</i>	Rattan	Khar tar daeng, hua	Edible young shoot, used for furniture making
<i>Calamus spp.</i>	Rattan	Kha pa	Edible young shoot, used for furniture making
<i>Cardiospermum halicacabum</i>		Kheng', mai'	Potential medicinal properties
<i>Careya arborea</i>	Wild guava		Non-grade timber for furniture and household items
<i>Caryota mitis</i>	Clustering fishtail palm	Man pao' khao	NTFP palm
<i>Casearia grewiaefolia</i>		Koi, houa	Leaves have medicinal applications; timber for posts and beams
<i>Cassia javanica</i>	Apple blossom tree	Man lien	Medicinal and ornamental
<i>Catunaregam tomentosa</i>		Koi, houa	Non-grade timber, potential medicinal properties
<i>Centella asiatica</i>	Asiatic pennywort	Hed la ngok	Edible NTFP, leaf a traditional accompaniment to rice and curry, traditional medicine
<i>Cephalostachyum virgatum</i>	Bamboo	Het khi ka deuane	Young shoot eaten, NTFP

Scientific Name	English Common Name	Lao Name (English)	Potential Uses
<i>Chromolaena odorata</i>	Siam weed	Nga Dokdone	Medicine, highly invasive plant
<i>Chrozophora tinctoria</i>			Food dye
<i>Cinnamomum iners</i>		Phak kood khao	Timber is insect resistant and used for house building and cabinet work. The bark yields an inferior grade of cinnamon but oil distilled from it and from the leaves can be used for flavouring and for incense sticks. Various part plants used for medicines, including for fevers
<i>Coffea arabica</i>		Mai yang	Coffee, native to Ethiopia
<i>Colocasia antiquorum</i>		Sat	Edible; tubers may be used in cooking
<i>Combretum decandrum</i>		Khorn khaen	Medicinal plant
<i>Coscinium fenestratum</i>	Yellow vine	Narm thaeng, kok	Edible fruit
<i>Costus speciosus</i>		Kok Euang	Young leaves can be eaten cooked Medicinal plant
<i>Crataeva nurvala</i>		Phak Koum	Edible fruit
<i>Cratogeomys formosum</i>	Pink mempatt	Mai ti	Medicinal plant, production of charcoal, edible young leaves, if grows tall enough, timber can be harvested
<i>Cratogeomys formosum var. prunifolium</i>	Pink mempatt	Ka tae tai' mai'	Medicinal plant, production of charcoal, edible young leaves, if grows tall enough, timber can be harvested
<i>Crypteronia paniculata</i>		Ya khuay	Decorative plant Grade 3 timber, Young shoots - raw or cooked. Eaten in salads or cooked and eaten as a vegetable, bark is used to treat blisters, yellowish-red timber is hard and durable. It is used for furniture, cart wheels and casing, wood is used for fuel
<i>Cyclea barbata</i>		Khua Mo Noi	Leaves edible and used in medicine (small herbaceous species)
<i>Daemonorops jenkinsiana</i>		Bar, kheua	Climbing rattan - furniture, resin, cane is mainly used for making rough baskets, chair frames, leaves are used for thatching, also for food (the young shoots are edible)
<i>Daemonorops schmidtii</i>			Rattan - furniture, resin, cane is mainly used for making rough baskets, chair frames, leaves are used for thatching
<i>Dendrocalamus longispathus</i>	Bamboo	Tong moom	Temporary housing material, material for fencing, and to make looms for weaving
<i>Dendrocalamus membranaceus</i>	Bamboo	Hai som	Temporary housing material, material for fencing, and to make looms for weaving
<i>Dialium cochinchinense</i>	Velvet tamarind	Dua pong	Grade 1 timber, sweet pulp of the fruit is edible, brown dye is obtained from the bark
<i>Dioscorea alata</i>	Purple yam	Mong, mak	Yam used in a variety of desserts, traditional medicine
<i>Dioscorea hispida</i>		May Lay	Medicinal herb
<i>Dioscorea pentaphylla</i>	Fiveleaf yam	So	Tubers of the vine can be cooked and eaten
<i>Dioscorea triphylla</i>	Fiveleaf yam	Khao	Tubers of the vine can be cooked and eaten
<i>Diospyros sp.</i>		Mai nang dam	Medicinal plant
<i>Diplazium esculentum</i>	Fern	Mak neng	Edible NTFP, young fronds are stir-fried as a "vegetable" or used in salads
<i>Dipterocarpus alatus</i>		Hamg kwang, dork	Timber, wood is much valued in construction and cabinetwork, when not exploited for its oily resin, bark of young trees is also used in traditional medicine
<i>Dipterocarpus costatus</i>		Yang Dong	Timber Grade 2 timber, resin is used particularly for the caulking of boats, and the preparation of torches, wood used for furniture
<i>Dipterocarpus obtusifolius</i>		Ton teen hong	Grade 2 timber, red brown wood is used in general construction, resin from the tree is used to make torches, drinking water obtained by cutting young stalks

Scientific Name	English Common Name	Lao Name (English)	Potential Uses
<i>Dipterocarpus turbinatus</i>			Grade 2 timber, red brown wood is used in general construction, resin from the tree is used to make torches, may be used in traditional medicine and as decorative/perfume plant
<i>Dracaena angustifolia</i>		Hed hou nou	Edible young shoots, can be used for furniture making
<i>Drynaria quercifolia</i>	Oakleaf fern	Mak ka bok	Edible young shoot
<i>Duabanga grandiflora</i>		Nam, phak	Ripen fruit can be eaten
<i>Eleusine indica</i>	Eleusin grass	Mai bark	Tuber can be eaten cooked; Medicinal plant
<i>Engelhardtia spicata</i>		Hed bot	Timber, Ripe fruit can be eaten
<i>Entada phaseoloides</i>	Matchbox bean	Hed khao	Fruit, seeds, may be used in traditional medicine
<i>Epipremnum giganteum</i>		Khan chong, phak	Edible young shoot, most parts may be toxic
<i>Erechtites valerianifolia</i>	Brazilian fireweed	La Mang	NTFP, native to southern and central America
<i>Ficus altissima</i>	Council tree	Khee thao	Timber, Edible seed
<i>Ficus hispida</i>		Van pa, phak	Ripe fruit can be eaten
<i>Garcinia oliveri</i>		Tam nyae, kheua mark	Edible tuber, fruit and young leaves, medicinal plant
<i>Glochidion eriocarpum</i>		Ton khee mod	Medicinal plant, all parts or roots and leaves are used as medicine for urticarial, mastitis, toothache, menorrhagia, dysentery, skin eczema, enteritis, etc.
<i>Glochidion sphaerogynum</i>		Khee Mod Ngai	Branches and leaves are used as medicine for the treatment of influenza, eczema, etc. Bark and wood are dried, chopped into pieces, heated, then applied as skin paints over affected spots
<i>Gigantochloa albociliata</i>		Yang mak nong	Bamboo shoots that are an important food source in the rainy season
<i>Gmelina arborea</i>	Beechwood	Nor mai lay	Medicinal plant, leaves, fruit, roots and bark used for medicine, timber is reasonably strong
<i>Haldina cordifolia</i>		Nor mai sord	Decorative, bark is antiseptic and febrifuge, juice of the plant is applied externally to kill worms in sores, infusion of the roots is used in the treatment of diarrhoea and dysentery
<i>Helminthostachys zeylanica</i>	Kamraj fern	Phi sua louang	Roots and leaves used in medicine and sometimes as food
<i>Hirneola polytricha</i>	Cloud ear fungus	Tarng	Food and potentially traditional medicine
<i>Irvingia malayana</i>	Irvingia	Het sa nun	Edible roasted seeds, non-grade timber used in furniture and household items
<i>Lasia spinosa</i>		Phak bouang	Edible, young leaves are used as a vegetable. The rhizomes are used medicinally (aquatic plant)
<i>Lentinus kurzianus</i>			Edible mushroom
<i>Lentinus polychrous</i>	Mushroom lentinus	Phai pa	Edible mushroom
<i>Lentinus praerigidus</i>			Edible mushroom
<i>Lentinus squarrosulus</i>	White rot fungus	Sar lao	Edible mushroom
<i>Limnocharis flava</i>		Phak kam jong	Edible, central flower stalk and the leaves are used in soups, curries, salads and stir-fries
<i>Mallotus paniculatus</i>		Tong Tau	Timber, wood is used for paper pulp, wallboard, light construction, and as firewood, may be used in traditional medicine
<i>Mangifera indica</i>	Mango	Mak Mouang	Edible fruit, timber may be used when tree no longer fruit bearing for furniture, may have medicinal properties
<i>Marsilea crenata</i>		Phak Vaen	Edible leaves (cooked or raw), aquatic herb
<i>Melientha suavis</i>		Phak Van	Edible young shoots

Scientific Name	English Common Name	Lao Name (English)	Potential Uses
<i>Mucuna pruriens</i>	Velvet bean	Ya paed/Kheua nam nae	Fallow crop fixe nitrogen and fertili e oil, traditional medicine
<i>Oxytenanthera albociliata</i>	Bamboo	Mai Lai	Edible shoots, furniture and farm tools
<i>Oxytenanthera parvifolia</i>	Bamboo	Mai Sod	Edible shoots, furniture and farm tools
<i>Passiflora foetida</i>	Bush passion fruit	Nod Sa	Edible fruit, young leaves edible, leaves used for medicine
<i>Pentace burmanica</i>		Sy sied	Bark used for medicine and tanning hides
<i>Phyllanthus emblica</i>		Mak Khampom	Non-grade timber for furniture, medicinal plant, edible fruit
<i>Pometia pinnata</i>	Island lychee	Mai kuang daeng/kor ka	Edible fruit, timber
<i>Rhapis micrantha</i>	Rhapis	San	Leaves used for handcrafts, ornamental
<i>Ricinus communis</i>			Seed used to create castor oil
<i>Saccharum arundinaceum</i>	Hardy sugar cane	Kon khee thang	Roots and stems used in medicine, youngest leaves are eaten as vegetable and in salads, leaf blades, and also the flowering stems, are used for thatching, paper, baskets. Strong stems used for construction (like bamboo)
<i>Schima wallichii</i>		Mai Mee	Timber used in construction and furniture, young plants, leaves and roots are used medicinally, against fevers
<i>Schizophyllum commune</i>	Mushroom bee	Hed bee	Edible mushroom
<i>Scoparia dulcis</i>	Goatweed	Khon khee thung	Medicinal plant
<i>Senna hirsuta</i>			Leaves may have medicinal properties, may be used as green mulch
<i>Senna occidentalis</i>			Seeds can be roasted as a substitute to coffee, but plant may be poisonous to cattle
<i>Senna tora</i>			Herb can be used as a treatment for swelling
<i>Smilax sp.</i>		Man pouk	Edible roots and shoots, medicine NTFP
<i>Spondias pinnata</i>	Wild mango	Mak kok	Ripe, unripe and bark used in traditional medicine for e.g. astringent, diarrhoea, vomiting
<i>Streblus asper</i>	Siamese rough bush		Non-grade timber, fibres used in paper making, leaves used for sandpaper, medicinal plant
<i>Syzygium cumini</i>		Mai Hah	Timber used in construction and furniture, edible fruit, fruit also used to produce wine and vinegar, seeds used in medicine
<i>Syzygium zeylanicum</i>		Sa Mek	Sweet aromatic edible fruit
<i>Terminalia elliptica</i>			Timber for furniture, medicinal, tapped for water
<i>Termitomyces robustus</i>	Mushroom termitomyces		Edible mushroom
<i>Termitomyces spp.</i>			Edible mushroom
<i>Tetracera indica</i>		San kheua	Medicinal plant (roots and leaves)
<i>Thysanolaena maxima</i>	Tiger grass	Khem	Flowers used as a broom
<i>Tiliacora triandra</i>		Ya nang	A juice (or extract) made from the leaves is used to make a broth, thickening agent for soup
<i>Tinospora crispa</i>		Kheua khao hor	Medicinal plant
<i>Volvariella esculenta</i>		Hed fueang	Edible mushroom
<i>Wallichia gracilis</i>		Hed pheung	NTFP palm
<i>Xerocomellus chrysenteron</i>	Mushroom		Edible mushroom
<i>Zanthoxylum rhetsa</i>	Zanthoxylum	Mak Khaen	Bark, immature fruits, seeds are used as spice, edible fruits and leaves cooked, leaves used to brew a "beer", various plant parts used as medicine, moderately hard timber
<i>Ziziphus attopensis</i>		Mak khaen	Medicinal plant

**Table C-3 Fauna likely to inhabit the HSRA and surrounds**

Common English Name	Scientific Name	Lao Name	IUCN Red List Status	Lao PDR Status
<b>Amphibians</b>				
Asian common toad	<i>Duttaphrynus melanostictus</i>	Khan Khak	LC	
Asian grass frog	<i>Fejervarya limnocharis</i>	Khiat Noi	LC	
	<i>Quasipaa fasciculispina</i>	Kop	VU	
	<i>Leptotalax sp.</i>	Kapad	N/A	
Burmese squat frog	<i>Calluella guttulata</i>	Eung	LC	
Spotted narrow-mouthed frog	<i>Kalophrynus interlineatus</i>	Sa ae	LC	
Beautiful pygmy frog	<i>Microhyla pulchra</i>	To sa ae	LC	
Sapgreen stream frog	<i>Hylarana nigrovittata</i>	Khiat Ta Ot	LC	
Chloronate huia frog	<i>Odorrana chloronota</i>	Khiat takheo	LC	
Green cascade frog	<i>Odorrana livida</i>	Khia Lang Kheo	DD	
Common tree frog	<i>Polypedates leucomystax</i>	Kapad	LC	
<b>Birds</b>				
Changeable hawk-eagle	<i>Nisaetus cirrhatus</i>	Leo moum	LC	
Common kingfisher	<i>Alcedo atthis</i>	Nok Ten Seo	LC	
Blyth's kingfisher	<i>Alcedo hercules</i>	Nok Ten	NT	PARL
Banded kingfisher	<i>Lacedo pulchella</i>	Nok ten	LC	
Crested kingfisher	<i>Megaceryle lugubris</i>	Nok ten	LC	
Stork-billed kingfisher	<i>Pelargopsis capensis</i>	Nok ten sio	LC	
Little swift	<i>Apus affinis</i>	Nok Aen Ban	LC	
Silver-backed needletail	<i>Hirundapus cochinchinensis</i>	Nok aen yai	LC	
Striated heron	<i>Butorides striata</i>	Nok Chao	LC	
Little egret	<i>Egretta garzetta</i>	Nok gngang khao	LC	
Oriental pied hornbill	<i>Anthracoceros albirostris</i>	Nok Keng	LC	
Emerald dove	<i>Chalcophaps indica</i>	Nok pau kheo	LC	
Pale-capped pigeon	<i>Columba punicea</i>	Nok Khao Kheo	VU	LKL
Green imperial-pigeon	<i>Ducula aenea</i>	Nok Mum	LC	ARL
Eastern spotted dove	<i>Spilopelia chinensis</i>	Nok Khao Tou	LC	
Oriental turtle dove	<i>Streptopelia orientalis</i>	Nok khau tou	LC	
Large-billed crow	<i>Corvus macrorhynchos</i>	Ka	LC	
Greater coucal	<i>Centropus sinensis</i>	Nok kod	LC	
Green-billed malkoha	<i>Phaenicophaeus tristis</i>	Nok son hok	LC	
Greater racket-tailed drongo	<i>Dicrurus paradiseus</i>	Nok seo hang gnao	LC	
Lesser racket-tailed drongo	<i>Dicrurus remifer</i>	Nok Seo Sy Dam	LC	
White-rumped munia	<i>Lonchura striata</i>	Nok pid	LC	
Wire-tailed swallow	<i>Hirundo smithii</i>	Nok aen	LC	PARL
Pied wagtail and white wagtail	<i>Motacilla alba</i>	Non Ka Daep Dau	LC	
Slender-billed oriole	<i>Oriolus tenuirostris</i>	Nok Khee Min	LC	
Scaly-breasted partridge	<i>Arborophila chloropus</i>	Nok Kho	LC	
Japanese quail	<i>Coturnix japonica</i>	Nok khoum	NT	LKL
Red junglefowl	<i>Gallus gallus</i>	Kai pah	LC	
Siamese fireback	<i>Lophura diardi</i>	Kai khoua nin	LC	PARL
Silver pheasant	<i>Lophura nycthemera</i>	Kai Koua louang	LC	
Rufous woodpecker	<i>Cealeus brachyurus</i>	Nok sai	LC	
Common flameback	<i>Dinopium javanense</i>	Nok hon khouane	LC	
Lesser yellownape	<i>Picus chlorolophus</i>	Nok sai	LC	
Black-headed woodpecker	<i>Picus erythropygius</i>	Nok Sai Sy Dam	LC	
Red-collared woodpecker	<i>Picus rabieri</i>	Nok Sai Sy Daeng	NT	



Common English Name	Scientific Name	Lao Name	IUCN Red List Status	Lao PDR Status
Vernal hanging-parrot	<i>Loriculus vernalis</i>	Nok kee	LC	
Sooty-headed bulbul	<i>Pycnonotus aurigaster</i>	Nok khuak	LC	
Black-crested bulbul	<i>Pycnonotus melanicterus</i>	Nok Kouak	LC	
White-breasted waterhen	<i>Amaurornis phoenicurus</i>	Nok vuk	LC	
Ruddy-breasted crake	<i>Porzana fusca</i>	Nok Kaina	LC	
Green-eared barbet	<i>Megalaima faistricta</i>	Nok Khone Dok	LC	
Golden-throated barbet	<i>Megalaima franklinii</i>	Khon dok Noi	N/A	
Common snipe	<i>Gallinago gallinago</i>	Nok Khee Kadeuan	LC	
Common myna	<i>Acridotheres tristis</i>	Nok ieng mon	LC	
Mountain tailorbird	<i>Orthotomus cuculatus</i>	Nok Ka Chip	LC	
Common tailorbird	<i>Orthotomus sutorius</i>	Nok ka chip	LC	
Blue whistling-thrush	<i>Myophonus caeruleus</i>	Nok ka in	LC	
<b>Mammals</b>				
Dhole	<i>Cuon alpinus</i>	Ma chok	EN	ARL
Crab-eating macaque	<i>Macaca fascicularis</i>	Ling mou	LC	
Indian muntjac	<i>Muntiacus muntjak</i>	Fan	LC	
Sambar deer	<i>Rusa unicolor</i>	Kouang	VU	PARL
Leopard cat	<i>Prionailurus bengalensis</i>	Hua nok/Sua pa	LC	
Asiatic brush-tailed porcupine	<i>Atherurus macrourus</i>	Horn	LC	
Malayan porcupine	<i>Hystrix brachyura</i>	Men	LC	
Greater slow sloth	<i>Nycticebus coucang</i>	Ling lom Noi	VU	LKL
Sunda pangolin	<i>Manis javanica</i>	Lin	EN	ARL
Greater bandicoot rat	<i>Bandicota indica</i>	Nou phouk	LC	
House mouse*	<i>Mus musculus</i>	Nou wai	LC	
Gairdner's shrewmouse	<i>Mus pahari</i>	Nou wai deng	LC	
Sladen rat	<i>Rattus karatensis</i>	Nou thong khao/Nou hai	N/A	
Hairy-nosed otter	<i>Lutra sumatrana</i>	Nak	EN	CARL
Great woolly horseshoe bat	<i>Rhinolophus luctus</i>	Chia na saek/Chia sam va	LC	
Big-eared horseshoe bat	<i>Rhinolophus macrotis</i>	Chia bee	LC	
Pallas's squirrel	<i>Callosciurus erythraeus</i>	Ka hok daeng	LC	
Irrawaddy squirrel	<i>Callosciurus pygerythrus</i>	Ka len	LC	
Squirrel	<i>Callosciurus sp.</i>	Ka hok dik	N/A	
Black giant squirrel	<i>Ratufa bicolor</i>	Bang Lua	NT	PARL
Hoary bamboo rat	<i>Rhizomys pruinosus</i>	Onh	LC	
Common wild pig*	<i>Sus scrofa</i>	Mou pah	LC	LKL
Javan chevrotain mousedeer	<i>Tragulus javanicus</i>	Fan kai	DD	
Common treeshrew	<i>Tupaia glis</i>	Ka nai	LC	
Asiatic black bear	<i>Ursus thibetanus</i>	Mee	VU	ARL
Masked palm civet	<i>Paguma larvata</i>	Ngen hang kho	LC	
Common palm civet	<i>Paradoxurus hermaphroditus</i>	Ngen om	LC	
Large Indian civet	<i>Viverra zibetha</i>	Ngen hang kan	NT	
<b>Reptiles</b>				
Emma Gray's forest lizard	<i>Calotes emma</i>	Ka pom	N/A	
Chinese water dragon	<i>Physignathus cocincinus</i>	Ka tang	N/A	
Lizard	<i>Pseudocalotes poilani</i>	Ka pom	N/A	
Zamenis	<i>Zamenis sp.</i>	Ngou sing	N/A	
Radiated ratsnake	<i>Elaphe radiata</i>	Ngou sa	N/A	
Monocled cobra	<i>Naja kaouthia</i>	Ngou Hau	LC	PARL
Cobra species	<i>Naja sp.</i>	Ngou hau	N/A	
King cobra	<i>Ophiophagus hannah</i>	Ngou chong ang	VU	PARL

Common English Name	Scientific Name	Lao Name	IUCN Red List Status	Lao PDR Status
Today gecko	<i>Gekko gecko</i>	Kap Kae	N/A	
Common house gecko	<i>Hemidictylus frenatus</i>	Chee kiem	LC	
Asian leaf turtle	<i>Cyclemys dentata</i>	Tau nbai mai	LR/NT	PARL
Red-necked keelback	<i>Rhabdophis subminiatus</i>	Ngou Dang Hae	LC	
Diamond-backed water snake	<i>Sinonatrix aequifasciata</i>	Ngou pah	LC	
Brown sweetlips	<i>Platysternon megacephalum</i>	Pou Lu	EN	
Asiatic reticulated python	<i>Python reticulatus</i>	Ngou leum	N/A	PARL
African bull frog*	<i>Pyxicephalus adspersus</i>	Kop	LC	
Reeves' smooth skink	<i>Scincella reevesii</i>	Chikor	N/A	
Spotted forest skink	<i>Sphenomorphus maculatus</i>	Chee Koh	N/A	
Southeast Asian softshell turtle	<i>Amyda cartilaginea</i>		VU	PARL
Chinese softshell turtle*	<i>Pelodiscus sinensis</i>	Pa pha	VU	
Bengal monitor lizard	<i>Varanus bengalensis</i>	Laen	LC	
Common water monitor	<i>Varanus salvator</i>	Hia	LC	PARL
Malayan pit viper	<i>Calloselasma rhodostoma</i>	Nou ka ba	LC	
White-lipped pitviper	<i>Cryptelytrops albolabris</i>	Ngou kheo	LC	

Key: \*Non-indigenous or non-native species; EN – Endangered; VU – Vulnerable; LC – Least Concern; NT – Near Threatened; LR – Lower Risk; N/A – Not Assessed; LKL – Little Known in Lao PDR; PARL – Potentially At Risk in Lao PDR

## APPENDIX D. LAO PDR LEGISLATION APPLICABLE TO THE INRMP SUB-PLANS

The following table summarises the applicable statutory requirements and guidelines for the INRMP and its sub-plans and briefly describes how they apply.

**Table D-1 Relevant Lao PDR Laws for Development and Management of the HSRA Settlement**

Lao PDR Law	Year	Description
<b>Settlement Area Management</b>		
Law on Urban Plan	1999	Stipulate the management, land use, construction and building of structures at national and local levels aiming at urban development meet the direction of the national socio-economic development plan, ensuring all social activities in the city maintain order safety, discipline, and hygiene and preserving cultural heritage, and ultimately protecting the environment and natural scenery.
Law on Local Administration	2003	<p>The law defines functions and outlines operational procedures of local administration to ensure the effective implementation of the Constitution, laws, socio-economic development plans, and protect the legitimate rights and benefits of the State and the people:</p> <ul style="list-style-type: none"> <li>• The government delegates responsibility to the local administration authorities to manage the territory, natural resources and population;</li> <li>• The roles and responsibilities of a village administration are to implement and manage the socio-economic development plans at the village level, to protect and maintain security and public order, and to protect and preserve natural resources and the environment within the village;</li> <li>• The formation, abolition, division, combination or definition of the land area of a village is approved by the district governor or municipal mayor;</li> <li>• A village in the low-lying areas should have a population of at least fine hundred;</li> <li>• A village in the mountainous or remote areas should have a population of at least two hundred; and</li> <li>• Socio-economic development conditions must be sustainable.</li> </ul>
Law on Environmental Protection	2013	<p>Outlines regulations and measures for environmental management, monitoring, control, preservation and rehabilitation aiming to balance between social and natural environment in a sustainable manner:</p> <ul style="list-style-type: none"> <li>• Persons, legal entities, and organizations shall be able to use natural resources in accordance with relevance laws – using natural resources with economical, rational, effective and sustainable ways;</li> <li>• Investment projects or activities that create environmental and social impacts shall correct, improve, rehabilitate and remunerate damages within affected areas;</li> <li>• Disposal of general wastes, particularly rubbish, shall be separated for different purposes such as recycle, reuse, reprocess as new products and elimination with methods and techniques within identified areas based on regulations;</li> <li>• Landfills for districts, villages, households, health facilities, educational institutes, government offices, factories and others shall be determined by the sectors and by collaborating with the natural resources and environment sector.</li> </ul>
<b>Agriculture</b>		
Agricultural Development Strategy 2011-2020	2010	<ul style="list-style-type: none"> <li>• The stated GOL vision of this Strategy is the development of agriculture, forestry, natural resources and rural areas based on long term, sustainable economic, social and ecological development. The development goals include:</li> <li>• Introduction and increased application of modernised lowland market-oriented agricultural production, adapted to climate change;</li> </ul>

Lao PDR Law	Year	Description
		<ul style="list-style-type: none"> <li>• Conservation of upland agro-systems, ensuring food security and improving the livelihoods of rural communities;</li> <li>• Stabilizing (minimising) reliance on shifting cultivation to preserve biodiversity, leading to significant quantitative and qualitative improvements of forest cover.</li> </ul>
Law on Agriculture	1998	<ul style="list-style-type: none"> <li>• Identifies the principles, rules, and measures regarding agricultural production and aims to encourage promote, and expand agricultural production to guarantee food supply and commodity production (amongst additional unrelated aims). Provides villagers with ownership of agricultural areas and products provided approval from MAP. Key elements include:</li> <li>• Individuals and organisations must first receive approval from the agriculture and forestry sector before undertaking agricultural activities;</li> <li>• Agricultural producers must use appropriate methods and measures to protect the land, water, forests, air and 'others';</li> <li>• Those who undertake agricultural activities have the right to legal protection; ownership of assets and products of their activities; and may transfer title;</li> <li>• Those who undertake agricultural activities have the responsibility of following Lao laws and regulations, avoiding damage to other production or the natural environmental; reporting animal epidemics; meeting tax and duty obligations; reporting results of agricultural activities in accordance with contracts; and cooperating with administrative and inspection officials;</li> <li>• The conversion of one type of agricultural land into another type must first be approved by the agriculture and forestry sector;</li> <li>• Individuals and organisations must attempt to improve the land to make it fertile, usable for long periods of time, and productive;</li> <li>• The use of irrigation in agricultural production must comply with the Law On Water and Water Resources;</li> <li>• For medium-scale irrigation (100 - 500 ha production area), the State and the people will jointly invest in building such irrigation and then transfer the ownership to the people for their own management and use;</li> <li>• The import or export of plant and animal species must be approved by the agriculture and forestry sector.</li> </ul>
Law on Irrigation	2012	<ul style="list-style-type: none"> <li>• Defines basic principles, regulations and measures on management, monitoring, and inspection of irrigation activities to ensure quality, effectiveness of all irrigation systems construction and operations based on their purposes.</li> </ul>
Regulation and Control of Pesticides (MAF/2860)	2010	<ul style="list-style-type: none"> <li>• Only register pesticides (through MAF) may be used.</li> </ul>
Commercial Tree Planting and Environmental Protection	2003	<ul style="list-style-type: none"> <li>• Practices and guidelines to mobilise the general public to engage in commercial tree planting and environmental protection activities with the stated goal of increasing plantations throughout the country.</li> </ul>
Management of Plantation and Plant Forest (MAF/234)	1995	<ul style="list-style-type: none"> <li>• Provides authorisation for individuals, organisations and businesses to plant trees on their land provided there are supporting legal documents certified by village and district authorities – while avoiding land prioritised for agricultural production / animal husbandry.</li> </ul>
Registration of Tree Planting Parcels (MAF1849)	1999	<ul style="list-style-type: none"> <li>• Stipulates requirements of tree planting parcels that are eligible for registration, including stocking requirements and documentation required (certificate of land ownership, land tax declaration, letter of application, certificate of residence for owner).</li> </ul>
Notification of Registration of	2010	<ul style="list-style-type: none"> <li>• Identifies certification requirements (approvals) for commercial tree planting operations, relevant for village authorities, District MAF, Provincial and Central MAF.</li> </ul>

Lao PDR Law	Year	Description
Plantations (MCAF/1374)		
Law on Forestry	2007	<ul style="list-style-type: none"> <li>Describes the land types and processes required for agricultural production and plantation establishment with respect to forest removal.</li> </ul>
Land and Forest Allocation for Management and Use (MAF/0822)		<ul style="list-style-type: none"> <li>Provides instructions and procedures to implement land and forest allocation to families, villages, departments and units to ensure the effective and sustainable use and management of natural resources:</li> <li>Reduction and stabilization of shifting cultivation by orienting towards lowland cultivation;</li> <li>Defines land types to be distributed within a village;</li> <li>Allocation of land and forest shall be linked to forest and environmental preservation, including land fertility and water resource protection;</li> <li>Defines eligibility of families and individuals to be entitled for land-forest allocation.</li> </ul>
<b>Forest Management</b>		
Constitution	Revised 2003	<ul style="list-style-type: none"> <li>The State protects the rights of ownership and ensures the right to use, transfer and inherit land owned by the national community</li> <li>All organizations and citizens must protect the environment and natural resources – land, water, forests, fauna and atmosphere</li> </ul>
Forestry Law	2007	<ul style="list-style-type: none"> <li>Governs the management, preservation, development, and utilisation of forest resources and forest land;</li> <li>Governs the activities that may be conducted in Protected Forests,</li> </ul>
Forestry Strategy 2020	2005	<ul style="list-style-type: none"> <li>Official document to guide the sustainable development and management of the forestry sector in line with national policies, strategies and priority programs for national socio-economic development and environmental conservation.</li> </ul>
PM Order 10 Management of Forests and Forestry Operations		<ul style="list-style-type: none"> <li>Wood and forestry produce processing into export oriented finished and semi-finished products shall be strongly promoted (except in special cases approved by the government).</li> <li>All types of rattan and sandalwood parts shall be processed into finished or semi-finished products before an export permit is issued.</li> </ul>
PM Order 15 Management of Forest and Forestry Business		<ul style="list-style-type: none"> <li>It is prohibited to collect non-seasonal resources (i.e. rattan, eaglewood, bamboo, resin, roots, vines, etc.) in closed season set by Province (31 May to 31 October).</li> <li>During closed season, forestry officials shall monitor collection</li> <li>Forestry officials shall organize an evaluation workshop to include program review (strong and weak points), lessons learned and review income from royalties and fees collected from timber use...</li> </ul>
PM Decree 169 on the Management and Use of Forests and Forest Land	1993	<ul style="list-style-type: none"> <li>Governs the management, use and conservation of all forests and forest land, and all activities pertaining to all types of forests and forest products;</li> <li>Aims to preserve forests, forest land, the environment, water sources and wildlife in view of meeting the requirements in national economic and socio-economic development and sustainable use of forests;</li> </ul> <p>There are sanctions within this decree for:</p> <ul style="list-style-type: none"> <li>Burning or destroying forests</li> <li>Felling or destroying protected tree species</li> <li>Killing or destroying protected animal species</li> <li>Exploiting, gathering or use of wood or forest produces in excess of the authorization</li> </ul>
MAF Regulation 221 Management and Use of Timber and Forest Products	2010	<ul style="list-style-type: none"> <li>To ensure that harvest of timber and forest products will be able to constantly supply the raw materials to the processing factory with satisfactory quality and appropriate techniques, support sustainable socioeconomic development, protect the environment, preserve forest regeneration and resources on a sustainable basis</li> </ul>



Lao PDR Law	Year	Description
		<ul style="list-style-type: none"> <li>• Forest Products are Non-Timber Forest Products (NTFPs) that are available in the natural forest. These are stem, climber, root, fruit, flower, leaf, shoot, bark of trees, seed, oil, resin, gum, mushroom, honey, etc.</li> <li>• Non seasonal Forest Product are NTFP that can be collected in any season such as: rattan, bamboo, dipterocarp resin, pine resin, bark, climber, root, etc.</li> <li>• Seasonal Forest Products are NTFPs that can only be collected during specific seasons such as: flowers, fruits, bamboo shoot, mushroom, etc.</li> </ul>
MAF Instruction 0822 on Land and Forest Allocation for Management and Use	1996	<ul style="list-style-type: none"> <li>• Managing and using natural resources in general and the land, forest and watershed resources in effective and sustainable manners and ensuring the protection of the environment and natural resources;</li> <li>• Reducing and progressing toward total termination of shifting cultivation by developing alternative agricultural-forestry systems that uplift livelihoods of those that practice shifting cultivation;</li> <li>• Promoting higher production of food; and</li> <li>• Promoting investment in commodity production thus generating additional income for households.</li> </ul>
MAF Decision 0054 on Customary Rights and the Use of Forest Resources	1996	<ul style="list-style-type: none"> <li>• Details the customary use rights of the Lao multi-ethnic people regarding the use of the forests, forestland and forest products</li> </ul>
PM Decree 333 on Protection Forests	2010	<ul style="list-style-type: none"> <li>• Defines the principles, procedures and management measures regarding the protection, conservation, development and sustainable use of the Protection Forest and Protection Forestry lands</li> <li>• Protection forests are divided into two categories: the absolutely/total prohibited zone and the utilisation zone;</li> </ul>
MOF Order 111 Funds from Harvest of Timber, NTFPs		<ul style="list-style-type: none"> <li>• Ensuring...utilization of funds generated by the collection of the duty from the harvest of...resources in order to ensure the effective replanting of...resources...</li> <li>• Scope of works eligible for the utilization of the compensation funds</li> </ul>
<b>Water Use and Aquatic Habitat</b>		
Water and water resources Law	1996	<ul style="list-style-type: none"> <li>• Governs the administration, exploitation, use and development of water and water resources</li> <li>• Aims to preserve the sustainability of water and water resources to ensure volume and quality necessary for the people's living requirements.</li> </ul>
Forestry Law	1997	<ul style="list-style-type: none"> <li>• Governs the sustainable management, preservation, development and utilization of forest resources ensuring a sustainable condition and protection of the environment, water resources from soil erosion and protecting aquatic life.</li> <li>• Prohibits hunting wildlife and aquatic animals of the species listed in Categories I and II during the spawning season (from 1st May to 31st October)</li> </ul>
Law on agriculture	1998	<ul style="list-style-type: none"> <li>• Fishery should ensure the protection and expansion of aquatic animals.</li> <li>• It is prohibit to use fishing equipment that are destructive.</li> <li>• When breeding aquatic animals, care should be taken to avoid putrid water endangering the environment.</li> </ul>
Decree to implement water and water resources Law	2001	<ul style="list-style-type: none"> <li>• All Lao people should protect and manage water and water resources in a sustainable way.</li> <li>• Ensures efficient development of use, conformity with the socio-economic development planning, increase in production, improvement of livelihood and sustainable use of water resources.</li> </ul>
Constitution of Lao PDR	2003	<ul style="list-style-type: none"> <li>• All legal entities and citizens have to protect the environment and natural resources, including land surfaces, animals and water resources.</li> </ul>
Land law	2003	<p>The use of water area land shall comply with the following conditions:</p> <ul style="list-style-type: none"> <li>• Not cause erosion;</li> </ul>

Lao PDR Law	Year	Description
		<ul style="list-style-type: none"> <li>• Not cause obstruction to waterways;</li> <li>• Not cause water levels to recede or to flood;</li> <li>• Not pollute or poison bodies of water;</li> <li>• Not cut trees or destroy the forest in water catchment areas;</li> <li>• Not dig or take away soil from swamps and wetland, except in case of necessity with prior authorisation from the concerned organisation.</li> </ul>
Fisheries Law	2009	<ul style="list-style-type: none"> <li>• Governs the conservation, protection, development and exploitation of aquatic habitat and fauna in accordance with laws and regulations and use necessary measures to limit adverse impacts.</li> <li>• The State promotes aquaculture, conservation, protection, development, and expansion of aquatic fauna and the management of their exploitation.</li> </ul>
Law on irrigation	2012	<ul style="list-style-type: none"> <li>• All persons and organizations operating irrigation have to prevent, protect and conserve natural resources particularly forests, biodiversity in the catchment area, reservoir and water resources from drying off, pollution and impacts to irrigation water and aquatic resources</li> <li>• Aims to maintain clean and sustainable use of irrigation water.</li> </ul>
Law on environmental protection	2013	<ul style="list-style-type: none"> <li>• The State promotes conservation and protection of natural resources.</li> <li>• The State aims to maintain ecological balance and abundance of natural resources, along with preserving species and genes that provide benefits and habitats with variations and sustainability;</li> </ul>
<b>Fire Management</b>		
Prime Minister's Decree on the Management and Use of Forests and Forest Lands (No. 169/PM)	1993	Article 30 states measures will be taken against offenders who burn or destroy forests and forest land area illegally.
MAF Directive 377 on the Customary Use of Forest Resources	1996	Article 2 of this policy guideline limits customary rights that negatively affect collectives or individuals, or that are inconsistent with government policy such as 'undifferentiated slash and burn' and forest fire for hunting.
Law Order 2094/MAF on Fighting Forest Fires During the Dry Season	1999	<p>Makes PAFO/DAFO responsible for implementing forest fire management activities and supporting the involvement of local communities in forest fire management (including managing, responding and reporting fires in their area).</p> <p>Prohibits shifting cultivation in evergreen forests, NBCAs, watershed protection areas and forests on steep slopes that could cause landslides.</p> <p>Prohibits burning trees, burning wild grass for hunting, dropping cigarette butts, making campfires without shelters and failing to extinguish campfires before leaving them.</p>
Forestry Law (No. 06/NA)	2007	<p>Contains specific provisions for the prevention of fires in Protection Forests, which includes the PFA and PAA.</p> <p>Activity restrictions will apply to these areas prohibiting the undertaking of shifting cultivation and burning.</p> <p>States the prevention and control of forest fire as the responsibility of all people.</p>
Law on Fire Prevention and Fighting (No. 09/NA)	2007	Sets out the principles, regulations and measures governing the organisation, activities, management and control of fire prevention and fighting in the country.
<b>Non-native Invasive Plants</b>		
Prime Minister Decree on Plant Quarantine (No. 66/PMO) and Regulations on the Quarantine of Plants in the Lao PDR (No. 069/MAF)	1993	<ul style="list-style-type: none"> <li>• Sets out plant quarantine protocols and outbreak control measures for pathogens and pests.</li> </ul>

Lao PDR Law	Year	Description
Regulation on Long-Term Management of Tree Plantation, and Regulations on the Management and Use of Plant Species and Seeds for Planting in the Lao PDR (No. 719/MAF)	1997	<ul style="list-style-type: none"> <li>Article 8 provides specific provisions for the monitoring and control of forest invasive species.</li> </ul>
Forestry Law (No. 06/NA)	2007	<ul style="list-style-type: none"> <li>Articles 28 and 43 contain specific provisions for the prevention and eradication of invasive species in Protection Forests, including the PFA and PAA.</li> </ul>
Plant Protection Law (No. 06/NA)	2008	<ul style="list-style-type: none"> <li>Article 11 requires reporting of pest infestation and outbreak in an area.</li> <li>Article 13 gives authority for MAF to coordinate with local administrative authorities the implementation of measures to control an outbreak of invasive species and pathogens.</li> <li>Article 38 prohibits individuals from moving plant, plant product and regulated article from infested area to other areas, and moving plants and plant products without permission (e.g. Certificates of Origin, import permits, phyto-sanitary certificates).</li> </ul>
Regulation on the Control of Pesticides in Lao PDR (No. 2860/MAF)	2010	<ul style="list-style-type: none"> <li>The use of chemicals used in pesticides for weed control is strictly regulated by the Regulation on the Control of Pesticides in Lao PDR (2010, No. 2860/MAF), which includes a list of banned pesticides to protect human health and the environment (refer to Annex 1).</li> </ul>
<b>Pests and Disease Management</b>		
Decree on Livestock Management in Lao PDR (No. 85/PMO)	1993	Sets out the conditions relating to animal disease prevention, control and vaccination.
Regulation on Livestock Management (No. 0004/MAF);	1997	Regulates pest and disease management in livestock, and implementation of outbreak control measures.
<b>Cultural Heritage</b>		
UNESCO Convention Concerning the Protection of the World Cultural and Natural Heritage (Adopted by the General Conference at its 17th session, Paris)	1972	<ul style="list-style-type: none"> <li>Defines cultural and natural heritage with outstanding universal value;</li> <li>Aims at effective and active measures are taken for the protection, conservation and preservation of the cultural and natural heritage in each State Party.</li> </ul>
Presidential Provision on the Preservation of Cultural, Historical and Natural Heritage (No. 03/PR)	1997	<ul style="list-style-type: none"> <li>Provides basic principles, regulations and measures for preservation, protection and management of national heritage;</li> <li>Classifies different types of national heritage;</li> <li>Outlines chance find procedures and exploration of traditional objects and archaeological sites.</li> </ul>
Land Law (No. 04/NA)	2003	Governs all land categories including management of cultural land.
Forestry Law (No. 6/NA)	2007	<ul style="list-style-type: none"> <li>Defines fundamental principles, regulations and measures on sustainable management, preservation, development and use of forest resources;</li> <li>Ensures protection of valuable sites of natural, historical and cultural significance.</li> </ul>

Lao PDR Law	Year	Description
Law on National Heritage (No. 44/NA)	2013	<ul style="list-style-type: none"> <li>• Outlines administration regimes for national heritage;</li> <li>• identifies two types of national heritage: (i) national heritage having scenic value; and (ii) national heritage having scientific or ecological value;</li> <li>• Four levels of national heritage: (i) local level; (ii) national level; (iii) regional level; and (iv) international level.</li> </ul>

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## **Appendix B: Public Consultation, Participation and Information Dissemination Plan for HSRA development**

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# **PUBLIC CONSULTATION, PARTICIPATION AND DISCLOSURE REPORT**

## **FOR THE HOUAY SOUP RESETTLEMENT AREA**



October 2015

# **PUBLIC CONSULTATION AND DISCLOSURE PLAN FOR THE HOUAY SOUP RESETTLEMENT AREA**

**FINAL**

Prepared for



By



October 2015



**EARTH SYSTEMS**  
Environment | Water | Sustainability

## RECORD DISTRIBUTION

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## DOCUMENT REVISION LIST

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This report is not to be used for purposes other than those for which it was intended. Environmental conditions change with time. The site conditions described in this report are based on observations made during the site visit and on subsequent monitoring results. Earth Systems does not imply that the site conditions described in this report are representative of past or future conditions. Where this report is to be made available, either in part or in its entirety, to a third party, Earth Systems reserves the right to review the information and documentation contained in the report and revisit and update findings, conclusions and recommendations.

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# 1 INTRODUCTION

NNP1’s overall approach and commitment to public consultation and information dissemination is outlined in the Project’s Public Consultation and Information Disclosure Plan (EIA 2014; SIA 2014; REDP 2014). This Plan is compliant with GOL legislation and the ADB’s Safeguard Policy Statement (2009).

This Public Consultation and Disclosure Plan (PCDP) for the HSRA has been developed to guide activities during the development of the HSRA. The Plan should be read in conjunction with the overall PCD activities contained the Project REDP (2014). It documents all PCD activities that have been conducted to date in relation to the HSRA and outlines a strategy and management plan for continued stakeholder engagement and information dissemination of environmental, social and other Project related matters during the development and operation of the HSRA.

This PCDP for the HSRA forms an annex of the Initial Environmental Examination update for the Proposed Houay Soup Resettlement Area (HSRA IEE) (Earth Systems, September 2015).

The PCDP for the HSRA:

- Adopts the goals, objectives and approach outlined in the Project’s existing PCDP (EIA 2014);
- Recognizes and builds off the significant PCD activities conducted by NNP1 to-date;
- Promotes close collaboration with NNP1 SMO/EMO and GOL partners during PCD activity implementation;
- Improves (where possible), engagement and involvement of key stakeholders in the planning for the HSRA development; and
- Ensures compliance with GOL legislation and ADB safeguards requirements.



## 2 THE NNP1 PCD PROGRAM

### 2.1 Context

NNP1 Power Company recognises that meaningful public consultation is a process that:

- Begins early in the Project preparation stage and is carried out on an ongoing basis throughout the Project cycle;
- Provides timely disclosure of relevant and adequate information that is understandable and readily accessible to affected people;
- Is undertaken in an atmosphere free of intimidation or coercion;
- Is gender inclusive and responsive, and tailored to the needs of disadvantaged and vulnerable groups; and
- Enables the incorporation of all relevant views of affected people and other stakeholders into decision making such as mitigation measures, resettlement activities, livelihood restoration, compensation, the sharing of development benefits and opportunities, and implementation issues.

Since 2007, and more intensively since August 2013, there have been numerous public consultation and participation briefings, presentations and meetings, which have taken place at the local, regional and national levels (refer to Section 3). A dialogue has been established with the various stakeholders directly and indirectly involved in the Project and interested in the Project's public consultation. This process has led to the consent of the affected households to the social and resettlement program developed with them (refer to REDP, NNP1 2014) including a dispute resolution mechanism for ineffectual implementation of plans.

### 2.2 PCD Objectives

The goal of NNP1's PCD activities are to ensure opportunities exist for stakeholders to be involved in Project design, including potentially affected people.

Key objectives are to:

- Ensure that stakeholders concerns are incorporated in the Project design and implementation;
- Increase stakeholder awareness and familiarity with the Project;
- Ensure transparency in the decision-making process;
- Enhance the potential benefits by directly involving relevant stakeholders;
- Support a robust mechanism for recording and resolving Project related issues and grievances; and
- Monitor the effectiveness of environmental and social impact mitigation, resettlement, compensation and livelihood restoration.

## 2.3 Legal and other requirements for PCD

### 2.3.1 National regulations

Public consultation and information disclosure is a core requirement in the legislative framework governing project development in Lao PDR. Key documents are shown in Table 2-1.

**Table 2-1 Key Legislation Concerning Project PCD Activities**

Legislation	Year
<b>Laws</b>	
Constitution of Lao PDR	2003
The Decree on the Compensation and Resettlement of Development Projects	2005
Regulations for Implementing Decree 192 / PM on Compensation and Resettlement of People Affected by Development Projects	2005
Decree on Environment and Social Impact Assessment	2010
Law on Environment Protection	2013
<b>Guidelines</b>	
The National Policy on Environmental and Social Sustainability of the Hydropower Sector	2005
Technical Guidelines on Compensation and Resettlement of People Affected by Development Projects, Regulation 699/PMO	2010
Public Involvement Guidelines	2012
Environmental Impact Assessment Guidelines	2012

Source: Earth Systems 2015

### 2.3.2 Concession Agreement

The Concession Agreement (CA) outlines specific requirements for stakeholder engagement, public information dissemination, reporting and grievance redress during environmental management; resettlement; compensation; and livelihood / community development aspects of the Project.

Key NNP1 obligations concerning stakeholder and information dissemination for the HSRA are contained in Annex C Environmental and Social Obligations, Part III Social Matters – Resettlement and Compensation (Annex C 2013).

### 2.3.3 International standards

The CA specifically requires compliance with the following standards relevant to stakeholder engagement and information disclosure (Table 2-2).

**Table 2-2 International Standards**

Standard	Year
<b>Key International Standards</b>	
ADB Safeguard Policy Statement	2009
ADB Public Communications Policy	2011
IFC Performance Sustainability Framework	2012

Source: Annex C 2013

Other relevant standards and best practice guidance includes the International Finance Corporation’s Stakeholder Engagement: A good practice handbook for companies doing business in emerging markets (IFC 2007); the World Bank Guidance Note on Tools for Pollution Management – Stakeholder Engagement and Grievance Mechanisms (World Bank 2012); and IFC’s Guide to Designing and Implementing Grievance Mechanisms (IFC 2008).

## 2.4 Stakeholder Identification and Analysis

An overview of the main stakeholder groups, potential Project impacts, and key interests is presented in Appendix A and a more detailed analysis provided in the SIA (SIA 2014). The main stakeholder groups that have been identified during the development of the Project include:

- People directly and indirectly impacted by the Project;
  - Eight (8) villages in Zone 1: Upstream of the Reservoir Area (Z1);
  - Three (3) villages in Zone 2: Upper Reservoir Area (2UR);
  - Four (4) villages in Zone 2: Lower Reservoir Area (2LR);
  - One (1) village in Zone 3: Construction Area (Z3); and
  - 11 villages in Zone 4: Downstream Area (Z5).
- Government officials at the district, provincial and national levels;
- Other hydropower projects upstream and downstream of the NNP1 Project;
- Other industrial projects operating in the area;
- Broader interested national community;
- Civil Society present in Lao PDR, and
- Other regional and international groups and organisations.

## 2.5 Approach and Methodology

NNP1 PCD approach uses a three (3) phase process as outlined in the REDP (2014) and Table 2-3.

**Table 2-3 Three phase approach to PCD implementation**

Phase	Details
1. Information Collection	Collection and dissemination of information on the human and physical characteristics of the current environment to assess Project impacts. During this phase, information about the Project features and the implications on the social and physical environment is obtained from, and also disseminated to, the stakeholders.
2. Stakeholder Consultation	Phase 2 involves consultation with the various stakeholders, emanating from the comments sought from them in response to the information gathered in the first phase and the subsequent adjustments made to the proposed mitigation measures and alternatives. It is also the stage when the consent of affected ethnic minority households is obtained and information collected is disclosed in affected villages to formulate compensation and offsetting measures, including resettlement planning. It is on-going with Asset Registration, Confirmation Surveys as well as a full Socioeconomic Survey, establishing the baseline for compensation and livelihood restoration activities.
3. Participation in Project design and implementation	The final phase of PCD activities relates to involvement and participation of key stakeholders in Project design and implementation. This is expected to continue during Project implementation. Livelihood restoration models are further developed in this stage, including the layout of the new village and the design of the most appropriate irrigation system for the replacement agricultural land in the Houay Soup resettlement site.

Source: REDP 2014, p.184

The Project PCD process takes several important factors into account including:

- Local authority structures, ensuring however that participation in consultation is not dominated by local authorities;
- The need to enter into good faith negotiations with affected ethnic group households;
- The active participation of women and vulnerable groups and the consideration of their needs and wants in planning of mitigation measures;
- Proper documentation of the process as well as accurate recording of participation and results of the stakeholder information and consultation process; and
- Various communication and disclosure formats to suit the needs of village level situation.

PCD activities are designed to ensure that the above factors are adequately addressed and meet the needs of target audiences and the requirements of the diverse and numerous stakeholders involved in this Project. Accessibility of information and participation has been enhanced through the establishment of information centres in the three Project districts.

NNP1 has also established a Grievance Redress Mechanism (GRM) for the Project in line with the GOL's Technical Guidelines on Compensation and Resettlement of People Affected by Development Projects (GOL 2010).

## 2.6 Institutional Arrangements

The Project has established three key units to ensure an effective PCD process:

- A community consultations team under the Social Development and Monitoring section, formed by experienced and safeguards-trained officers; this team is responsible for communication between the Project and PAP's;
- A company-wide communication team under the Administrative Division, engaging in PCD with external stakeholders, including press, IO's and NGO's; and
- A GOL relations team under the Administrative Division with officers assigned for SMO and EMO facilitating communication between the Project and different levels of Government.

In addition to the work of the above three teams, all SMO maintain regular interaction with PAP's.

## 3 PCD ACTIVITIES: RESETTLEMENT DESIGN

### 3.1 Summary of Previous PCD Activities

PCD activities for the Project began early in the Project preparation stage (2007) and have been carried out on an ongoing basis throughout the Project cycle. Activities have included meetings, focus groups discussions, and participatory engagements with affected villages; meetings and consultation with GOL agencies; and a number of stakeholder forums with a wide range of Project stakeholders.

Earlier PCD activities (2007 onwards) regarding resettlement and the HSRA were focused on PAP's in 'resettlement communities' who will be impacted by reservoir inundation including:

- Three (3) villages in Zone 2: Upper Reservoir Area (2UR);
- Four (4) villages in Zone 2: Lower Reservoir Area (2LR); and
- One (1) village in Zone 3: Construction Area (Z3).

More recent PCD activities (2014 onwards) have also included PAP's in 'host villages' who are currently using the proposed HSRA including:

- One (1) village in the Construction Zone (Z3)
- Two (2) villages in the Downstream Area (Zone 4).

A summary of these activities is provided in Appendix B. A summary of the key outcomes of these activities is presented in the preceding sections.

#### 3.1.1 Resettlement Communities

Consultations with resettlement communities resulted in a number of key milestones:

##### ***Agreement of Resettlement Options***

NNP1 agreed to three options for resettlers in consultation with PAPs and GOL:

- Resettlement to a site agreed by PAPs, the GOL and NNP1;
- Self-resettlement within the Project area of influence with follow-up activities by the Project; and
- Self-resettlement outside the Project area of influence with no follow-up by the Project.

Agreed criteria apply to each option to ensure the economic viability of resettlement. Finalisation of resettlement decisions by PAP's is ongoing.

##### ***Site Selection***

One of the most important concerns raised by PAPs has been the selection of the resettlement site – with PAPs affected by the main reservoir expressing a preference to be relocated near their current location.

NNP1 along with PAPs and applicable GOL authorities investigated several potential resettlement sites throughout the ESIA process. In 2011, the Houay Soup Resettlement Area (HSRA) was selected as the NNHPPs designated resettlement site.

##### ***Confirmed Project Design***

Stakeholders have had a number of opportunities to participate in all aspects of design of the Houay Soup Resettlement Area including, but not limited to, site location, access roads, transmission line alignment, land use planning and zoning, housing design and public infrastructure.



The consultation process over the project design period resulted in several design adaptations to comply with the requests and concerns of PAP's. Some examples of consultation about project design can be found in Table 3-1 and more detailed information can be found in the SIA (2014) and REDP (2014).

**Table 3-1 Examples of Stakeholder Inputs into Project Design**

Date	Details
2007	Community consultations were conducted in Ban Houaypamom, Ban Sopphuane, Ban Sopyouak, Ban Namyouak and Ban Hatsaykham to understand villagers' preferences regarding the configuration and composition of the new resettlement villages.
2012	PAP's were involved in the survey of land use and land claims in the HSRA.
Mid - 2013	PAP representatives participated in a site visit to the designated resettlement area during the feasibility study of the site. A focus group discussion was also conducted.
Mid - 2013	PAP's from Zone 3 went together with a 3D Model of the site to the villages of 2LR and explained their current use of the site and expectations how it could be used in the future.

Source: REDP 2014

### 3.1.2 Host Communities

A combination of PCD activities including field surveys, interviews and public consultations have been held with the host communities. Initial PCD activities were conducted to make villagers aware of the potential adverse and positive Project impacts and solicit their attitudes and opinions about being a host community. Subsequent consultations have focussed on compensation arrangements and resource sharing options to account for losses due to land acquisition by the Project. Comprehensive registration of host community assets in the HSRA have been undertaken to inform compensation requirements and work has been done with host communities to design livelihood activities in the HSRA which will form part of the compensation package. External institutions such as IAP, LTA and ADB missions have also engaged with host villagers to assess local Project impacts and management / mitigation options as part of their overall Project assessment.

### 3.1.3 Key Issues Raised in the PCD Process for the HSRA

A number of issues have been identified during PCD activities for the HSRA and these are being managed on an ongoing basis by the SMO. Key current issues include:

- Resettlement options: Issues relating to resettlement options include animosity from some villagers (particularly in Zone 2LR) because they feel that their preferred resettlement sites were not properly considered by the Project; fears that the HSRA will be unable to support the design population and concerns that the Project and GOL will neglect PAP's after only a few years of resettlement. Another reservation expressed by some PAP's is that they were not given better options rather than self-resettlement without future livelihood support from the Project;
- Soil quality in the HSRA: A common complaint from PAP's is that soil within the HSRA is not fertile and therefore not suitable for cultivation. Some villagers have expressed the view that soil fertility is more important than the quality of infrastructure with respect to sustainability of the resettlement; and
- Compensation rates: Compensation rates for some Project impacts have been and still are the subject of ongoing negotiations. In addition to rates, the nature of compensation has been the subject of debate (i.e. land for land, cash or in-kind etc.).

A flowchart on resettlement issues was developed by the SMO in June 2015 and is available in Appendix C.

## 3.2 PCD Activities during the IEE Update of the HSRA

### 3.2.1 PCD Activities for the IEE / INRMP

The first round of consultations focussed on data collection, general feedback and inputs into preliminary Integrated Natural Resource Management (INRMP) design while the second round of consultations involved a presentation of new information and discussion on the proposed detailed design of the HSRA. Key topics for each element of the presentations were as follows:

- INRMP – Outline and discussion of preliminary land and forest zoning allocations that were developed and Protected Forest Area management in the proposed HSRA. Discussion of next steps in the PLUP process; and
- IEE – Discussion of the potential environmental and social impacts of the design and proposed mitigation and management measures during the construction and post construction phases.

As discussed in the sections below, PCD activities were tailored to target audiences with the nature of consultations dependent on stakeholder interest in the Project.

### 3.2.2 Information Collection with NNP1 SMO

Earth Systems held a number of meetings with NNP1 (EMO, SMO, and TD) representatives during the IEE and INRMP development process to obtain information and up-to-date designs for the HSRA. The consultations with EMO involved issues related to natural resources management and in particular the land use zoning. Meetings with SMO and TD involved discussion of HSRA infrastructure development planning and data collection.

### 3.2.3 Meetings with GOL

A number of meetings have been held with government officials during development of the IEE and INRMP. Consultations at both Provincial and District level are described below.

#### ***Provincial Meetings***

An initial meeting was conducted with officials from Bolikhamsay Province in June 2015 to A brief initial meeting was held with the Bolikhamsay Provincial Government in Paksan in June 2015 to gain permission for conduct of INRM field studies and discuss the plan with Provincial authorities.

A follow up meeting was held with the Deputy Director of the Provincial Department of Natural Resources and Environment (PONRE) in August 2015 in order to present the initial HSRA infrastructure development plan and land use zoning, and attain permission to conduct further fieldwork and consultations for the IEE. Feedback from PONRE during the meeting included:

- Their support for detailed planning in the HSRA to inform subsequent Participatory Land Use Planning (PLUP);
- The need to show sensitivity in relation to the issue of compensation until compensation rates have been finalised; and
- An observation that GOL will not convert PFA land until the final resettlement population for the HSRA has been determined.

PONRE granted permission for the fieldwork and assigned one PONRE and two DONRE officials to accompany the field survey team to the villages.



Plate 1 Hom district consultation



Plate 2 Meeting with Province and District in Bolikhamxay

### ***District Consultations***

Formal consultations were conducted in Bolikhan and Hom Districts in August 2015. Both meetings included representatives from the respective Provincial and District Governments. The consultations included a presentation detailing development of the land use zoning during the INRMP planning process and a feedback session with GOL participants. Feedback from District Consultations included:

- The need for sustainable agriculture/land improvement with concerns raised over the allocation of agricultural land in terms of area, soil fertility and productivity to support the HSRA population;
- The need for cultural sensitivity in sustainable agriculture design (i.e. Hmong people prefer upland farming systems without the use of chemical inputs);
- Discussion about compensation, particularly in upland areas, and the land/asset registration process;
- The need for completion of land use zoning and land demarcation prior to resettlement to discourage forest encroachment in the HSRA; and
- The need for a robust water resource management plan in the INRMP to address water scarcity during the dry season, ensure a long term water supply and identify potential areas for village aquatic preservation. In terms of residential and agricultural land allocation, it was observed that this process must be done properly with documents to avoid land conflicts and a recommendation was made to provide PAP's with temporary land documents without tax payment for three years during their transition period, after which permanent land titles can be issued.

GOL officials at both meetings expressed strong support for participation in the PLUP process and identified the DONRE Land Management and Forest Resource Management Units as key players in the land use planning and land titling process for the HSRA once the resettlement starts. The Resettlement Management Unit also confirmed its role in facilitating the resettlement process.

### ***NNP1 / MONRE***

On July 13, 2015 NNP1 sent a letter to MONRE (No.210/NN1PC-VTE-OUT/15) to propose the conversion of 648 ha of the Nam Ngiep Nam Mang Protection Forest Area to State Land (for HSRA settlement construction). The acting Director General of the Land Management Department contacted the Minister of MONRE on July 27, 2015 to seek approval on behalf of NNP1 (NO.1879/MoNRE.LD). The minister from MONRE confirmed transformation of the 648 ha of PFA for resettlement and rehabilitation of PAPs by the Nam Ngiep 1 Hydropower Project (No.4467/MONRE) on July 31, 2015. Further consultation was completed on August 12, 2015 to formally identify the surveyed 648 ha. State Land Use Rights to

the 648 ha were granted by the Acting Director General on August 12, 2015 ((No.2104/MONRE.DOLA) Refer to the HSRA IEE, Appendix J for documentation).

### ***NNP1 / MONRE.LMD***

NNP1 met with MONRE.DoLA on 23 September 2015 to discuss HSRA residents' utilisation rights for the 3,175 ha of Nam Ngiep Nam Mang PFA that will be included in the HSRA. It was agreed that NNP1 may utilise the area to provide resources for HSRA residents. However, prior to granting permission, it was proposed that the Land Management Department will coordinate with the Forestry Management Department and Department of Forestry under the Ministry of Agriculture and Forestry with respect to the north-western boundary of the HSRA PFA area, and determine whether it is a protection area or a production area. On October 6, 2015 MONRE.DoLA proposed that NNP1 / RMU should coordinate with the provincial sectors (primarily Bolikhamsay Natural Resources and Environment Division and the Agriculture and Forestry Division to ensure compliance with the roles and responsibilities of the related sectors. NNP1 / RMU will report on the Project's progress, for near-term clarification of boundaries (refer to IEE, Appendix J).

### ***Exhibition***

NNP1 organized the HSRA development and Ban Hatsaykham exhibition on 17 August 2015 in Bolikhan District. The exhibition was developed to provide public information on HSRA development plan to local GOL officials, the general public and civil society who are interested in the Project and was attended by representatives from NNP1 (SMO, EMO and TD); local GOL representatives from Bolikhan, Thaphabath, Thathom Districts and Bolikhamxay Provincial Departments; and villagers from Hatsaykham, Hat Gniun, Thaheua, Nonsomboun, Sisavath, and the 2UR villages. The exhibition included a display of the conceptual design of HSRA development infrastructure, livelihood development activities and soil improvement techniques. A series of presentations were delivered to all participants outlining the HSRA development, benefits and impacts, and importantly, a clarification on terms and conditions for compensation.





Plate 3 Exhibition at Bolikhan District



Plate 4 Exhibition at Bolikhan District



Plate 5 Exhibition at Bolikhan District



Plate 6 Exhibition at Bolikhan District

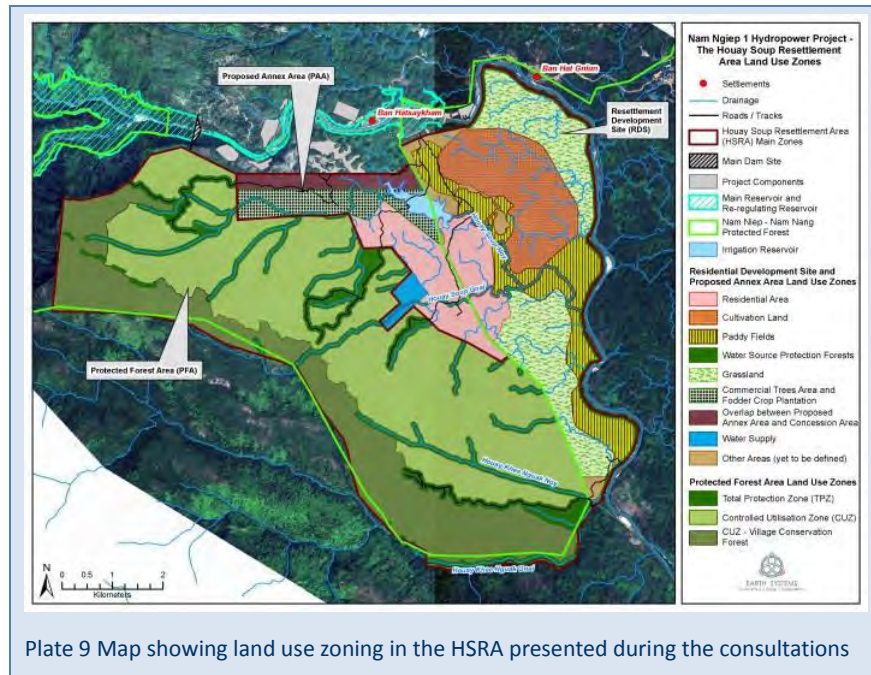


Plate 7 Exhibition at Bolikhan District



Plate 8 Exhibition at Bolikhan District





### 3.2.4 Village Consultations

Village consultations were conducted with ‘host villages’ (Ban Hatsaykham, Ban Hat Gniun and Ban Somseun) during the data collection stage in June. Follow up consultations were held in August with both ‘host’ villages and the ‘resettlement’ villages (Ban Nam Youak, Ban Sop Youak, Ban Sopphuane, and Ban Houay Pamom) to present up to date information relating to HSRA development and land use planning of the area, and conduct male and female focus groups to elicit PAP inputs into the land zoning process and document any other feedback. A summary of these consultations is provided below.

#### **IEE / INRMP Consultations with Host Villages**

Consultations were held with Ban Hat Gniun, Ban Hatsaykham and Ban Somseun, in late June to inform them of the INRMP field studies, gain feedback on current land use and future planning of the HSRA and to source village guides to assist with navigation on the HSRA. Data was collected during these consultations relating to themes such as land use, biodiversity, NTFP collection and fisheries. Information obtained during these consultations is contained in the INRMP and the HSRA IEE.

Consultations to present results of field studies and preliminary land zoning within the HSRA were held with ‘host’ communities in August 2015. Village involvement in the planning process was seen as a key concern for villagers in Ban Hatsaykham. Villagers cited a bad prior experience where their concerns relating to appropriate culvert size during design and construction of the Houay Say Bridge were ignored leading to flooding issues during heavy rain.

Villagers in both Ban Hat Gniun and Ban Somseun expressed dissatisfaction with some aspects of HSRA development. A number of villagers in both communities were requested to cease cultivation in the HSRA in recent years and this has affected a number of households, particularly those with ownership of land outside the HSRA. Additionally, villagers from Ban Somseun and Ban Hat Gniun will lose agricultural land in the HSRA but will not get compensation like Ban Hatsaykham and they requested that NNP1 provide livelihood development assistance to those who lose agricultural land. Concerns were also raised about the increased pressure on natural resources in the HSRA after resettlement and the future availability of NTFP’s to support livelihoods for PAP’s.



Plate 10 Village consultation in Ban Somseun



Plate 11 Male focus group in Ban Somseun



Plate 12 Village consultation in Ban Hatsaykham



Plate 13 Village consultation in Ban Hat Gnun

### **IEE / INRMP Consultations with Resettlement Villagers**

Village consultation meetings with the ‘resettlement’ villages of Ban Nam Youak, Ban Sop Youak, Ban Sopphuane, and Ban Houay Pamom were conducted in August 2015. Two District officials and one NNP1 staff attended the consultations to assist with the presentation and translate into Hmong language. There is currently a general reticence among the ‘resettlement’ villages to resettle in the HSRA due to a number of concerns and a feeling of regret for the loss of productive farmlands that have been used for generations. Soil fertility was the key issue raised in all four communities. Villagers in Ban Sopphuane and Ban Houaypamom are happy with the design and planning of infrastructure and land use zoning in the HSRA but people are concerned about the suitability of the soil for agriculture. PAP’s from both Ban Sopphuane and Ban Sopyouak believe that alternative sites with more fertile soils were not given enough consideration by the Project.

Another fear raised was the perceived inability of the HSRA to support the design population and concern that livelihood support will be reduced soon after resettlement due to the low level of current support and experiences with other hydropower projects. Residents from Ban Sopyouak claimed that only 20% of their village will opt for resettlement in the HSRA and they requested that NNP1 not allocate too much budget on development of the HSRA infrastructure but rather give high compensation to the PAPs so that they are more resilient for self-resettlement. Villagers in Ban Houaypamom observed that land allocation for the resettlers must be conducted properly with documents to secure their use rights so that conflicts between the resettlers as well as with host villages are minimised.





Plate 14 Village consultation in Ban Sopyouak



Plate 15 Village consultation in Ban Sopphuane



Plate 16 Village consultation in Ban Houaypamom



Plate 17 Village consultation in Ban Namyouak

## 4 PCD ACTIVITIES: RESETTLEMENT IMPLEMENTATION

The following section outlines planned PCD activities during the construction and post construction phases of the HSRA. These activities will be implemented in accordance with NNP1's existing PCD principles and approaches outlined in the REDP (NNP1 2014) and summarised in Section 2.5.

### 4.1 On-ground PCD Activities

On-ground PCD activities relating to the development of the HSRA will be conducted in three (3) phase as outlined below.

#### 4.1.1 Preparation

Preparatory PCD activities commenced during the feasibility phase of the project and will continue during the construction phase until the majority of PAPs have been resettled to the HSRA. These activities will be led by NNP1 and include:

- Consultation and use of existing grievance mechanisms with host communities and later resettled villagers from Ban Hatsaykham concerning potential impacts related to the construction of the HSRA facilities;
- Further consultation with GOL and host communities regarding compensation and livelihood restoration activities and the conduct of participatory land use planning activities to ensure adequate allocation of village land and land use zones;
- Conduct of indicative Choice Survey on Resettlement / Self-Resettlement including consultations on Resettlement Plan for 2LR and resettlement options for women, youth and vulnerable people;
- Further consultations with GOL and resettlement villages regarding the INRMP and proposed land use planning and process for the HSRA;
- Construction of facilities within the HSRA for the conduct of effective PCD activities (i.e. village meeting building and village notice board); and
- Preliminary participatory land use planning activities with villagers from Ban Hatsaykham from April 2018 (planned resettlement date).

#### 4.1.2 Participatory Land Use Planning

Formal PLUP activities will commence in 2018 when the PAPs from 2LR villages have resettled to the HSRA. These activities will be led by relevant government provincial and district authorities with the support of NNP1. Activities are outlined in detail in the INRMP and include:

- Establishment of the village committee and natural resource management groups;
- Consultation activities to finalise village land and forest zoning;
- Consultation activities to finalise village natural resource management plans and agreements for GOL endorsement;
- Conduct of land registration and titling for individual land and community land;
- Provision of relevant land and forest data to village, district and provincial authorities; and

- On-going NNP1 engagement and support during the implementation of natural resource management plans and agreements.

During the PLUP process NNP1 will also:

- Establish a formal grievance mechanism for the newly established Houay Soup village; and
- Conduct Livelihood Restoration and Community Development Activities including programs for agricultural extension, health, education and vulnerable households.

### 4.1.3 Monitoring

NNP1 will work closely with GOL authorities and Project lenders to ensure that the following monitoring activities are undertaken:

- Implementation of an ongoing social monitoring and management program including regular consultations with village and GOL authorities and monthly, quarterly, annual government reporting; and
- A participatory review of PLUP implementation by relevant GOL authorities with the support of NNP1, two (2) years after the completion of Phase 2 PLUP activities.

#### *Other monitoring*

- EMU monitoring; and
- External monitoring reports from LTA, IAP missions.

## 4.2 Other PCD Activities

Other PCD activities will include:

- Provincial and central government engagements such as meetings, workshops, exhibitions, site visits etc.; and
- Wider stakeholder PCD activities including public reporting, public information dissemination (i.e. website) and the conduct of broader stakeholder forums.

## 4.3 PCD Activities, Schedule and Responsibilities

A summary of PCD activities, schedule and responsibilities is outlined in Table 4-1.



**Table 4-1 PCD - Actions, Schedule, Responsibilities**

Action	Schedule/ Frequency	Responsibility	Monitoring
<b>On-Ground PCD Activities</b>			
<b>Preparation Activities</b>			
Consultation and use of existing grievance mechanisms with host communities and later resettled villagers from Ban Hatsaykham concerning potential impacts related to the construction of the HSRA facilities	October 2015 / weekly	NNP1 SMO	EMU / LTA / IAP
Further consultation with GOL and host communities regarding compensation and livelihood restoration activities and the conduct of participatory land use planning activities to ensure adequate allocation of village land and land use zones	October / as required	NNP1 SMO	EMU / LTA / IAP
Conduct of indicative Choice Survey on Resettlement/Self-Resettlement including consultations on Resettlement Plan for 2LR and resettlement options for women, youth and vulnerable people	September until December 2015	NNP1 SMO	EMU / LTA / IAP
Further consultations with GOL and resettlement villages regarding the INRMP and proposed land use planning and process for the HSRA	October 2015 / as required	NNP1 SMO	EMU / LTA / IAP
Construction of facilities within the HSRA for the conduct of effective PCD activities (i.e. village meeting building and village notice board)	April 2016 / once	NNP1 SMO	EMU / LTA / IAP
Preliminary participatory land use planning activities with villagers from Ban Hatsaykham from April 2016 (planned resettlement date)	April 2016 / as required	NNP1 SMO	EMU / LTA / IAP
<b>Participatory Land Use Planning</b>			
Establishment of the village committee and natural resource management groups	2018 / as required	PONRE / DONRE / PAFO / DAFO, NNP1 / RMU	WMC / PCLRC and LTA / IAP
Consultation activities to finalise village land and forest zoning	2018 / as required	PONRE / DONRE / PAFO / DAFO, NNP1 / RMU	WMC / PCLRC and LTA / IAP
Consultation activities to finalise village natural resource management plan and agreements for GOL endorsement	2018 / as required	PONRE / DONRE / PAFO / DAFO, NNP1 / RMU	WMC / PCLRC and LTA / IAP

Action	Schedule/ Frequency	Responsibility	Monitoring
Provision of relevant land and forest data to village, district and provincial authorities	2018 / as required	PONRE / DONRE / PAFO / DAFO, NNP1 / RMU	WMC / PCLRC and LTA / IAP
On-going NNP1 engagement and support during the implementation of natural resource management plans and agreements	2018 / as required	PONRE / DONRE / PAFO / DAFO, NNP1 / RMU	WMC / PCLRC and LTA / IAP
Establish and implement a formal grievance mechanism for the newly established Houay Soup village	2018 / as required	NNP1 / RMU	PCLRC and LTA / IAP
Conduct Livelihood Restoration and Community Development Activities including programs for agricultural extension, health, education and vulnerable households	April 2016 / Ongoing until the end of 2023, five years after COD	NNP1 / RMU	WMC / PCLRC and LTA / IAP
<b>Monitoring</b>			
Implementation of an ongoing social monitoring and management program including regular consultations with village and GOL authorities and monthly, quarterly, annual government reporting	Monthly, Quarterly, Semi-annual	NNP1 SMO, LTA and IAP Missions	PCLRC and LTA / IAP
A participatory review of PLUP implementation two (2) years after the completion of Phase 2 PLUP activities	two (2) years after the completion of Phase 2 PLUP activities	PONRE / DONRE / PAFO / DAFO, NNP1 / RMU	PCLRC and LTA / IAP
EMU Monitoring	Ongoing / As required	NNP1 / EMU	EMU and LTA / IAP
External monitoring reports from LTA, IAP missions	Semi-annual	LTA / IAP	LTA / IAP
<b>Other PCD Activities</b>			
Provincial and central government engagements such as meetings, workshops, exhibitions, site visits etc.	Quarterly / As required	NNP1 SMO	GOL / LTA / IAP
Wider stakeholder PCD activities including public reporting, public information dissemination (i.e. website) and the conduct of broader stakeholder forums	As required	NNP1 SMO	GOL / LTA / IAP

Source: REDP 2014, Earth Systems 2015

## 5 REFERENCES

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GOL 2012, Guideline on Public Involvement in Environmental and Social Impact Assessment, Government of Lao PDR, 2012

World Bank 2012, World Bank Guidance Note on Tools for Pollution Management – Stakeholder Engagement and Grievance Mechanisms, last accessed 31 August 2015, Available: <http://documents.worldbank.org/curated/en/2012/01/16565836/getting-green-sourcebook-pollution-management-policy-tools-growth-competitiveness>

## 6 ANNEXES

### Annex 1: Stakeholder Summary

**Table 1-1 Key Project Stakeholders**

Stakeholder	Potential Project Impact	Relative Priority of Interest	Key Stakeholder Interests in the Project
<b>Primary Stakeholders</b>			
<b>Directly affected people</b> (i.e. displaced PAP's who will lose their property and/or livelihood opportunities due to inundation of the NNP1 reservoirs, and/or construction of various Project components.	(-) (+)	1	<ul style="list-style-type: none"> <li>• The comprehensive environmental, economic, social and cultural impacts of the Project</li> <li>• What properties and how much property will be affected? Privately owned or public property?</li> <li>• What will they get in return?</li> <li>• How will the losses be compensated or the impacts be mitigated?</li> <li>• Where will they be resettled?</li> <li>• How will their livelihoods be affected by the Project?</li> <li>• Who are the main people responsible or the people or organizations to contact in case compensation or mitigations measures are unsatisfactory?</li> <li>• Can they take part in the Project as workers or some other capacity?</li> <li>• What will be their sources of income after the Project?</li> <li>• Will they still be able to continue their existing ways of life or livelihoods?</li> </ul>
<b>Indirectly affected people</b> (i.e. non-displaced PAPs: who are in the same communities as some of the directly affected people, or who share the Nam Ngiep basin	(-) (+)	2	<ul style="list-style-type: none"> <li>• What will be the impacts of the Project?</li> <li>• Can they be certain there will be no direct impacts to them?</li> <li>• Will they also have the right to participate in the development programs or other activities of the Project that can provide benefits?</li> <li>• Is there any chance for them to be hired to work for the Project?</li> <li>• What will be their livelihoods with the Project?</li> <li>• Will they still be able to continue their existing ways of life or livelihoods?</li> </ul>
<b>Labourers and other staff</b>	(+)	3	<ul style="list-style-type: none"> <li>• Good living conditions in the workers camp and good facilities</li> <li>• Adequate protection in hazard prone areas or protection from hazardous materials</li> <li>• Sufficient training for the assigned tasks</li> </ul>

<b>Village Organizations:</b> <ul style="list-style-type: none"> <li>• Village Headman and Deputy</li> <li>• Village Security</li> <li>• Police</li> <li>• Health Volunteers</li> <li>• Lao Youth</li> <li>• Lao Women Union</li> <li>• Front for National Construction</li> </ul>	(-) (+)	1	<ul style="list-style-type: none"> <li>• Continuation of existing organizational arrangements at the new resettlement sites</li> <li>• Boundaries and land use of the new villages</li> <li>• Land reallocation criteria and fair application of the criteria</li> <li>• Management of newly introduced development projects</li> <li>• Priority of participation in the newly introduced development projects or activities</li> <li>• Ability to be the first line of approach for Grievance Procedures</li> </ul>
<b>Secondary Stakeholders</b>			
<b>Developers:</b> <ul style="list-style-type: none"> <li>• NNP1</li> <li>• EGAT</li> <li>• KANSAI</li> <li>• LHSE</li> </ul>	(+)	1	<ul style="list-style-type: none"> <li>• Costs</li> <li>• The most economical and practical process</li> <li>• The fastest way to implement the plan efficiently</li> <li>• Efficient and effective communication with stakeholders</li> <li>• Investment profit and positive image</li> <li>• Ability to meet loan and legal requirements of GOL and Lenders</li> </ul>
<b>Development Lenders:</b> ADB and JBIC + Banks adhering to Equator Principles (Development Banks)	(+)	1	<ul style="list-style-type: none"> <li>• Reduce poverty among APs and promote national development of Lao PDR</li> <li>• The Project is implemented according to approved plans and Concession Agreement</li> <li>• Affected people are adequately compensated</li> <li>• Integration of the Project into the overall plans and policies of the banks</li> <li>• Assure compliance with social and environmental safeguards to protect people, flora, fauna, and environment in the Project area</li> <li>• Managing reputational risk to the Banks based on sound project planning and implementation</li> </ul>
<b>Commercial Lenders:</b> Different commercial banks from Thailand and other countries	(+)	1	<ul style="list-style-type: none"> <li>• Dividends</li> <li>• Continuing repayment of debts</li> <li>• Reputation from being involved in a development project</li> <li>• Avoidance of bad publicity due to project controversies</li> </ul>



<b>Government of Lao PDR</b> via various line ministries: <ul style="list-style-type: none"> <li>• Prime Minister's Office</li> <li>• MONRE</li> <li>• MAF</li> <li>• Ministry of Communication, Transport, Post and Construction</li> <li>• Ministry of Industry and Handicrafts</li> <li>• DOE</li> <li>• Ministry of Labour and Social Welfare</li> <li>• Ministry of Information and Culture</li> <li>• Ministry of Education</li> <li>• Ministry of Health</li> </ul>	(+)	1	<ul style="list-style-type: none"> <li>• Integration of the Project into the National Development Plan 2010-2015 and the Millennium Development Goals</li> <li>• Implementation of activities according to the Concessions Agreement</li> <li>• Sustainability of positive developments</li> <li>• Budget in-flows</li> <li>• Development of infrastructure</li> <li>• Technology transfers</li> <li>• Minimizing environmental and social impacts</li> <li>• Benefits to the local people, distributed thoroughly and evenly</li> <li>• Effective communication between the Project, GOL authorities, provincial and district counterparts, and affected people</li> <li>• Involvement of district and provinces in Project implementation</li> </ul>
<b>GOL Authorities at Provincial Level:</b> Vientiane Province, Xaysomboun Province, Bolikhamxay Province	(-) (+)	3	<ul style="list-style-type: none"> <li>• Integration of Project and its elements into provincial development plans</li> <li>• Selection and management of personnel required to help implement and/or monitor the Project</li> </ul>
<b>GOL Authorities at District Level:</b> Hom District, Bolikhan District, Pakxan District, Thaphabath District, Pak Ngum District, Thathom District	(-) (+)	1	<ul style="list-style-type: none"> <li>• Integration of Project and its elements in district development plans</li> <li>• Selection and management of personnel required to help implement and/or monitor the Project</li> <li>• Benefit to the district and local people</li> <li>• Land use and land reallocation, as well as issuance of legal tenure documents</li> </ul>
<b>External Stakeholders</b>			
<b>NGOs and other external stakeholders</b>	(-) (+)	3	<ul style="list-style-type: none"> <li>• Impacts on environment within Nam Ngiep watershed</li> <li>• Impacts on environment of the Mekong River</li> <li>• Impacts of the Project on local people and the Lao PDR</li> <li>• Issues of culture, gender, ethnicity, etc.</li> <li>• Compliance with IFI safeguards policies</li> </ul>
<b>Media</b>	(-) (+)	3	Accompanying hydropower development in Mekong sub-region and disclose information to a global public, including the national audiences of developers

Source: REDP 2014, P.180

## Annex 2: Record of Consultation and Information Disclosure Activities

**Table 2-1 Record of Previous Consultation Activities**

Stakeholder Group	Date	Description of Consultations	Participants	Content
Zone 2UR villages: Villagers, village authorities	2007	Household and village survey at 3 villages	All households	Data collection for ESIA Draft
	July 2011	Household and village survey at 3 villages	All households	Data collection for ESIA Draft
	October 2, 2011	Consultation Meeting at Ban Pou	PAPs: 181; GOL: 5; NNP1: 7; Consultants: 8	Information on updated ESIA reports and PAP's suggestions; focus-group-discussions have been conducted, too
	October 3, 2011	Consultation Meeting at Hatsamkhone	PAPs: 100; GOL: 5; NNP1: 7; Consultants: 8	
	October 3, 2011	Consultation Meeting at Ban Piengta	PAPs: 72; GOL: 5; NNP1: 7; Consultants: 8	
	December 08, 2012	Focus Group Discussions at Ban Pou	Groups of 5-10 people	Ideas of development of women, youth, and elders and input and requests towards the Project
	December 09, 2012	Focus Group Discussions at Ban Hatsamkhone		
	December 11, 2012	Focus Group Discussions at Ban Piengta		
	August 13, 2013	Village Consultation Meeting at Ban Pou	PAPs:109 ; GOL: 2; NNP1: 6	Presentation of Project structure; entitlements; GRM; discussions on entitlements; decision to relocate within village boundaries and support project; BCS Agreements and request to the Project;
	August 14, 2013	Village Consultation Meeting at Ban Hatsamkhone	PAPs:70 ; GOL: 2; NNP1: 6	
	August 15, 2013	Village Consultation Meeting at Ban Piengta	PAPs: 89; GOL: 2; NNP1: 6	
	March/ April 2014: Several meetings including focus group discussions	Start of continuing work of the Community Consultations Team in Pou, Hatsamkhone, and Piengta	NNP1PC, Villagers	Disclosure and discussions of DEM 2UR, options of livelihood planning
	Zone 2LR villages: villagers, village authorities	31 Oct 2007	Consultation meeting in Sop Youak village	62 PAPs, 9 GOL, 5 NNP1, 5 Consultants
16 Sep 2011		Consultation Meeting at Namyouak	124 PAP, GOL, 7 NNP1, 9 Consultants	Information on updated ESIA reports and PAP's suggestions; focus-group-discussions have been conducted, too
17 Sep 2011		Consultation Meeting at Sopyouak	92 PAP, 2 GOL, 7 NNP1, 9 Consultants	
18 Sep 2011		Consultation Meeting at Sopphuane	34 PAP, 1 GOL, 7 NNP1, 9 Consultants	

Stakeholder Group	Date	Description of Consultations	Participants	Content
	19 Sep 2011	Consultation Meeting at Houaypamom	130 PAP, 3 GOL, 7 NNP1, 8 Consultants	
	4-7 Mar 2012	Consultation Meetings at 4 villages	171	Discussion of Project and GOL answers of 12 questions raised by 2LR villagers
	May 2012	Informal Meetings, with lenders at 4 villages		
	31 Aug 2013	Consultation Meeting at Namyouak	118	Presentation of Project structure; entitlements; GRM; discussions on entitlements and RAP; Broad Community Support Agreements and request to the Project.
	1 Sep 2013	Consultation Meeting at Sopphuane	79	
	2 Sep 2013	Consultation Meeting at Houaypamom	51	
	3 Sep 2013	Consultation Meeting at Sopyouak	100	
	3 Sep 2013	Consultation with elders of all 4 villages	About 40, incl. NNP1, elders and additional villagers	Discussion of Project timeline and next steps
	4-5 Dec 2013	Participation at Hmong New Year	NNP1PC, Villagers and representatives	Informal discussions on Project development
Mar 2014	Start of continuing work of the Community Consultations Team in the villages	NNP1PC, Villagers	Discussions of Entitlements, options of resettlement, resettlement and livelihood planning	
Zone 3: Villagers, Village Authorities	Jul 2011	Household and village survey at Hatsaykham	All households included	Data collection for ESIA Draft
	25 Sep 2011	Consultation Meeting at Hatsaykham	77 PAP, 1 GOL, 6 NNP1, Consultants	Information on updated ESIA reports and PAP's suggestions; focus-group-discussions have been conducted, too; PAPs of Z3 requested to resettle to Houay Soup
	May 2012	Informal Meetings, with lenders at Hatsaykham		
	13-14 Nov 2012	Focus Group Discussions at Hatsaykham	Groups of 5-10 people	Ideas of development of women and elders and input and requests towards the Project
	18 Dec 2013	Village Consultation Meeting	NNP1PC, RMU, villagers of Hatsaykham and Hat Gniun	Entitlements, Grievance Redress Mechanism, Access Road Development
	Mar 2014	Start of continuing work of the Community Consultations Team in the villages	NNP1PC, Villagers	Discussions of Entitlements, options of resettlement, resettlement and livelihood planning
Zones 4 and 5: Villagers, Village	29 Oct 2007	Consultation Meeting at Ban Hat Gniun	30 PAP, 11 GOL, 3 NNP1, Consultants	Broad consultation on environmental and social mitigation measures

Stakeholder Group	Date	Description of Consultations	Participants	Content
Authorities	26 Sep 2011	Consultation Meeting at Hat Gniun	54 PAP, 3 GOL, 6 NNP1, 8 Consultants	Information on updated ESIA reports and PAPs' suggestions; focus-group-discussions have been also conducted.
	26 Sep 2011	Consultation Meeting at Thahuea	51 PAP, 3 GOL, 6 NNP1, 8 Consultants	
	May 2012	Informal Meetings, with lenders at and Hat Gniun		
	14-15 Nov 2013	Focus Group Discussions at Hat Gniun	Groups of 5-10 people	Ideas of development of women and elders and input and requests towards the Project
	15 Nov 2013	Focus Group Discussions at Thahuea	Groups of 5-10 people	Ideas of development of women and input and requests towards the Project
	17 Dec 2013	Village Consultation Meeting	NNP1PC, RMU, villagers of Nonsomboun and Sisavath	Entitlements, Grievance Redress Mechanism, Access Road Development
	March/ April 2014: Several meetings including focus group discussions	Start of continuing work of the Community Consultations Team in Pou, Hatsamkhone, and Piengta	NNP1PC, Villagers	Disclosure and discussions of DEM 2UR, options of livelihood planning

Source: EIA 2014, REDP 2014

**Table 2-2: Record of District and Province Consultation**

Stakeholder Group	Date	Description of Consultations	Participants	Content
Provincial and District Level: Bolikhamxay, Vientiane, and Xieng Khouang Provinces (not included is day-to-day cooperation with the RMU and DCC and related meetings) / now Xaysomboun Province with the districts of	January 16, 2008	Public Consultation at Bolikhan District	PAPs: 18; GOL: 32; NNP1: 9; Consultants: 10	Presentation and consultation on the development of ESIA documents
	January 18, 2008	Consultation and discussion at Hom District	PAPs: 16; GOL: 28; NNP1: 9; Consultants: 12	Presentation of first concepts of mitigation measures
	February 21, 2008	Consultation and discussion at Thathom District	PAPs: 13; GOL: 56; NNP1: 8; Consultants: 5	Collection of comments from the stakeholders participating in the meeting
	April 22, 2008	Consultation and discussion at Bolikhamxay Provinces	PAPs: 23; GOL: 31; NNP1: 9; Consultants: 30	Understanding of the proposed ESIA reports presented by the Consultancy Company hired by the Project
	April 24, 2008	Consultation and discussion at Xieng Khouang Provinces	PAPs: 43; GOL: 79; NNP1: 18; Consultants: 21	Collection of comments and proposals from the related agencies on the ESIA draft as well as suggested mitigation
	April 28, 2008	Consultation and discussion at Vientiane Provinces	PAPs: 22; GOL: 42; NNP1: 17; Consultants:	

Stakeholder Group	Date	Description of Consultations	Participants	Content
Pakxan, Bolikhan, Hom, and Thathom District			12	measures
	April 04, 2012	Consultation and discussion by Vientiane and Bolikhamxay Provinces	PAPs: 44; GOL: 38; NNP1: 29; Consultants: 3	Discussion of Project and GOL answers of 12 questions raised by 2LR villagers
	June 09, 2008	Consultation and discussion at Hom District	PAPs: 10; GOL: 9; NNP1: 1; Consultants: 8	Presentation and consultation on the development of ESIA documents
	June 12, 2008	Consultation and discussion at Pakxan District	PAPs: 14; GOL: 8; NNP1: 1; Consultants: 6	
	July 2, 2008	Consultation and discussion at Thathom District	PAPs: 18; GOL: 4; NNP1: 1; Consultants: 4	Presentation of first concepts of mitigation measures
	November 5, 2008	Consultation and discussion at Hom District	PAPs: 8; GOL: 16; NNP1: 1; Consultants: 7	Collection of comments from the stakeholders participating in the meeting
	January 10, 2014	PRLRC Meeting	PRLRC, NNP1PC	Discussion of Access Road Entitlements, Cut-off-date, Compensation Rates
	February 26, 2014	Consultation with the newly established Province of Xaysomboun	GOL incl. Provincial Governor, NNP1PC	Discussion of Project, Entitlements, Standards, and Procedures
	April 7, 2014	Consultation with the newly established PRLRC	PRLRC, NNP1PC	Resolution on Entitlements, Standards, Procedures, and Cut-Off-Date
District Level: Bolikhan, Pakxan, Hom, and Thathom Districts (not included is day-to-day cooperation with the DCCs and related meetings) and meetings with districts above	January 16, 2008	Public Consultation at Bolikhan District	PAPs: 18; GOL: 32; NNP1: 9; Consultants: 10	Presentation and consultation on the development of ESIA documents
	January 18, 2008	Consultation and discussion at Hom District	PAPs: 16; GOL: 28; NNP1: 9; Consultants: 12	Presentation of first concepts of mitigation measures
	February 21, 2008	Consultation and discussion at Thathom District	PAPs: 13; GOL: 56; NNP1: 8; Consultants: 5	Collection of comments from the stakeholders participating in the meeting
	June 09, 2008	Consultation and discussion at Hom District	PAPs: 10; GOL: 9; NNP1: 1; Consultants: 8	
	June 12, 2008	Consultation and discussion at Pakxan District	PAPs: 14; GOL: 8; NNP1: 1; Consultants: 6	
	July 2, 2008	Consultation and discussion at Thathom District	PAPs: 18; GOL: 4; NNP1: 1; Consultants: 4	
	November 5, 2008	Consultation and discussion at Hom District	PAPs: 8; GOL: 16; NNP1: 1; Consultants: 7	

Source: REDP 2014



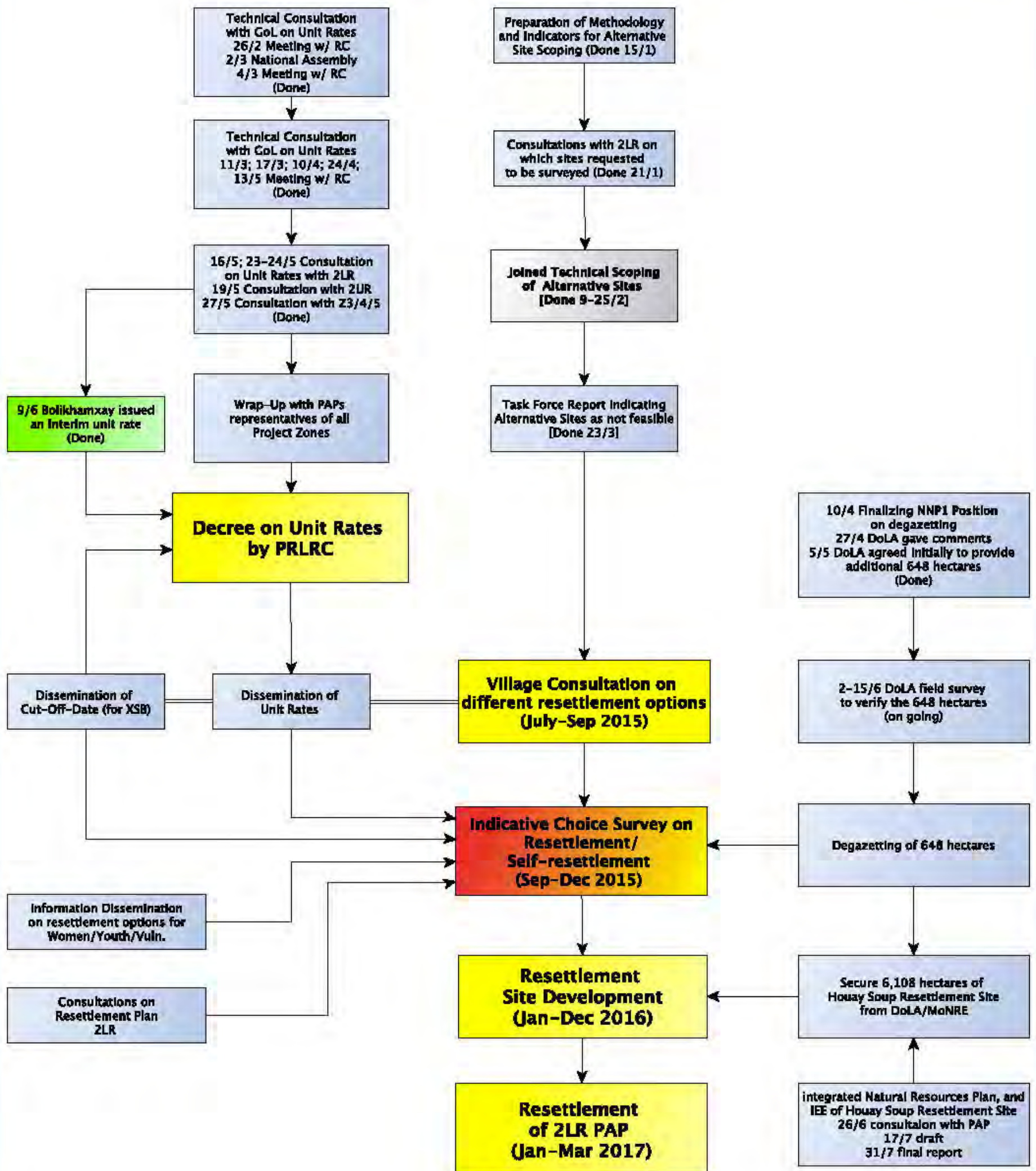
**Table 2-3 National Consultations**

Stakeholder Group	Date	Description of Consultations	Participants	Content
Central Level: Stakeholders including international Finance Institutes, MONRE, other GOL Organizations and Agencies, General Public, and NGOs.	May 2011	Consultation and discussion at Hom District	GOL, NNP1, ADB, IO's, Media	Presentation of the Project and initial results of the social document preparation
	July 2011	Technical Workshop and site visit to proposed resettlement site by MONRE		
	April 2012	National Consultation Meeting	GOL, PAP's, NNP1, Media	
	March 2014	ADB Audit Mission Access Road	ADB, PAP's along Access Road including Zones 3 and 5, GOL, NNP1	Discussion of implementation of LACP-AR, BCS
	April 2014	Site visit of the National Assembly	PAP's from Zones 2LR, 3 and 5, GOL, NNP1	Discussion of Resettlement Plans
	May 2014	ADB Due Diligence Mission	ADB, PAP's from Zones 2, 3 and 5, GOL, NNP1	Discussion of BCS and Social Documents
	May 7 2014 in Vientiane, May 9 in Paksan	2 Broad Stakeholder Forums incl. GOL, IO's, NGO's, NPA's, Press etc.	GOL, NNP1, ADB, IO's, NGO's, NPA's, Media	Disclosure of Draft Social Documents and discussion of Project impacts and social and environmental mitigation measures

Source: REDP 2014

## Annex 3: Flowchart for Resettlement Issues

# Flowchart on Resettlement Issues 2015 (update June 9, 2015)



## Annex 4: Feedback from PCD Activities during INRMP / IEE development

**Table 4-1 Feedback from PCD Activities during INRMP / IEE development**

Date	Consultation Activities	Feedback
<b>GOL Meetings</b>		
22/06/2015	Provincial IEE INRM consultation	A brief initial meeting was held with the Bolikhamxay Provincial Government in Paksan June 2015 to gain permission for conduct of INRMP field studies and discuss the plan with Provincial authorities.
18/08/2015	Provincial IEE HSRA consultation	<p>Meeting was conducted with the Deputy Director of the Provincial Department of Natural Resources and Environment (PONRE) in Paksan. The Deputy Director of PONRE appreciated the need for fieldwork to be conducted and assigned three officials, one from PONRE and two from DONRE, to accompany the field survey team to the villages.</p> <p>Key comments made by the Deputy Director of PONRE included:</p> <ul style="list-style-type: none"> <li>• The land capability assessment and zoning is an integral part of the HSRA development and so requires proper detailed planning;</li> <li>• The consultation team shall present only issues related to the HSRA development and should not discuss any issues related to compensation as it is sensitive before the compensation rates are announced;</li> <li>• The number of resettled households from 2LR villages is still unclear;</li> <li>• NNP1 and ADB shall not worry about land acquisition (conversion of PFA) for the HSRA development because the GOL needs to know the exact number of resettled people and then will allocate the land later;</li> <li>• DONRE (Land Management Unit and Forest Resource Management Unit) is fully involved in land use planning and land titling for the HSRA once the resettlement starts. The PONRE will partly involve but just to oversee the activities.</li> </ul>
19/08/2015	District consultation in Bolikhan district, Bolikhamxay Province	<p>Formal consultation was conducted with representatives from Bolikhan District and Provincial Departments. Key comments during the consultation include:</p> <ul style="list-style-type: none"> <li>• Concerns over compensation for those who owns many plots of upland area – will NNP1 compensate them all and how land/asset registration will be done;</li> <li>• Land use zoning and land demarcation should be completed prior to resettlement takes place to avoid PAPs encroach forests for slash and burnt cultivation in other areas;</li> <li>• Allocation of lowland rice fields to PAPs shall be implemented after completion of agricultural land development. Specific terms and conditions for agricultural land development shall be identified ( for example: contractor shall remain topsoil during land development) in the contract;</li> <li>• Agricultural land improvement will need to be implemented in accordance with techniques recommended by agriculture experts – both from GOL departments and external specialists;</li> <li>• Equitable assistance must be provided to both PAPs as well as host communities regarding livelihood restoration and support;</li> <li>• Participatory land use planning with PAPs and host communities is very important and this exercise needs to be carried out once People move in the HSRA. It is also recommended to include land improvement techniques in the Report;</li> <li>• Land for land should be prioritized for the loss of land of the host villages. Cash compensation should be the last option;</li> <li>• Concerns over agricultural land allocation per households in the HSRA. We need to consider the area, soil fertility and productivity;</li> <li>• It is recommended that NNP1 shall have water resource management plan because water is scare during dry season in the HSRA and to ensure long term water supply for the people;</li> <li>• It would be good if the INRMP identify potential areas for village aquatic preservation;</li> <li>• Residential and agricultural land allocation must be done properly with documents to avoid land conflicts. It is recommended that a temporary land documents will be given to PAPs without tax payment for three years during their transition and after that permanent land titles can be issued for them.</li> </ul>

24/08/2015	District consultation in Hom district, Xaysomboun Province	<p>The HSRA development consultation meeting with Hom district and Provincial authorities was held on 24th August 2015 in Hom District Meeting room. There were six participants from district offices and two officials from PONRE attended the meeting. Key contents discussed during the consultation meeting are:</p> <ul style="list-style-type: none"> <li>• It is recommended that NNP1 presents the final IEE, INRMP reports, and infrastructure development plan to relevant GOL agencies for their information and implementation. The reports and plan should be translated in Lao language;</li> <li>• The social and environmental management and monitoring plans (including forest, biodiversity and land management) for the HSRA should be relevant and applicable to the local context especially Hmong's culture and lifestyle. The Hmong people are specialized and prefer upland cultivation without using chemicals and fertilizers for improving crop yields. However, many people experienced cultivating in the HSRA in the past and they were not satisfied with the outputs because of poor soil quality. So it is important that NNP1 needs to build trust amongst the resettlers that there will be a sustainable agriculture development in the HSRA;</li> <li>• The land use plan and infrastructure development plan for the HSRA must be designed and implemented in consultation with resettled people. The local GOL wants to see all plans and reports of the HSRA development for their information and implementation with NNP1;</li> <li>• The proposed lowland rice area would not be sufficient if all PAPs from the Zone 2LR and Ban Hatsaykham resettle to the HSRA.</li> </ul> <p>The district assigned two district officials to accompany the consultation team to the 2LR villages.</p>
<b>Village Consultations</b>		
22-23/06/2015	Village consultations / LKS in Ban Somseun, Ban Hat Gniun and Ban Hatsaykham	<p>Consultations were held with Somseun, Hat Gniun and Hatsaykham to inform them of the INRM field studies, gain feedback on current use and future planning of the HSRA and to source village guides to assist with navigation on the HSRA. Information obtained during these consultations is contained in the INRM plan and the HSRA IEE.</p>
20-21/08/2015	Village consultations in Ban Somseun, Ban Hat Gniun and Ban Hatsaykham	<p>The consultations at Ban Hatsaykham had 37 participants including 12 females. Key comments from Ban Hatsaykham include:</p> <ul style="list-style-type: none"> <li>• The development of access road to the HSRA – NNP1 should design and build permanent bridge crossing Houay Soup Noy not temporary bridge;</li> <li>• NNP1 should consider recommendations from villagers and incorporate them in the design and planning of infrastructure. Bad experience with the design of the Houay Say Bridge is obvious where the villagers suggested to install larger size culvert but the engineer did not listen to them. This cause overflow of water during heavy rain and flooding;</li> <li>• Land levelling for residential site in the HSRA has to be done properly to avoid issues related to stormwater and drainage.</li> </ul> <p>The Ban Hat Gniun consultation included 61 villagers (39 females). Key issues and comments are summarized below:</p> <ul style="list-style-type: none"> <li>• All village participants acknowledged that the participatory land use planning is very important not only with the PAPs but also the host communities who are currently use the land in the HSRA;</li> <li>• Many households ceased cultivation in the HSRA since last year as they were told if they do they would not receive compensation;</li> <li>• It would be good if NNP1 and GOL provide land for land compensation;</li> <li>• Many people worry that they will not be allowed to access the HSRA for collection of NTFPs/TFPs and food stuffs after the resettlement;</li> <li>• NNP1 should consider more development assistance to the village. Currently, the village wants to establish a village market and would request NNP1 to help clear the land for the marketplace;</li> <li>• People concern over increased pressure on natural resources where it provides food and income for the villagers.</li> </ul> <p>A village consultation meeting for Ban Somseun was held on 19th August 2015. There were 31 villagers attended with 13 females. After Project presentation, focus group discussion was conducted for men and women's groups. Key comments are summarized below:</p>



		<ul style="list-style-type: none"> <li>• Villagers who own agricultural land in the HSRA stopped cultivation in their lands few years ago as they were told not to do so. This affected a number of households who don't have land outside the HSRA;</li> <li>• Any notification about the NNP1's Project was not written document. Project's information was disseminated orally by Project staff and local officials, for example order to stop cultivation in the HSRA. This bring about the effectiveness of the messages and notification.</li> <li>• Land for land compensation is the most preferable mode of compensation but it needs to consider soil fertility, accessibility and availability of the land in other areas;</li> <li>• Ban Somseun and Ban Hat Gniun lose agricultural land in the HSRA but will not get compensation like Ban Hatsaykham. So NNP1 shall provide livelihood development assistance to those who lose agricultural land.</li> </ul>
25-26/08/2015	Village consultations in Ban Namyouak, Ban Sopyouak, Ban Sopphuane and Ban Houaypamom	<p>Ban Namyouak (25<sup>th</sup> August 2015)</p> <p>The IEE consultation and information disclosure had approximately 59 people (19 women). Their general perspectives towards the HSRA is negative. The following summaries are opinions of the people expressed during the meeting towards the HSRA development:</p> <ul style="list-style-type: none"> <li>• Most of the villagers will not move to the HSRA as they believe that:             <ul style="list-style-type: none"> <li>○ The soil is not fertile and so not suitable for cultivation;</li> <li>○ The land is not sufficient for all the resettlement people if they relocate to the HSRA;</li> <li>○ People fear of being neglected by the Project and GOL after few years of resettlement;</li> </ul> </li> <li>• NNP1 can plan and develop the HSRA for the PAPs but the villagers will not guarantee to resettle in the designated resettlement area;</li> <li>• The villagers proposed to resettle to Nam Choy area in Thathom district where soil is more suitable for cultivation but this was rejected by the Project and the GOL. The Project and the GOL insisted to select the HSRA as the designated resettlement site without good reasons and explanations given to the PAPs;</li> <li>• Many people don't want to relocate to the HSRA but they were not given better options rather than self-resettlement without future livelihood support from the Project;</li> <li>• Few households may be interested to resettle to the HSRA but will have to wait and see the first phase of resettlement of Ban Hatsaykham;</li> </ul> <p>Ban Sopyouak (25<sup>th</sup> August 2015)</p> <p>There were 52 people with 15 females in attendance for the consultation meeting. Key comments from group discussions are:</p> <ul style="list-style-type: none"> <li>• It can be expected that only 20% of the villagers will relocate to the HSRA and the rests will prefer living in adjacent to their current village location above flooding area;</li> <li>• NNP1 should not allocate too much budget on development of the HSRA infrastructure but rather give high compensation to the PAPs so that they are more resilient for self-resettlement;</li> <li>• Currently, NNP1 does not provide tangible benefits to the PAPs. Very little livelihood support is being provided only for few households so many people are afraid that when they relocate to the HSRA they will receive the same level of support from the NNP1;</li> <li>• The soil improvement technique for agriculture should be done in a proper way. Application of chemical fertilizers in agriculture is not preferable for the Hmong people as it costs a lot of money;</li> <li>• People heard bad stories of resettlement from some of hydropower projects and they are afraid that they would encounter similar circumstances if they move to the HSRA;</li> <li>• The villager people feel regret that they have to lose their productive farmlands where they harvested since generations.</li> </ul> <p>Ban Sopphuane (26<sup>th</sup> August 2015)</p> <p>A total of 23 people with 8 females participated in the village consultation. Key discussion topics during the consultation are:</p> <ul style="list-style-type: none"> <li>• The villagers are happy with the design and planning of infrastructure and land use zoning in the HSRA but people concern about the suitability of the soil for agriculture;</li> </ul>

		<ul style="list-style-type: none"> <li>• Currently, about 3-4 households expressed interest to relocate in the HSRA while the remaining households will prefer self-resettlement in nearby current village location;</li> <li>• NNP1 shall consider alternative resettlement sites. People suggested two relocation sites in Nam Choy are and another area in Boualapha district, Khammouane province but all of these proposals were rejected by the Project and GOL;</li> </ul> <p>A village consultation for Ban Houaypamom was organized on 26th August 2015 to discuss on the IEE for the HSRA development and INRMP especially on the preliminary land use planning. There was a total 41 villagers with 25 women participated the meeting. Key comments discussed during the meeting are:</p> <ul style="list-style-type: none"> <li>• Land allocation for the resettlers must be conducted properly with documents to secure their use rights. This will prevent land conflicts amongst the new resettlers as well as between the resettlers and the host villages who are currently using the land;</li> <li>• Many people heard about negative narratives of the HSRA particularly on poor soil quality for cultivation but not many villagers experience by themselves;</li> <li>• The villagers agree with all infrastructure development plans such as houses, public services, and agricultural infrastructure but these are not as important as soil quality for productive cultivation;</li> <li>• Although some families will resettle in the HSRA but they would come to cultivate in the current village location where the land is available;</li> <li>• The Project should allocate land to the villagers before resettlement takes place so that they can start planting crops which will take times to give them produce such as banana, pineapple, cassava, and among others. People worry that once they settle down in the HSRA, they will lack supplementary diets during the first few years;</li> </ul> <p>The villagers are afraid that they would be neglected after few years of resettlement. They concern that they would not receive continuous and sufficient support from NNP1 on livelihood development activities.</p>
<b>Exhibition</b>		
17/08/2015	Provincial Project Exhibition conducted in Paksan. HSRA IEE information presented / distributed	<p>NNP1 organized the HSRA development and Ban Hatsaykham exhibition on 17 August 2015 in Bolikhan District. The exhibition aimed to provide public information on HSRA development plan to local GOL officials, general public and civil society who were interested about the Project. The exhibition involved a display of conceptual design of HSRA development infrastructure, livelihood development activities, soil improvement techniques, and among others. A series of presentations were delivered to all participants which outlined the HSRA development, benefits and impacts, and importantly a clarification on terms and conditions for compensation.</p> <p>The exhibition was attended by representatives from:</p> <ul style="list-style-type: none"> <li>• NNP1 (SMO, EMO and TD);</li> <li>• Local GOL (Representatives from Bolikhan, Thaphabath, Thathom Districts and Bolikhamxay Provincial Departments); and</li> <li>• Villages (B. Hatsaykham, B. Hat Gniun, B. Thaheua, B. Nonsomboun, B. Sisavath, and 2UR villagers).</li> </ul>

Source: Earth Systems 2015

## Annex 5: Meeting Register

ສາທາລະນະລັດ ປະຊາທິປະໄຕ ປະຊາຊົນລາວ

ສັນຕິພາບ ເອກະລາດ ປະຊາທິປະໄຕ ເອກະພາບ ວັດທະນາຖາວອນ

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### **ບົດບັນທຶກກອງປະຊຸມປຶກສາຫາລືແບບເປີດກວ້າງຂັ້ນເມືອງ**

## **ກ່ຽວກັບການວາງແຜນການນໍາໃຊ້ທີ່ດິນ ແລະ ໂຄງລ່າງພື້ນຖານຕ່າງໆໃນເຂດຍົກຍ້າຍຈັດສັນຫ້ວຍສູບ ຂອງໂຄງການເຂື່ອນໄຟຟ້ານ້ຳງຽບ 1**

### **1. ຈຸດປະສົງ**

- ເພື່ອປຶກສາຫາລື, ແລກປ່ຽນຄໍາຄິດຄໍາເຫັນ ກ່ຽວກັບການວາງແຜນການນໍາໃຊ້ທີ່ດິນ ແລະ ໂຄງລ່າງພື້ນຖານຕ່າງໆໃນເຂດຍົກຍ້າຍຈັດສັນຫ້ວຍສູບ ຂອງໂຄງການເຂື່ອນໄຟຟ້ານ້ຳງຽບ 1
- ເພື່ອເຮັດໃຫ້ການວາງແຜນດັ່ງກ່າວ ສອດຄ່ອງກັບແຜນນະໂຍບາຍ ແລະ ຂໍ້ກຳນົດຂອງທ້ອງຖິ່ນ ສາມາດເຮັດໃຫ້ວຽກງານດັ່ງກ່າວຈັດຕັ້ງປະຕິບັດໄດ້ຕາມຄາດໝາຍທີ່ວາງໄວ້.
- ເພື່ອນໍາເອົາເນື້ອໃນຂອງການປຶກສາຫາລື ປະກອບເຂົ້າໃນບົດລາຍງານການວາງແຜນການນໍາໃຊ້ທີ່ດິນ ແລະ ໂຄງລ່າງພື້ນຖານຕ່າງໆໃນເຂດຍົກຍ້າຍຈັດສັນຫ້ວຍສູບ ຂອງໂຄງການເຂື່ອນໄຟຟ້ານ້ຳງຽບ 1.

### **2. ເນື້ອໃນ**

- ໃນຕອນເຊົ້າ ເວລາ 8:40 ຂອງວັນທີ 19 ສິງຫາ 2015 ທີ່ຫ້ອງປະຊຸມຫ້ອງການແຜນການ ເມືອງບໍລິຄັນ ແຂວງບໍລິຄໍາໄຊ. ກອງປະຊຸມປຶກສາຫາລືແບບເປີດກວ້າງຂັ້ນເມືອງ ກ່ຽວກັບການວາງແຜນການນໍາໃຊ້ທີ່ດິນ ແລະ ໂຄງລ່າງພື້ນຖານຕ່າງໆໃນເຂດຍົກຍ້າຍຈັດສັນຫ້ວຍສູບ ຂອງໂຄງການເຂື່ອນໄຟຟ້ານ້ຳງຽບ 1 ໂດຍມີຕ່າງໜ້າໜ່ວຍງານຄຸ້ມຄອງສັງຄົມ ຂອງບໍລິສັດໄຟຟ້ານ້ຳງຽບ 1, ບໍລິສັດທີ່ປຶກສາສິ່ງແວດລ້ອມ ເອິດຊິດສເຕີມ, ຫ້ອງການຊັບພະຍາກອນທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມ, ຫ້ອງວ່າການເມືອງ, ຫ້ອງການກະສິກຳ ແລະ ປ່າໄມ້ ແລະ ພາກສ່ວນຕ່າງໆທີ່ກ່ຽວຂ້ອງລວມທັງໝົດ 12 ທ່ານ.
- ພາຍຫຼັງທີ່ປຶກສາສິ່ງແວດລ້ອມ ແລະ ສັງຄົມ ບໍລິສັດເອິດຊິດສເຕີມ ຂຶ້ນນໍາສະເໜີ ຈຸດປະສົງ ແລະ ສະພາບລວມຂອງການວາງແຜນການນໍາໃຊ້ທີ່ດິນ ແລະ ໂຄງລ່າງພື້ນຖານຕ່າງໆໃນເຂດຍົກຍ້າຍຈັດສັນຫ້ວຍສູບ ຂອງໂຄງການເຂື່ອນໄຟຟ້ານ້ຳງຽບ 1, ທຸກພາກສ່ວນທີ່ເຂົ້າຮ່ວມກອງປະຊຸມ ໄດ້ປຶກສາຫາລື ແລະ ແລກປ່ຽນຄໍາຄິດຄໍາເຫັນດັ່ງລຸ່ມນີ້:
  - 1) ຫ້ອງວ່າການປົກຄອງເມືອງບໍລິຄັນ ເຫັນວ່າທີ່ຜ່ານມາ ແມ່ນມີຄວາມຫຍຸ້ງຍາກໃນການຈົດທະບຽນການນໍາໃຊ້ທີ່ດິນ ຄ່າຊົດເຊີຍທີ່ດິນປະຊາຊົນບ້ານເກົ່າ 1-5 ປີ ຈະເຮັດໃຫ້ໄດ້ບໍ່. ສະເໜີໃຫ້ມີແຜນກຳນົດຂອບເຂດຍົກຍ້າຍຈັດສັນຢ່າງຈະແຈ້ງ, ມີການຄຸ້ມຄອງ ແລະ ລະບຽບຫຼັກການຢ່າງຮັດກຸມ, ມີການປັກຫຼັກໝາຍເຂດ ແລະ ມີຄະນະການຄຸ້ມຄອງຄັກແນ່ ກ່ອນທີ່ຈະມີການຍົກຍ້າຍ ເພື່ອເປັນການຄວບຄຸມການຖາງປ່າເຮັດໄຮ່ຂອງປະຊາຊົນບໍ່ໃຫ້ຊະຊາຍ.

- 2) ຫ້ອງການກະສິກຳເມືອງ ສະເໜີວ່າ ໃຫ້ມີການປັບປຸງດິນທີ່ເປັນນາ ໃຫ້ໄຖຮຽບຮ້ອຍກ່ອນທີ່ຈະມີການຈັດສັນ ຍົກຍ້າຍປະຊາຊົນມາຢູ່ ແລະ ມີສັນຍາຮັດກຸມຢ່າງຄັກແນ່ ເພື່ອປ້ອງກັນການບຸກເບີກພື້ນທີ່ຂອງຜູ້ຮັບເໝົາລອກເອົາ ໜ້າດິນທີ່ທຳການຜະລິດໄປເຮັດຄູຄັນນາ ພື້ນທີ່ທຳການຜະລິດພັດເປັນດິນຫິນແຮ່ທີ່ປຸກເຂົ້າບໍ່ໄດ້.
- 3) ຮອງຫົວໜ້າພະແນກພະລັງງານ ແລະ ບໍ່ແຮ່ (ອາເອັມຢູ) ສະເໜີວ່າ
  - ໂຄງການໄດ້ມີງົບປະມານເພື່ອຮອງຮັບແລ້ວ. ຕໍ່ກັບການສູນເສຍດິນໜ້າດິນສຳລັບດິນປຸກຝັງຈາກຜູ້ ບຸກເບີກພື້ນທີ່ ສະເໜີໃຫ້ເຮັດຕາມເຕັກນິກວິຊາການຂອງກະສິກຳໄດ້ວາງອອກ ເຊັ່ນ ເບິ່ງພື້ນທີ່ດິນກ່ອນ.
  - ສິ່ງທີ່ສຳຄັນ ໃນການຫຼຸດຜ່ອນຜົນກະທົບທາງດ້ານສັງຄົມ ໃຫ້ແນະນຳທາງບໍລິສັດໄຟຟ້ານ້ຳງຽບ 1 ຕື່ມ ເພື່ອ ໃຫ້ປະຕິບັດໄປຕາມຂັ້ນຕອນເຕັກນິກຂອງກະສິກຳໃຫ້ລະອຽດ (ລົງເລິກຂັ້ນຕອນການພັດທະນາດິນ ກະສິກຳ ໂດຍການມີສ່ວນຮ່ວມຂອງປະຊາຊົນ).
  - ການເກັບກຳສະຖິຕິເສດຖະກິດ-ສັງຄົມໃຫ້ຮູ້ວ່າ ການທຳການຜະລິດຂອງປະຊາຊົນໄດ້ຫຼຸດລົງຫຼັງຈາກມີ ໂຄງການເກີດຂຶ້ນ.
- 4) ຫ້ອງການກະສິກຳ ໜ່ວຍງານຄຸ້ມຄອງທີ່ດິນ ສະເໜີ
  - ໃຫ້ມີການວາງແຜນທີ່ດິນໃຫ້ລະອຽດໂດຍການມີສ່ວນຮ່ວມຂັ້ນບ້ານ. ດີໃຈທີ່ໄດ້ມີການວິໄຈດິນ ແລະ ຮູ້ ວ່າຕ້ອງໄດ້ມີການປັບປຸງດິນ. ແນະນຳໃຫ້ມີການແນະນຳການປັບປຸງດິນເຂົ້າໃນບົດລາຍງານຕື່ມເພື່ອໃຫ້ ສົມບູນຂຶ້ນ.
  - ການຂຶ້ນສຳມະໂນຄົວທີ່ດິນກະສິກຳ ແມ່ນຕ້ອງໄດ້ເຮັດໄປຕາມຂັ້ນຕອນ ເຊັ່ນແຜນຍຸດທະສາດການນຳໃຊ້ ທີ່ດິນ 5 ປີຂອງກົມທີ່ດິນຈຸລະພາກວາງອອກ.
- 5) ຮອງຂະແໜງຄຸ້ມຄອງທີ່ດິນ ແຂວງ ສະເໜີວ່າ
  - ໃຫ້ຄົ້ນຄວ້າຕື່ມກ່ຽວກັບໂຕເລກຂອງທີ່ດິນທີ່ສະໜອງໃຫ້ກັບປະຊາຊົນເຂດຍົກຍ້າຍຈັດສັນບ້ານໃໝ່ ແລະ ສະເໜີໃຫ້ມີແຜນໃນການພື້ນຟູດິນຕື່ມ. ຕ້ອງມີໃບແຈ້ງທີ່ດິນໃນເບື້ອງຕົ້ນ
  - ສະເໜີເອົາງົບປະມານເຂົ້າໃນການອອກໃບຕາດິນ, ອາດຈະມີງົບປະມານສຳລັບທຶມງານເພື່ອປະກອບ ເອກະສານຕ່າງໆປະມານ 5-6 ຄົນ.
- 6) ພະແນກຊັບພະຍາກອນທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມ ສະເໜີໃຫ້ມີການວາງແຜນຂອງບໍລິສັດໃຫ້ຕິດພັນກັບການ ປ້ອງກັນສິ່ງແວດລ້ອມເຂົ້າຕື່ມ.
- 7) ກະສິກຳເມືອງສະເໜີທາງໂຄງການຊ່ວຍໃຫ້ສ້າງສູນວິໄຈດິນຫຼັງ 1 ເພື່ອຄົ້ນຄວ້າເລື່ອງບໍ່ດິນ, ມີຫ້ອງທົດລອງວິໄຈດິນ ແລະ ສູນສາທິດ.
- 8) ກອງເລຂາ
  - ສະເໜີໃຫ້ບໍລິສັດທີ່ປຶກສາຂຽນແຜນຄຸ້ມຄອງແຫຼ່ງນ້ຳໃຫ້ລະອຽດຕື່ມ ເນື່ອງຈາກວ່າຊັບພະຍາກອນ ແຫຼ່ງນ້ຳໃນເຂດຍົກຍ້າຍຈັດສັນຍັງມີໜ້ອຍ ແລະ ເພື່ອຮັບປະກັນໃຫ້ມີນ້ຳໃຊ້ຢ່າງພຽງພໍສຳລັບປະຊາຊົນທີ່ ຍົກຍ້າຍມາຢູ່ໃໝ່.



- ມາດຕະການຫຼຸດຜ່ອນທາງດ້ານສິ່ງແວດລ້ອມ ໃຫ້ມີການຈັດຕັ້ງປະຕິບັດໄປຕາມລະບຽບການ ແລະ ມີຜູ້ຮັບຜິດຊອບຄັກແນ່.
- ຖືຄວາມສໍາຄັນໃນການກຳນົດ ແລະ ຄຸ້ມຄອງເຂດວັງສະຫງວນໃຫ້ບ້ານ.
- ສະເໜີໃຫ້ບໍລິສັດຄົ້ນຄວ້າໃນການອອກໃບຕາດິນໃຫ້ສອດຄ່ອງກັບລະບຽບການຕ່າງໆໃຫ້ມີຄວາມຊັດເຈນ.
- ການມອບໃບແຈ້ງທີ່ດິນໃຫ້ກັບປະຊາຊົນ, ຖ້າບໍລິສັດບໍ່ມອບໃຫ້ ຈະມີການຊ່ວຍເສຍພາສີປະຈຳປີບໍ່ແທນປະຊາຊົນໄດ້ບໍ່.

9) ຫ້ອງການຊັບພະຍາກອນທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມເມືອງ

- ສະເໜີໃຫ້ມີການຈັດສັນກ່ອນທີ່ຈະມີການຍົກຍ້າຍ. ເວລາຈັດສັນຢາກໃຫ້ມີຂອບເຂດລະອຽດເພື່ອບໍ່ໃຫ້ມີການຂັດແຍ່ງກັນ ໂດຍສະເພາະດິນກະສິກຳ. ເວລາຈັດສັນແລ້ວ ສະເໜີໃຫ້ອອກສິດນຳໃຊ້ທີ່ດິນຊົ່ວຄາວກ່ອນທີ່ຈະອອກເປັນໃບແຈ້ງ ຫຼື ໃບຕາດິນ ເພື່ອຮັບປະກັນບໍ່ໃຫ້ມີການຊື້ຂາຍ ຫຼື ໂອນຕໍ່ແບບບໍ່ຖືກຕ້ອງ. ຕໍ່ຜູ້ທີ່ມີການປະກອບເອກະສານດັ່ງກ່າວແລ້ວ, ເມື່ອຄົບກຳນົດ (ເຊັ່ນ 3 ປີ) ກໍສາມາດເລີ່ມເກັບພາສີໄດ້. ຫຼັງຈາກອອກເອກະສານແລ້ວ ແນະນຳໃຫ້ອອກສຳມະໂນ ເພື່ອອໍານວຍຄວາມສະດວກໃນການເກັບກຳຂໍ້ມູນໃຫ້ຊັດເຈນໃນການນຳໃຊ້ທີ່ດິນຕົວຈິງ.
- ສຳລັບການກຳນົດຂອບເຂດ ສະເໜີໃຫ້ມີການເຜີຍແຜ່ນິຕິກຳຕ່າງໆກ່ອນເຂົ້າໄປຢູ່ເພື່ອບໍ່ໃຫ້ແຕະຕ້ອງກັບດິນຂອບເຂດອື່ນ ເພື່ອໃຫ້ປະຊາຊົນຮັບຮູ້ ເນື່ອງຈາກວ່າກົດໝາຍທີ່ກ່ຽວຂ້ອງຍັງບໍ່ເປັນທີ່ຮັບຮູ້ກັນເທື່ອສຳລັບບ້ານທີ່ຢູ່ຫ່າງໄກ (ບ້ານເປົ້າໝາຍຂອງໂຄງການ).

3. ສະຫຼຸບ

ຜ່ານການປຶກສາຫາລື, ແລກປ່ຽນຄຳຄິດຄຳເຫັນຂອງກອງປະຊຸມໃນຄັ້ງນີ້ ທຸກພາກສ່ວນທີ່ກ່ຽວຂ້ອງໄດ້ຕົກລົງເຫັນດີເປັນເອກະພາບກັນ ກ່ຽວກັບການວາງແຜນການນຳໃຊ້ທີ່ດິນ ແລະ ໂຄງລ່າງພື້ນຖານຕ່າງໆໃນເຂດຍົກຍ້າຍຈັດສັນຫ້ວຍສູບຂອງໂຄງການເຂື່ອນໄຟຟ້ານ້ຳງຽບ 1 ເພື່ອເຮັດໃຫ້ວຽກງານດັ່ງກ່າວສາມາດຈັດຕັ້ງປະຕິບັດໃຫ້ປະສິບຜົນສຳເລັດຕາມແຜນທີ່ໄດ້ກຳນົດໄວ້.

ທີ່ເມືອງບໍລິຄັນ, ວັນທີ 19/08/2015.

ຫ້ອງວ່າການປົກຄອງເມືອງບໍລິຄັນ



ຜູ້ບັນທຶກກອງປະຊຸມ

ຜູ້ຈັດຕາ

Registration Form (ຟອມລົງທະບຽນ)

ເມັງ ບໍລິສັດ

19-8-2015

	ຊື່ ແລະ ນາມສະກຸນ	ພາກສ່ວນ	ເບີຕິດຕໍ່	ລາຍເຊັນ
	1 ທ. ສິດທິ ຈະນະ ສາວົງ	ກະສິກໍາ-ບໍລິໂພກ	22118411	
	2 ມ. ພິດສະໄນ ກວິວິສາ	ແຜນຍຸດທະສາດ	99893619	
	3 ທ. ບໍ່ມີ ພິດສະໄນ	ພູ ແລະ ບໍ່ມີ	22815029	
	4 ທ. ສິດທິ ຈະນະ ສາວົງ	ຊື່ ພິດສະໄນ	86376544	
	5 ທ. ສິດທິ ຈະນະ ສາວົງ	ບໍລິຫານ ຈັບເມັງ	22105031	
A	6 ທ. ສິດທິ ຈະນະ ສາວົງ	ຝະ ນາ ຊື່ ສ. 2	82339739	
	7 ທ. ສິດທິ ຈະນະ ສາວົງ	ສາບ, ບອ	95514888	
	8 ທ. ສິດທິ ຈະນະ ສາວົງ	ບໍລິຫານ ຈັບເມັງ	22889992	
	9 ທ. ສິດທິ ຈະນະ ສາວົງ	Yulstam (SMO)	2288650	
	10 ທ. ສິດທິ ຈະນະ ສາວົງ	RMU (BLX)	51540919	
A	11 ທ. ສິດທິ ຈະນະ ສາວົງ	ພາກສ່ວນ	22822951	
A	12 ທ. ສິດທິ ຈະນະ ສາວົງ	ບໍລິຫານ	94942122	
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ສາທາລະນະລັດ ປະຊາທິປະໄຕ ປະຊາຊົນລາວ  
ສັນຕິພາບ ເອກະລາດ ປະຊາທິປະໄຕ ເອກະພາບ ວັດທະນາຖາວອນ

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## ບົດບັນທຶກກອງປະຊຸມປຶກສາຫາລືແບບເປີດກວ້າງຂັ້ນເມືອງ

ກ່ຽວກັບການວາງແຜນການນໍາໃຊ້ທີ່ດິນ ແລະ ໂຄງລ່າງພື້ນຖານຕ່າງໆໃນເຂດຍົກຍ້າຍຈັດສັນຫ້ວຍສູບ  
ຂອງໂຄງການເຂື່ອນໄຟຟ້ານ້ຳງຽບ 1

### 1. ຈຸດປະສົງ

- ເພື່ອປຶກສາຫາລື, ແລກປ່ຽນຄໍາຄິດຄໍາເຫັນ ກ່ຽວກັບການວາງແຜນການນໍາໃຊ້ທີ່ດິນ ແລະ ໂຄງລ່າງພື້ນຖານຕ່າງໆໃນເຂດຍົກຍ້າຍຈັດສັນຫ້ວຍສູບ ຂອງໂຄງການເຂື່ອນໄຟຟ້ານ້ຳງຽບ 1
- ເພື່ອເຮັດໃຫ້ການວາງແຜນດັ່ງກ່າວ ສອດຄ່ອງກັບແຜນນະໂຍບາຍ ແລະ ຂໍ້ກຳນົດຂອງທ້ອງຖິ່ນ ສາມາດເຮັດໃຫ້ວຽກງານດັ່ງກ່າວຈັດຕັ້ງປະຕິບັດໄດ້ຕາມຄາດໝາຍທີ່ວາງໄວ້.
- ເພື່ອນໍາເອົາເນື້ອໃນຂອງການປຶກສາຫາລື ປະກອບເຂົ້າໃນບົດລາຍງານການວາງແຜນການນໍາໃຊ້ທີ່ດິນ ແລະ ໂຄງລ່າງພື້ນຖານຕ່າງໆໃນເຂດຍົກຍ້າ
- ຍຈັດສັນຫ້ວຍສູບ ຂອງໂຄງການເຂື່ອນໄຟຟ້ານ້ຳງຽບ 1.

### 2. ເນື້ອໃນ

- ໃນຕອນບ່າຍ ເວລາ 14:00 ຂອງວັນທີ 24 ສິງຫາ 2015 ທີ່ຫ້ອງປະຊຸມ ຂອງຫ້ອງວ່າການປົກຄອງເມືອງ ເມືອງ ຮົ່ມ ແຂວງ ໄຊສົມບູນ. ກອງປະຊຸມປຶກສາຫາລືແບບເປີດກວ້າງຂັ້ນເມືອງ ກ່ຽວກັບການວາງແຜນການນໍາໃຊ້ທີ່ດິນ ແລະ ໂຄງລ່າງພື້ນຖານຕ່າງໆໃນເຂດຍົກຍ້າຍຈັດສັນຫ້ວຍສູບ ຂອງໂຄງການເຂື່ອນໄຟຟ້ານ້ຳງຽບ 1 ໄດ້ໄຂຂຶ້ນຢ່າງເປັນທາງການ ໂດຍມີ ຜູ້ຕາງໜ້າຈາກ ພະແນກຊັບພະຍາກອນທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມ, ຫ້ອງວ່າການປົກຄອງເມືອງ, ຫ້ອງການຊັບພະຍາກອນທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມ, ຫ້ອງການກະສິກຳ ແລະ ປ່າໄມ້, ຫ້ອງການ ພະລັງງານ ແລະ ບໍ່ແຮ່, ຫ້ອງການ ແຜນການ ບໍລິສັດທີ່ປຶກສາສິ່ງແວດລ້ອມ ເອີດຊິດສເຕີມ ເຂົ້າຮ່ວມລວມທັງໝົດ 10 ທ່ານ.
  - ພາຍຫຼັງທີ່ປຶກສາສິ່ງແວດລ້ອມ ແລະ ສັງຄົມ ບໍລິສັດເອີດຊິດສເຕີມ ຂຶ້ນນໍາສະເໜີ ຈຸດປະສົງ ແລະ ສະພາບລວມຂອງການວາງແຜນການນໍາໃຊ້ທີ່ດິນ ແລະ ໂຄງລ່າງພື້ນຖານຕ່າງໆໃນເຂດຍົກຍ້າຍຈັດສັນຫ້ວຍສູບ ຂອງໂຄງການເຂື່ອນໄຟຟ້ານ້ຳງຽບ 1, ທຸກພາກສ່ວນທີ່ເຂົ້າຮ່ວມກອງປະຊຸມ ໄດ້ປຶກສາຫາລື ແລະ ແລກປ່ຽນຄໍາຄິດຄໍາເຫັນດັ່ງລຸ່ມນີ້:
- 1) ສະເໜີໃຫ້ ທາງໂຄງການເຂື່ອນໄຟຟ້ານ້ຳງຽບ 1 ເຜີຍແຜ່ບົດລາຍງານ ການສຶກສາເບື້ອງຕົ້ນກ່ຽວກັບຜົນກະທົບຕໍ່ສິ່ງແວດລ້ອມ, ແຜນການນໍາໃຊ້ທີ່ດິນ ແລະ ໂຄງລ່າງພື້ນຖານຕ່າງໆໃນເຂດຍົກຍ້າຍຈັດສັນຫ້ວຍສູບ ໃຫ້ແກ່ໜ່ວຍງານທີ່ກ່ຽວຂ້ອງຂອງລັດ.

2) ຫ້ອງການຊັບພະຍາກອນທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມ ສະເໜີໃຫ້

- ທາງໂຄງການເອົາໃຈໃສ່ ແຜນຄຸ້ມຄອງ ສັງຄົມ, ແຜນພື້ນຟູ ເຂດປ່າປ້ອງກັນ, ແຜນຄຸ້ມຄອງ ຊີວະນາໆພັນ ແລະ ແຜນນຳໃຊ້ທີ່ດິນ ຢ່າງລະອຽດ. ເນື່ອງຈາກໃນໄລຍະຜ່ານມາປະຊາຊົນ ເຫັນວ່າພື້ນທີ່ທຳກິນໃນເຂດ ຫ້ວຍສູບແມ່ນບໍ່ອຸດົມບູນ ຈຶ່ງສະເໜີໃຫ້ທາງໂຄງການ ສ້າງຄວາມເຊື່ອໝັ້ນ ແລະ ສ້າງແຜນຄຸ້ມຄອງແບບ ຍືນຍົງໃນເຂດຫ້ວຍສູບໃຫ້ແກ່ປະຊາຊົນທີ່ຍົກຍ້າຍໄປຢູ່.
- ເອົາໃຈໃສ່ ແຜນການນຳໃຊ້ທີ່ດິນ ແລະ ໂຄງລ່າງພື້ນຖານຕ່າງໆໃນເຂດຍົກຍ້າຍຈັດສັນຫ້ວຍສູບ. ຫ້ວຍ ງານທີ່ຮັບຜິດຊອບ ຕ້ອງເຜີຍແຜ່ບົດລາຍງານດັ່ງກ່າວໃຫ້ ທາງພາກສ່ວນທີ່ກ່ຽວຂ້ອງຮັບຮູ້ ແລະ ຈັດຕັ້ງ ປະຕິບັດຕາມເຫັນສົມຄວນ.

3) ເຫັນວ່າ ເນື້ອທີ່ນຳໃຊ້ໃນເຂດຍົກຍ້າຍຈັດສັນຫ້ວຍສູບທີ່ຖືກຈັດສັນໄວ້ນັ້ນ ສົມທຽບເນື້ອທີ່ດິນໃສ່ຈຳນວນຄົວ ເຮືອນໃນ 4 ບ້ານ ເຫັນວ່າ ແມ່ນບໍ່ພຽງພໍສຳລັບ ປະຊາຊົນທີ່ຈະຍົກຍ້າຍໄປອາໄສຢູ່ໃນພື້ນທີ່ດັ່ງກ່າວ.

### 3. ສະຫຼຸບ

ຜ່ານການປຶກສາຫາລື, ແລກປ່ຽນຄຳຄິດຄຳເຫັນຂອງກອງປະຊຸມໃນຄັ້ງນີ້ ທຸກພາກສ່ວນທີ່ກ່ຽວຂ້ອງໄດ້ຕົກລົງ ເຫັນດີເປັນເອກະພາບກັນ ກ່ຽວກັບການວາງແຜນການນຳໃຊ້ທີ່ດິນ ແລະ ໂຄງລ່າງພື້ນຖານຕ່າງໆໃນເຂດຍົກຍ້າຍຈັດ ສັນຫ້ວຍສູບ ຂອງໂຄງການເຂື່ອນໄຟຟ້ານ້ຳງຽບ 1 ເພື່ອເຮັດໃຫ້ວຽກງານດັ່ງກ່າວສາມາດຈັດຕັ້ງປະຕິບັດໃຫ້ປະສິບ ຜົນສຳເລັດຕາມແຜນທີ່ໄດ້ກຳນົດໄວ້.

ທີ່ເມືອງ ຮົ່ມ, ວັນທີ 24/08/2015.

ຫ້ອງການປົກຄອງເມືອງຮົ່ມ



ຢ່າງປາວເຮີ ເຍ່ຍຮິວ

ຜູ້ບັນທຶກກອງປະຊຸມ

A handwritten signature in blue ink, likely belonging to the recorder of the meeting.



Registration Form (ຟອມລົງທະບຽນ)

Public consultation

	ຊື່ ແລະ ນາມສະກຸນ	ພາກສ່ວນ	ເບີຕິດຕໍ່	ລາຍເຊັນ
1	ທ. ຢາງ ວິວຣັດ ເວ່ນຈິນ	ທອງວິໄນ	55424398	YungR
2	ທ. ວິໄນ ວິໄນ	ອົງການ ວິໄນ	99290969	Wang
3	ທ. ສິດທິ ສິດທິ	ພ.ແຂກ ຈຸດ ທຸລະກິດ	22345007	Wang
4	ທ. ກຸ່ມ ກຸ່ມ ກຸ່ມ	ອົງການ ກຸ່ມ	99502355	Wang
5	ທ. ວິໄນ ວິໄນ	ອົງການ ວິໄນ	58790237	Wang
6	ທ. ວິໄນ ວິໄນ	ອົງການ ວິໄນ	95443339	X-kasong
7	ທ. ວິໄນ ວິໄນ	ອົງການ ວິໄນ	22907676	Wang
8	ທ. ວິໄນ ວິໄນ	ອົງການ ວິໄນ	22925242	Wang
9	ທ. ວິໄນ ວິໄນ	ອົງການ ວິໄນ	99900544	Wang
10	ທ. ວິໄນ ວິໄນ	Earth Systems	54666688	Wang
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Registration Form (ຟອມລົງທະບຽນ)

Somsoun  
19-8-2015

	ຊື່ ແລະ ນາມສະກຸນ	ພາກສ່ວນ	ເບີຕິດຕໍ່	ລາຍເຊັນ
1	ທ. ວິໄນ ພູມສິວ		22100034	ສຸກ
2	ທ. ຈະທາ		91561808	ວິໄນ
3	ທ. ສິມພອນ		55969632	ສຸກ
4	ທ. ພິມພອນ		55288855	ສຸກ
5	ທ. ພິມພອນ ບົວທອງ	ອົງ 92	96929453	ສຸກ
6	ທ. ສິມພອນ	ປະຊາສົມ	5646.0125	ສຸກ
7	ທ. ສິມພອນ	ສາຍພັດ	22802012	ສຸກ
8	ທ. ສິມພອນ	ປະຊາສົມ	56627332	ສຸກ
9	ທ. ສິມພອນ	ປະຊາສົມ		ສຸກ
10	ທ. ສິມພອນ	ປະຊາສົມ	22960316	ສຸກ
11	ທ. ສິມພອນ	ປະຊາສົມ	2282 4958	ສຸກ
12	ທ. ສິມພອນ	ປະຊາສົມ		ສຸກ
13	ທ. ສິມພອນ	ປະຊາສົມ		ສຸກ
14	ທ. ສິມພອນ	ປະຊາສົມ		ສຸກ
15	ທ. ສິມພອນ	ປະຊາສົມ	0305084630	ສຸກ
16	ທ. ສິມພອນ	ປະຊາສົມ	0309010212	ສຸກ
17	ທ. ສິມພອນ	ປະຊາສົມ		ສຸກ
18	ທ. ສິມພອນ	ປະຊາສົມ		ສຸກ
19	ທ. ສິມພອນ	ປະຊາສົມ	0305220830	ສຸກ
20	ທ. ສິມພອນ	ປະຊາສົມ		ສຸກ
21	ທ. ສິມພອນ	ປະຊາສົມ		ສຸກ
22	ທ. ສິມພອນ	ປະຊາສົມ		ສຸກ
23	ທ. ສິມພອນ	ປະຊາສົມ		ສຸກ
24	ທ. ສິມພອນ	ປະຊາສົມ		ສຸກ
25	ທ. ສິມພອນ	ປະຊາສົມ	02056113297	ສຸກ
26	ທ. ສິມພອນ	ປະຊາສົມ	02022586332	ສຸກ
27	ທ. ສິມພອນ	ປະຊາສົມ	02099547877	ສຸກ
28	ທ. ສິມພອນ	ປະຊາສົມ	99477168	ສຸກ
29	ທ. ສິມພອນ	ປະຊາສົມ	22000650	ສຸກ
30	ທ. ສິມພອນ	ປະຊາສົມ	22105031	ສຸກ
31	ທ. ສິມພອນ	ປະຊາສົມ	99992122	ສຸກ
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Registration Form (ຟອມລົງທະບຽນ)

Hatyann (1)  
20/8/2015

	ຊື່ ແລະ ນາມສະກຸນ	ພາກສ່ວນ	ເບີຕິດຕໍ່	ລາຍເຊັນ
1	ຂ. ແກ້ວ	ປ/ຊ		ແກ້ວ
2	ສາ ຂົນ	ປ/ຊ	໑9203034	ຂົນ
3	ຂ. ແທ້	ປ/ຊ	໑໒໕໕634	ແທ້
4	ນ. ແກ້ວ	ປ/ຊ		ແກ້ວ
5	ຂ. ຫ້າຍ	ປ/ຊ		ຫ້າຍ
6	ຂ. ຢາ	ປ/ຊ	໑4໕714696	ຢາ
7	ຂ. ວາ	ຂ/ຮ	໕441340	ວາ
8	ຂ. ດອສ	ຂ/ຮ		ດອສ
9	ຂ. ປາຍ	ປ/ຊ		ປາຍ
10	ຂ. ພິມ	ປ/ຊ		ພິມ
11	ຂ. ຈິມ ທອມ	ປ/ຊ		ຈິມ ທອມ
12	ຂ. ບາງ	ປ/ຊ		ບາງ
13	ຂ. ບາງ	ປ/ຊ		ບາງ
14	ຂ. ຈິມ ທອມ	ປ/ຊ		ຈິມ ທອມ
15	ຂ. ວອດ	ປ/ຊ		ວອດ
16	ຂ. ວິ	ປ/ຊ		ວິ
17	ຂ. ແກ້ວ	ປ/ຊ		ແກ້ວ
18	ນາງ ຂົນ	ປ/ຊ		ຂົນ
19	ນາງ ພິມ	ປ/ຊ		ພິມ
20	ນາງ ທອມ	ປ/ຊ		ທອມ
21	ນາງ ວິ	ປ/ຊ		ວິ
22	ນາງ ວອດ	ປ/ຊ		ວອດ
23	ນາງ ຈິມ	ປ/ຊ		ຈິມ
24	ນາງ ວິ	ປ/ຊ		ນາງ ວິ
25	ນາງ ແທ້	ປ/ຊ		ນາງ ແທ້
26	ນາງ ວິ	ປ/ຊ		ນາງ ວິ
27	ນາງ ທອມ	ປ/ຊ		ນາງ ທອມ
28	ນາງ ທອມ	ປ/ຊ		ນາງ ທອມ
29	ນາງ ວິ	ປ/ຊ		
30	ນາງ ວິ	ປ/ຊ		
31	ນາງ ພິມ ທອມ	ປ/ຊ		
32	ນາງ ຈິມ	ປ/ຊ		
33	ນາງ ວິ	ປ/ຊ		ນາງ ວິ
34	ນາງ ທອມ	ປ/ຊ		ນາງ ທອມ
35	ນາງ ວິ	ປ/ຊ		ນາງ ວິ





Registration Form (ຟອມລົງທະບຽນ)

	ຊື່ ແລະ ນາມສະກຸນ	ພາກສ່ວນ	ເບີຕິດຕໍ່	ລາຍເຊັນ
1	ທ. ມອ້ວ	ປ/ຊ	56582931	
2	ທ. ລອນ	ປ/ຊ		
3	ທ. ລັດ	ປ/ຊ		
4	ທ. ນວນ	ປ/ຊ	59313118	
5	ທ. ງຽ	ປ/ຊ	59960226	
6	ທ. ທອງໄຊ	ປ/ຊ		
7	ທ. ພອນໄຊ	ປ/ຊ	95976061	
8	ທ. ກວັດ	ປ/ຊ		
9	ທ. ພິມ	ປ/ຊ	59540994	
10	ທ. ສິສະຫວັດ	ປ/ຊ	59354378	
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12	ທ. ສິສະຫວັດ	ປ/ຊ		
13	ທ. ສິສະຫວັດ	ປ/ຊ		
14	ທ. ສິສະຫວັດ	ປ/ຊ	54890356	
15	ທ. ສິສະຫວັດ	ປ/ຊ		
16	ທ. ສິສະຫວັດ	ປ/ຊ	030505078	
17	ທ. ສິສະຫວັດ	ປ/ຊ	91751767	
18	ທ. ສິສະຫວັດ	ປ/ຊ		
19	ທ. ສິສະຫວັດ	ປ/ຊ		
20	ທ. ສິສະຫວັດ	ປ/ຊ		
21	ທ. ສິສະຫວັດ	ປ/ຊ	56381014	
22	ທ. ສິສະຫວັດ	ປ/ຊ	96167879	
23	ທ. ສິສະຫວັດ	ປ/ຊ	22105034	
24	ທ. ສິສະຫວັດ	ປ/ຊ	91180875	
25	N. ສິສະຫວັດ	NMPA, SMO.	29291540	
26	ທ. ສິສະຫວັດ	ປ/ຊ	22822751	
27	ທ. ສິສະຫວັດ	ປ/ຊ		
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ສາຍໂທລະສັບ





	ຊື່ ແລະ ນາມສະກຸນ	ພາກສ່ວນ	ເບີຕິດຕໍ່	ລາຍເຊັນ
1	ສ. ລິນສະ ພອນ	NNPA, SMO	29202540	
2	ທ. ຄຳສິ ສຸວັນລາດ	ທຳນຽມເມັງ.	22105031	
3	ສ. ສິມພອນ ພະຍີ	ທຳນຽມເມັງ	91180875	
4	ທ. ປິ່ງຢູ	ປ/ອ.	97871009	
5	ທ. ບຸນທິນ ມະຫາວິ	ພຽງສາ ນາຍ	92822751	
6	ທ. ສາວທິ ສີ	ປ/ອ.		
7	ທ. ສິນທິ	ປ/ອ.	52812100	
8	ທ. ສິມພອນ	ປ/ອ.		
9	ທ. ປິ່ງຢູ	11 ມວນສາມ	0304705203	
10	ທ. ສິມພອນ ພະຍີ	ທ. ສິມພອນ ພະຍີ	0304871404	
11	ສ. ສິນທິ	-  -		
12	ທ. ປິ່ງຢູ	-  -	52912405	
13	ທ. ປິ່ງຢູ	ປ/ອ.	0809376366	
14	ສ. ວິນ	ປ/ອ.		
15	ສ. ສິນທິ	ປ/ອ.	x	
16	ສ. ພິນ	ປ/ອ.		
17	ສ. ສິນທິ			
18	ສ. ສິນທິ			
19	ສ. ສິນທິ	ປ/ອ.	x	
20	ທ. ສິນທິ		95572851	
21	ທ. ສິນທິ			
22	ສ. ສິນທິ	ປ/ອ.		
23	ທ. ສິນທິ	ທຳນຽມເມັງ ທຳນຽມເມັງ		
24	ທ. ສິນທິ	ທຳນຽມເມັງ	95418484	
25	ທ. ສິນທິ	ພ/ອ.	99297118	
26	ທ. ສິນທິ	ທຳນຽມເມັງ ທຳນຽມເມັງ	52156388	
27	ທ. ສິນທິ	ທຳນຽມເມັງ ທຳນຽມເມັງ	95577350	
28	ທ. ສິນທິ		5757569	
29	ທ. ສິນທິ			
30	ສິນທິ		6751132	
31	ທ. ສິນທິ			
32	ສ. ສິນທິ	ປ/ອ.	52339053	
33	ທ. ສິນທິ	ປ/ອ.		
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35	ທ. ສິນທິ	ສິນທິ	54622161	



Registration Form (ຟອມລົງທະບຽນ)

Hatsaykham  
20/8/2015

	ຊື່ ແລະ ນາມສະກຸນ	ພາກສ່ວນ	ເບີຕິດຕໍ່	ລາຍເຊັນ
1	ທ. ຢຸດ	ທາດຊາຍຫີ	0309502596	
2	ທ. ວິໄນ	-	0809990894	ວ.ຈ.
3	ທ. ວິໄນ			
4	<del>ທ. ວິໄນ</del>	→ ທ.	0309542656	ທ. ວິໄນ
5	ທ. ວິໄນ	ປ/ຊ.	x	ວິໄນ
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Registration Form (ຟອມລົງທະບຽນ)

Ban Houaypamom

	ຊື່ ແລະ ນາມສະກຸນ	ພາກສ່ວນ	ເບີຕິດຕໍ່	ລາຍເຊັນ
1	ທ້າວ ວິ ວຸດ	ປ/ຊ		ທ້າວ ວິ ວຸດ
2	ປັງ ລິວ ປັງ	ບ. ຫວັດ ປາ ພວ້ຍ		ປັງ ລິວ ປັງ
3	ບາ ປາ ປັງ	ປະຊາ ຊື່	ບ ຫວັດ ປາ ພວ້ຍ	ບາ ປາ ປັງ
4	ກໍ ເມັ ກຸ້ງ	12095	ບ ຫວັດ ປາ ພວ້ຍ	ກໍ ເມັ ກຸ້ງ
5	3 ພາ ປັງ ປັງ	ປ/ຊ		3 ພາ ປັງ ປັງ
6	ພິ ລິ	-		ພິ ລິ
7	6 ກຸ້ງ ປັງ	-	-	6 ກຸ້ງ ປັງ
8	ປັງ ລິ ວຸດ	ປ: ຫວັດ ປາ ພວ້ຍ		ປັງ ລິ ວຸດ
9	ເຍັ ພິ ລິ ວຸດ	ຫວັດ ຫວັດ ປາ ພວ້ຍ		ເຍັ ພິ ລິ ວຸດ
10	ກວິ ວຸດ	ປ/ຊ		ກວິ ວຸດ
11	ຂ. ເປັ ປັງ	-		ເປັ ປັງ
12	ນ. ພິ ລິ ວຸດ	-		ພິ ລິ ວຸດ
13	ນ. ຫວັດ	-		ຫວັດ
14	ນ. ວຸດ ປັງ	-		ວຸດ ປັງ
15	ນ. ພິ ລິ	-		ພິ ລິ
16	ຂ. ພິ ລິ	-		ພິ ລິ
17	ນ. ປັງ ປັງ	-		ປັງ ປັງ
18	ນ. ກໍ ວຸດ	-		ກໍ ວຸດ
19	ນ. ເປັ ປັງ	-		ເປັ ປັງ
20	ນ. ຈຸ ລິ	-		ຈຸ ລິ
21	ນ. ຈຸ ລິ	-		ຈຸ ລິ
22	ນ. ເດຍ ທີ່	-		ເດຍ ທີ່
23	ນ. ກິ ວິ ວຸດ	-		ກິ ວິ ວຸດ
24	ນ. ປາ ພວ້ຍ	-		ປາ ພວ້ຍ
25	ນ. ຢິ ລິ	-		ຢິ ລິ
26	ທ. ປາ ພວ້ຍ	-		ປາ ພວ້ຍ
27	ທ. ເມັ ກຸ້ງ	ບໍ ຈິ ກາ ມ ຊື່. ສ. ສ.	99290969	ເມັ ກຸ້ງ
28	ທ. ປັງ ປັງ ປັງ ປັງ ປັງ	ເຮືອ ຈຳ ນະ ທິ ກ ລາ ມ ສ	55424998	ປັງ ປັງ ປັງ ປັງ ປັງ
29	ທ. ເປັ ປັງ	ປ/ຊ		ເປັ ປັງ
30	ຂ. ກຸ້ງ ປັງ	-		ກຸ້ງ ປັງ
31	ຈຸ ລິ ວຸດ	-		ຈຸ ລິ ວຸດ
32	ຂ. ກິ ວິ ວຸດ	-		ກິ ວິ ວຸດ
33	ຂ. ລິ ວິ ວຸດ	-		ລິ ວິ ວຸດ
34	ຂ. ຈຸ ລິ	-		ຈຸ ລິ
35	ຂ. ລິ ວິ ວຸດ	-		ລິ ວິ ວຸດ





Registration Form (ຟອມລົງທະບຽນ)

Ban Houaypamom

ຊື່ ແລະ ນາມສະກຸນ	ພາກສ່ວນ	ເບີຕິດຕໍ່	ລາຍເຊັນ
1 ທ. ໄກ້ ທີ່	ປ/ຊ		ໄກ້ ທີ່
2 ຂ. ແອຍ ຊີ	-  -		ແອຍ ຊີ
3 ຂ. ແອຍ ຊີ	-  -		ແອຍ ຊີ
4 ຂ. ທ້ອງ	-  -		ທ້ອງ
5 ທ. ສະໄຫຼ່	-  -		
6 ພງ ໄກ້ ທີ່	-  -		
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Registration Form (ຟອມລົງທະບຽນ)

	ຊື່ ແລະ ນາມສະກຸນ	ພາກສ່ວນ	ເບີຕິດຕໍ່	ລາຍເຊັນ
1	ທ. ທາວ ວິ	ບາມ ບາ ປັດຕາ	0309741857	
2	ທ. ວິ ສິ ກິ	-	0304610525	
3	ທ. ວິ ວິ ວິ	-	02097023998	
4	ທ. ວິ ວິ ວິ	-		
5	ທ. ວິ ວິ ວິ			12/2
6	ທ. ວິ ວິ ວິ	H		12/2
7	ທ. ວິ ວິ ວິ	-	030951484	
8	ທ. ວິ ວິ ວິ	-	030477604	
9	ທ. ວິ ວິ ວິ	-		12/2
10	ທ. ວິ ວິ ວິ	-		12/2
11	ທ. ວິ ວິ ວິ	-		-
12	ທ. ວິ ວິ ວິ	-	020991599112	
13	ທ. ວິ ວິ ວິ	-	0309276842	-
14	ທ. ວິ ວິ ວິ	-		
15	ທ. ວິ ວິ ວິ	-		
16	ທ. ວິ ວິ ວິ	-		
17	ທ. ວິ ວິ ວິ	-		
18	ທ. ວິ ວິ ວິ	-		
19	ທ. ວິ ວິ ວິ	-		-
20	ທ. ວິ ວິ ວິ	-		-
21	ທ. ວິ ວິ ວິ	-		-
22	ທ. ວິ ວິ ວິ	-		-
23	ທ. ວິ ວິ ວິ	-		-
24	ທ. ວິ ວິ ວິ	-		-
25	ທ. ວິ ວິ ວິ	ທ. ວິ ວິ ວິ	55444398	
26	ທ. ວິ ວິ ວິ	ທ. ວິ ວິ ວິ	99290969	
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ເວັບ Nam Youck  
25.8.15

Registration Form (ຟອມລົງທະບຽນ)

	ຊື່ ແລະ ນາມສະກຸນ	ພາກສ່ວນ	ເບີຕິດຕໍ່	ລາຍເຊັນ
1	ທ. ສິດສິດ	ນັກຮຽນ (ນາຍບ້ານ)	0309515901	ສາມາດ
2	ທ. ສິດສິດ	ນັກຮຽນ	0309734337	ທ. ສິດສິດ
3	ທ. ສິດສິດ ສິດສິດ	-	0309328617	ທ. ສິດສິດ
4	ນາຍບ້ານ	ແມ່ຍິງ		ນາຍບ້ານ
5	ນ. ສິດສິດ ສິດສິດ	ແມ່ຍິງ	0309256617	ສິດສິດ
6	ນ. ສິດສິດ	ແມ່ຍິງ		ສິດສິດ
7	ນ. ສິດສິດ	ແມ່ຍິງ		ສິດສິດ
8	ນ. ສິດສິດ ສິດສິດ	ແມ່ຍິງ		ສິດສິດ
9	ນ. ສິດສິດ	ແມ່ຍິງ		ສິດສິດ
10	ນ. ສິດສິດ	-		ນ. ສິດສິດ
11	ນ. ສິດສິດ	-		ສິດສິດ
12	ນ. ສິດສິດ	-		ສິດສິດ
13	ນ. ສິດສິດ			ສິດສິດ
14	ນ. ສິດສິດ			ສິດສິດ
15	ນ. ສິດສິດ			
16	ນ. ສິດສິດ			
17	ທ. ສິດສິດ	-	0309734298	ສິດສິດ
18	ທ. ສິດສິດ	-		
19	ທ. ສິດສິດ			
20	ທ. ສິດສິດ		0209892998	
21	ທ. ສິດສິດ	-		
22	ທ. ສິດສິດ		0309515881	ສິດສິດ
23	ທ. ສິດສິດ	-	0309487731	ສິດສິດ
24	ທ. ສິດສິດ	-	0309524362	ສິດສິດ
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Registration Form (ຟອມລົງທະບຽນ)

	ຊື່ ແລະ ນາມສະກຸນ	ພາກສ່ວນ	ເບີຕິດຕໍ່	ລາຍເຊັນ
1	ທ້າວ ວິໄລ ທີ່ ວາງ	ປ/ກ		
2	ທ້າວ ວິໄລ	ທ		
3	ທ້າວ ພອນສິ	-  -		<i>[Signature]</i>
4	ທ້າວ ວິໄລ	ທ້າວ ວິໄລ		
5	ທ້າວ ວິໄລ	ທ້າວ ວິໄລ		<i>[Signature]</i>
6	ທ້າວ ວິໄລ	ທ້າວ ວິໄລ		<i>[Signature]</i>
7	ທ້າວ ວິໄລ	ທ້າວ ວິໄລ		<i>[Signature]</i>
8	ທ້າວ ວິໄລ	ທ້າວ ວິໄລ		<i>[Signature]</i>
9	ທ້າວ ວິໄລ			
10	ທ້າວ ວິໄລ			
11	ທ້າວ ວິໄລ			
12	ທ້າວ ວິໄລ			
13	ທ້າວ ວິໄລ			
14	ທ້າວ ວິໄລ			
15	ທ້າວ ວິໄລ			
16	ທ້າວ ວິໄລ			
17	ທ້າວ ວິໄລ			
18	ທ້າວ ວິໄລ			<i>[Signature]</i>
19	ທ້າວ ວິໄລ			<i>[Signature]</i>
20	ທ້າວ ວິໄລ	ທ້າວ ວິໄລ	99290969	<i>[Signature]</i>
21	ທ້າວ ວິໄລ	ທ້າວ ວິໄລ		<i>[Signature]</i>
22	ທ້າວ ວິໄລ			
23	ທ້າວ ວິໄລ	ທ້າວ ວິໄລ	55424398	<i>[Signature]</i>
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Registration Form (ຟອມລົງທະບຽນ)

25.8.15

	ຊື່ ແລະ ນາມສະກຸນ	ພາກສ່ວນ	ເບີຕິດຕໍ່	ລາຍເຊັນ
1	ທ່ານ ສິມ ສິມສິມ	ທ່ານ ສິມສິມ	0209288984	Handwritten signature
2	ທ່ານ ເຢຍ ຢາງ	ທ່ານ ສິມສິມ		
3	ທ່ານ ສິມ ສິມ	ທ່ານ ສິມສິມ	0309103158	Thompson
4	ທ່ານ ສິມ ສິມ			
5	ທ່ານ ສິມ ສິມ			Handwritten signature
6	ທ່ານ ສິມ ສິມ			
7	ທ່ານ ສິມ ສິມ			
8	ທ່ານ ສິມ ສິມ	-	02096511638	Handwritten signature
9	ທ່ານ ສິມ ສິມ	-		Handwritten signature
10	ທ່ານ ສິມ ສິມ		0309683043	
11	ທ່ານ ສິມ ສິມ			
12	ທ່ານ ສິມ ສິມ			
13	ທ່ານ ສິມ ສິມ	ປ/ຊ	0209813990	
14	ທ່ານ ສິມ ສິມ	Handwritten mark		Handwritten signature
15	ທ່ານ ສິມ ສິມ	Handwritten mark		
16	ທ່ານ ສິມ ສິມ	Handwritten mark	9851965	Handwritten signature
17	ທ່ານ ສິມ ສິມ	Handwritten mark		
18	ທ່ານ ສິມ ສິມ	Handwritten mark		
19	ທ່ານ ສິມ ສິມ	Handwritten mark		
20	ທ່ານ ສິມ ສິມ	Handwritten mark		
21	ທ່ານ ສິມ ສິມ	Handwritten mark		
22	ທ່ານ ສິມ ສິມ	Handwritten mark		
23	ທ່ານ ສິມ ສິມ	Handwritten mark		
24	ທ່ານ ສິມ ສິມ	Handwritten mark		
25	ທ່ານ ສິມ ສິມ	Handwritten mark		
26	ທ່ານ ສິມ ສິມ	Handwritten mark		ທ່ານ ສິມ ສິມ
27	ທ່ານ ສິມ ສິມ	Handwritten mark		
28	ທ່ານ ສິມ ສິມ	Handwritten mark		
29	ທ່ານ ສິມ ສິມ	Handwritten mark		
30	ທ່ານ ສິມ ສິມ	Handwritten mark		
31	ທ່ານ ສິມ ສິມ	Handwritten mark		
32	ທ່ານ ສິມ ສິມ	ທ່ານ ສິມ ສິມ	55444398	Handwritten signature
33	ທ່ານ ສິມ ສິມ	Handwritten mark		
34	ທ່ານ ສິມ ສິມ	ທ່ານ ສິມ ສິມ	95216944	Handwritten signature
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ເຊັນປິຈິງ ຢ່າງເພຍຕິວ



Registration Form (ຟອມລົງທະບຽນ)

	ຊື່ ແລະ ນາມສະກຸນ	ພາກສ່ວນ	ເບີຕິດຕໍ່	ລາຍເຊັນ
1	ທ. ນາວະນີ ຢຳ	ສາທາລະນະ	95216944	
2	ທ. ດາວະນີ ຢຳ	ປ/ຊ		
3	ທ. ຢຳ ສິ	ປ/ຊ		
4	ທ. ຢຳ ສິ	ປ/ຊ		
5	ທ. ຢຳ ສິ ຢຳ	ປ/ຊ		
6	ທ. ຢຳ ສິ ຢຳ	ປ/ຊ		
7	ທ. ຢຳ ສິ	ປ/ຊ		
8	ທ. ຢຳ ສິ	ປ/ຊ		
9	ທ. ຢຳ ສິ	ປ/ຊ		
10	ທ. ຢຳ ສິ	ປ/ຊ		
11	ທ. ຢຳ ສິ ຢຳ	ປ/ຊ		
12	ທ. ຢຳ ສິ	ປ/ຊ		
13	ທ. ຢຳ ສິ	ປ/ຊ		
14	ທ. ຢຳ ສິ	ທົວ ເໝີ ສິ ທາ ພິມິ ຢຳ 0304626155		
15	ທ. ຢຳ ສິ ຢຳ	ປ/ຊ ສາທາລະນະ	030 940 8978	
16	ທ. ຢຳ ສິ ຢຳ	ປ/ຊ		
17	ທ. ຢຳ ສິ	ປ/ຊ		
18	ທ. ຢຳ ສິ	ອົງການປະຊາກອນສາທາລະນະ	99290969	
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ເຊັນບີຈິງໆ ຢ່າງເໝາະສົມ



	ຊື່ ແລະ ນາມສະກຸນ	ພາກສ່ວນ	ເບີຕິດຕໍ່	ລາຍເຊັນ
1	ທ່ານ ສິມ ສິມສິມ	ບໍລິສັດ	0309288984	Handwritten signature
2	ທ່ານ ເຢັຍ ຢືນ	ບໍລິສັດ		
3	ທ່ານ ສິມ ສິມ	ບໍລິສັດ	0309103158	Thomph
4	ທ່ານ ສິມ ສິມ			
5	ທ່ານ ສິມ ສິມ			Handwritten signature
6	ທ່ານ ສິມ ສິມ			
7	ທ່ານ ສິມ ສິມ			
8	ທ່ານ ສິມ ສິມ	-/-	02096511638	Handwritten signature
9	ທ່ານ ສິມ ສິມ	-/-		Handwritten signature
10	ທ່ານ ສິມ ສິມ		0309683043	
11	ທ່ານ ສິມ ສິມ			
12	ທ່ານ ສິມ ສິມ			
13	ທ່ານ ສິມ ສິມ	ປ/ຊ	02098139920	
14	ທ່ານ ສິມ ສິມ	-/-		Handwritten signature
15	ທ່ານ ສິມ ສິມ	-/-		
16	ທ່ານ ສິມ ສິມ	-/-	9851965	Handwritten signature
17	ທ່ານ ສິມ ສິມ	-/-		
18	ທ່ານ ສິມ ສິມ	-/-		
19	ທ່ານ ສິມ ສິມ	-/-		
20	ທ່ານ ສິມ ສິມ	-/-		
21	ທ່ານ ສິມ ສິມ	-/-		
22	ທ່ານ ສິມ ສິມ	-/-		
23	ທ່ານ ສິມ ສິມ	-/-		
24	ທ່ານ ສິມ ສິມ	-/-		
25	ທ່ານ ສິມ ສິມ	-/-		
26	ທ່ານ ສິມ ສິມ	-/-		ທ່ານ ສິມ ສິມ
27	ທ່ານ ສິມ ສິມ	-/-		
28	ທ່ານ ສິມ ສິມ	-/-		
29	ທ່ານ ສິມ ສິມ	-/-		
30	ທ່ານ ສິມ ສິມ	-/-		
31	ທ່ານ ສິມ ສິມ	-/-		
32	ທ່ານ ສິມ ສິມ	ບໍລິສັດ	55444398	Handwritten signature
33	ທ່ານ ສິມ ສິມ	ບໍລິສັດ		
34	ທ່ານ ສິມ ສິມ	ບໍລິສັດ	952169449	Handwritten signature
35				



ເຂັ້ມປີຈິ່ງນູ ຢ່າງເພຍຕົວ





# NAM NGIEP 1 POWER COMPANY

Registration Form ໃບລົງທະບຽນ

Name of Activities ຊື່ກິດຈະກຳ..... ກຳລັງຮັບສະໜອງໂລກສາຍສົ່ງສາຍສົ່ງກະທົມສາຍສົ່ງສາຍສົ່ງ (ສົ່ງໂທລະສັບ) ບັນທຶກ

Location ສະຖານທີ່: .....

Date ວັນທີ : ..... 17/2/2015 .....

No ລດ	Name and Sure Name ຊື່ແລະນາມສະກຸນ	Position ຕຳແໜ່ງ	From ມາຈາກພາກສ່ວນ	Telephone number ເບີໂທລະສັບຕິດຕໍ່	Signature ລາຍເຊັນ
1	ທະນາວິໄນ	ປຶກສາ	ສົ່ງໂທລະສັບ	55088613	ໄມ້
2	POKHA	GOR	NNPI	2309195	ໄມ້
3	Xieng ma	GOR	—	59081640	ໄມ້
4	Somsavanh	DB	NNPI	22400005	ໄມ້
5	Say Kham		ຄ.ສ. ເມັດ	58961783	ໄມ້
6	ທ. ວິໄນ		ຄ.ສ. ເມັດ	5814197	ໄມ້
7	ສົມສາວ ທະນາວິໄນ	ສຳນັກງານ	ຄ.ສ. ເມັດ	55553679	ໄມ້
8	ທ. ທິວະນາ ສາວພອນ	ບັນທຶກ	ບັນທຶກ ພ.ສຳນັກງານ	2955557	ໄມ້
9	ທ. ສາວສະໜາ ສົມສາວ	ວິຊາການ	ຄ.ສ. ເມັດ	58888912	ໄມ້
10	ທ. ບົວວິໄນ ພອນສະໜາ	ວິຊາການ	ເມັດ	99888552	ໄມ້
11	ທ. ສາວວິໄນ ສົມສາວ	—	—	22566712	ໄມ້
12	ທ. ສົມສາວ ສົມສາວ	—	ຄ.ສ. ເມັດ	23283888	ໄມ້
13	ທ. ສົມສາວ ສົມສາວ	—	—	95515118	ໄມ້
14	ທ. ສົມສາວ ສົມສາວ	ທ. ສາວ	ຄ.ສ. ເມັດ	030544825	ໄມ້
15	ທ. ສົມສາວ ສົມສາວ	ທ. ສາວ	ຄ.ສ. ເມັດ	55330861	ໄມ້
16	ທ. ສົມສາວ ສົມສາວ	ທ. ສາວ	ຄ.ສ. ເມັດ	2240958	ໄມ້





# NAM NGIEP 1 POWER COMPANY

Registration Form ໃບລົງທະບຽນ

Name of Activities ຊື່ກິດຈະກຳ.....

Location ສະຖານທີ່.....

Date ວັນທີ : .....

No ລດ	Name and Sure Name ຊື່ແລະນາມສະກຸນ	Position ຕຳແໜ່ງ	From ມາຈາກພາກສ່ວນ	Telephone number ເບີໂທລະສັບຕິດຕໍ່	Signature ລາຍເຊັນ
1	ທ. ພິດສານ ພອນສິວ ວິຈິ	ວິຊາການ	ທ່ານ ສຸມ ສິມ	09560731	
2	ທ. ທິງຄຳ ແສງໂທວິສະວິຈິ	ວິຊາການ	ທ່ານ ສານ ວິສາ	08082339	Pancy
3	ທ. ສິມສິງ ພອນສິວ ວິຈິ	ປະທານ	ສະໜາ ພອນສິງ	55492452	
4	ທ. ສິມສິງ ພອນສິວ ວິຈິ	ວິຊາການ	ເມັດ	55726601	
5	ທ. ສິມສິງ ພອນສິວ ວິຈິ	ວິຊາການ	ທ່ານ ພອນ	9997711	
6	ທ. ສິມສິງ ພອນສິວ ວິຈິ	ວິຊາການ	RMU	91751394	
7	ທ. ສິມສິງ ພອນສິວ ວິຈິ	ວິຊາການ	ເມັດ	22332229	
8	ທ. ສິມສິງ ພອນສິວ ວິຈິ	ວິຊາການ	ທ່ານ ສິມ ພອນ	22345820	
9	ທ. ສິມສິງ ພອນສິວ ວິຈິ	ວິຊາການ	ເມັດ	55332015	
10	ທ. ສິມສິງ ພອນສິວ ວິຈິ	ວິຊາການ	ທ່ານ ສິມ ພອນ	22803368	
11	ທ. ສິມສິງ ພອນສິວ ວິຈິ	ວິຊາການ	ທ່ານ ສິມ ພອນ	23006080	
12	ທ. ສິມສິງ ພອນສິວ ວິຈິ	ວິຊາການ	ທ່ານ ສິມ ພອນ	59769878	
13	ທ. ສິມສິງ ພອນສິວ ວິຈິ	ວິຊາການ	ເມັດ	222037405	
14	ທ. ສິມສິງ ພອນສິວ ວິຈິ	ວິຊາການ	ເມັດ	22938797	
15					
16					

Nam Ngiep 1 Power Company Limited

Ban Phonesiuan, House No.236, Unit 16, Sisattanak District, Vientiane

Tel: +856 21 261251, Fax: +856 21 261252





# NAM NGIEP 1 POWER COMPANY

Registration Form ໃບລົງທະບຽນ

Name of Activities ຊື່ກິດຈະກຳ.....

Location ສະຖານທີ່.....

Date ວັນທີ : .....

No ລດ	Name and Sure Name ຊື່ແລະນາມສະກຸນ	Position ຕຳແໜ່ງ	From ມາຈາກພາກສ່ວນ	Telephone number ເບີໂທລະສັບຕິດຕໍ່	Signature ລາຍເຊັນ
1	ບ. ວາງ ວິໄນ	ຮອງ ລັດຖະມົນຕີ	ສູນ ທາງອາວຸກ	030 9738860	ບ. ວາງ ວິໄນ
2	ບ. ແມ້ງ ທີ່	ຮອງ ລັດຖະມົນຕີ	ສູນ ທາງອາວຸກ	02054173781	ບ. ແມ້ງ ທີ່
3	ທ. ພອນ ສີ ຊິງ	ນາຍ ບາງ	ບາງ ທາງອາວຸກ	54404340	
4	ທ. ພູມສິ ຊິງ ນາ	ນາຍ ບາງ	ທ່ວງ	55491810	
5	ທ. ພອນ ສີ ຊິງ	ຮອງ ລັດຖະມົນຕີ	ທ່ວງ ມ. ງ-ລ ບາງ	54052325	
6	ບ. ອິນ ພິ ພິ ຊິງ	ຮອງ ລັດຖະມົນຕີ	ທ່ວງ ມ. ງ-ລ ບາງ	9999941	
7	ທ. ຊິງ ພອນ ຊິງ	ຮອງ ລັດຖະມົນຕີ	ທ່ວງ ມ. ງ-ລ ບາງ	2477168	
8	ບ. ບຸນ ສິ ຊິງ	ຮອງ ລັດຖະມົນຕີ	ທ່ວງ ມ. ງ-ລ ບາງ	22236655	
9	ທ. ສິ ຊິງ ພອນ ຊິງ	ຮອງ ລັດຖະມົນຕີ	ທ່ວງ ມ. ງ-ລ ບາງ	22105031	
10	ທ. ວິໄນ ພິ ຊິງ	ຮອງ ລັດຖະມົນຕີ	ທ່ວງ ມ. ງ-ລ ບາງ	56536423	
11	ທ. ພອນ ສີ ຊິງ	ຮອງ ລັດຖະມົນຕີ	ທ່ວງ ມ. ງ-ລ ບາງ	28742500	
12	ບ. ທິ ພິ ຊິງ	ຮອງ ລັດຖະມົນຕີ	ທ່ວງ ມ. ງ-ລ ບາງ	55177984	
13	ບ. ສິ ຊິງ ພອນ ຊິງ	ຮອງ ລັດຖະມົນຕີ	ທ່ວງ ມ. ງ-ລ ບາງ	22831991	
14	ບ. ສິ ຊິງ ພອນ ຊິງ	ຮອງ ລັດຖະມົນຕີ	ທ່ວງ ມ. ງ-ລ ບາງ	91180875	
15	ທ. ພອນ ສີ ຊິງ	ຮອງ ລັດຖະມົນຕີ	ທ່ວງ ມ. ງ-ລ ບາງ	99464491	
16	ບ. ພອນ ສີ ຊິງ	ຮອງ ລັດຖະມົນຕີ	ທ່ວງ ມ. ງ-ລ ບາງ	28534790	







# NAM NGIEP 1 POWER COMPANY

Registration Form ໃບລົງທະບຽນ

Name of Activities ຊື່ກິດຈະກຳ.....

Location ສະຖານທີ່:.....

Date ວັນທີ :.....

No ລດ	Name and Sure Name ຊື່ແລະນາມສະກຸນ	Position ຕຳແໜ່ງ	From ມາຈາກພາກສ່ວນ	Telephone number ເບີໂທລະສັບຕິດຕໍ່	Signature ລາຍເຊັນ
1	ນ. ວິໄນ ສຸກຊິນ	ວິຊາກາມ	ພທ ເມັດ	030944282	Vong
2	ນ. ສິດສະໄໝ ວຽນທອນ	ວິຊາກາມ	ທຳອິດ ຊຸມເມັດ	02097574882	Limy
3	ທ. ໂອນທິ	-/-	-/-	22804431	Phong
4	ນ. ພຸງສິ ວິໄນ	-/-	-/-	02096915552	Phong
5	ນ. ບໍລິສິດ ສິດສະໄໝ	-/-	ທຳອິດ ຊຸມເມັດ	030503884	Phong
6	ທ. ສິດສະໄໝ	-/-	ວິໄນ	2242244	Phong
7	ທ. ສິດສະໄໝ ສິດສະໄໝ	ວິໄນ	ວິໄນ	030522023	Phong
8	ນ. ສິດສະໄໝ ສິດສະໄໝ	ວິໄນ	ວິໄນ	58277997	Phong
9	ນ. ສິດສະໄໝ ວິໄນ	ວິໄນ	ວິໄນ	23188438	Phong
10	ນ. ສິດສະໄໝ ສິດສະໄໝ	-/-	ທຳອິດ ຊຸມເມັດ	28380588	Phong
11	ທ. ບຸນທິ ພຸງສິ	-/-	-/-	97337644	Phong
12	ທ. ສິດສະໄໝ	-/-	-/-	5799485	Phong
13	ທ. ສິດສະໄໝ	ວິໄນ	ທຳອິດ ຊຸມເມັດ	5751132	Phong
14	ທ. ສິດສະໄໝ ວິໄນ	ວິໄນ	ວິໄນ	22103288	Phong
15	ທ. ສິດສະໄໝ ວິໄນ	ວິໄນ	ວິໄນ	54325559	Phong
16	ທ. ສິດສະໄໝ	ວິໄນ	ວິໄນ	22336885	Phong





# NAM NGIEP 1 POWER COMPANY

Registration Form ໃບລົງທະບຽນ

Name of Activities ຊື່ກິດຈະກຳ: .....

Location ສະຖານທີ່: .....

Date ວັນທີ: .....

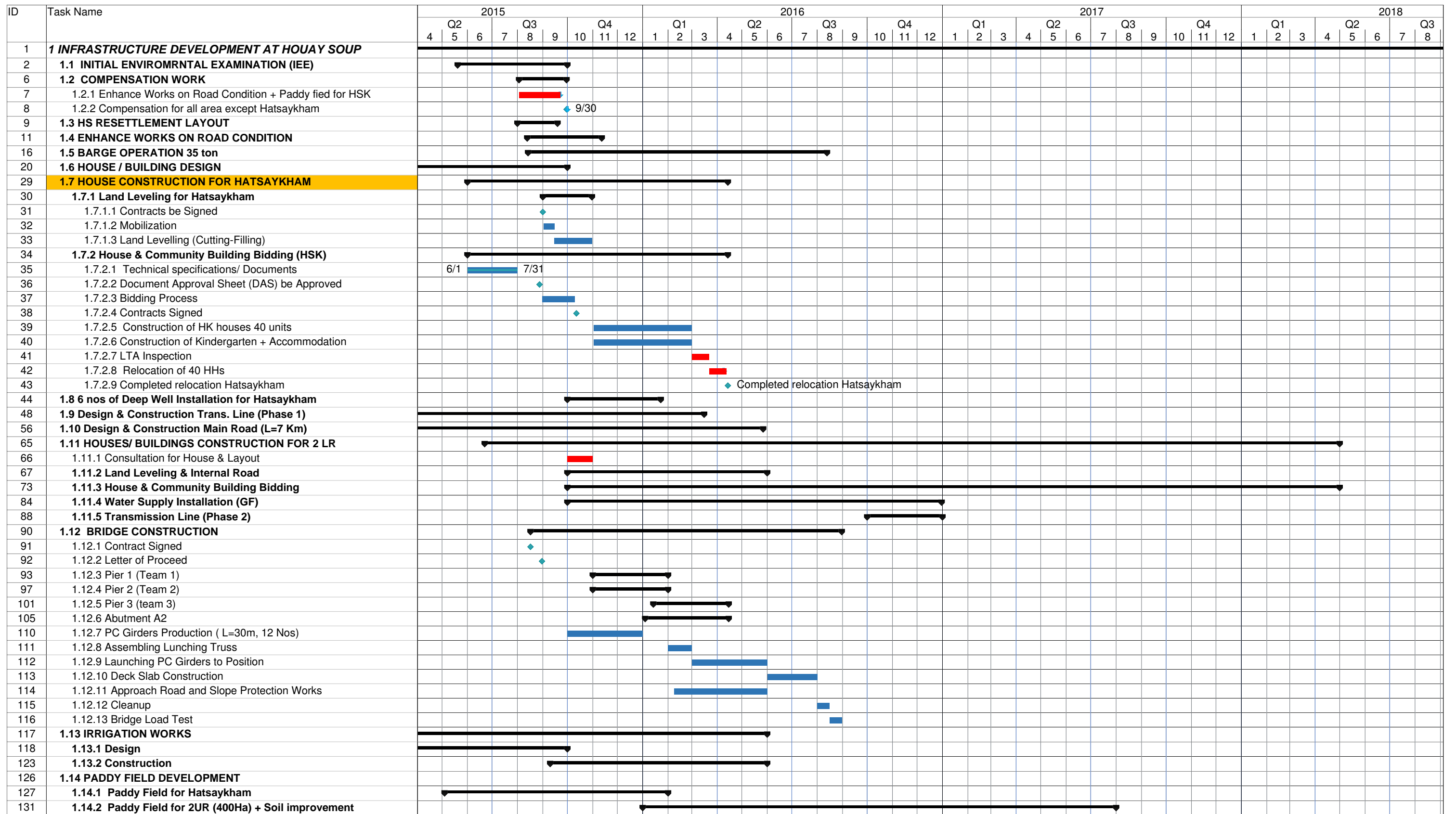
No ລດ	Name and Sure Name ຊື່ແລະນາມສະກຸນ	Position ຕຳແໜ່ງ	From ມາຈາກພາກສ່ວນ	Telephone number ເບີໂທລະສັບຕິດຕໍ່	Signature ລາຍເຊັນ
1	ທ. ວິສຸ ພົມ ສຸວັນ ວະລາ	ປະທານ ວິຊາ ການຄ້າ	ສື່ສານ ບາດ 10	540815245	
2	ທ. ສິມ ສິມ ສິມ	ຜູ້ບໍລິຫານ	ທ່ອງທ່ຽວ	550671487	
3	ທ. ວິລາວັນ ຈິມທະວີ		Earth systems	55154345	
4	ທ. ພອນທິ ທາກສິວັນ	ທາງໜ້າ	RMU & SB	55552229	
5	ທ. ສິມສິ ສາຍ ພູອັງ	ບຸກຄົນ	RMU(BLP)	54540919	
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					



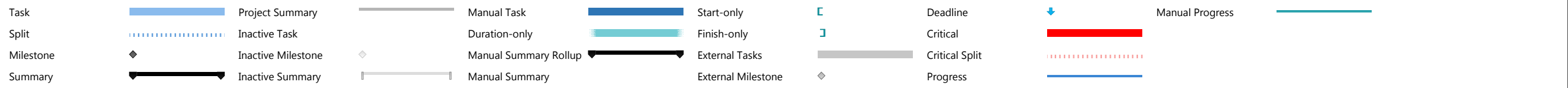
---

## **Appendix C: Infrastructure Schedule**

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Project: 150513\_HouaySoupDe  
Date: Tue 9/8/15



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## **Appendix D: Terrestrial Flora, NTFP and TFP**

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# Appendix D: Biodiversity

Earth Systems surveyed the HSRA in June 2015 (refer to Section 5.3 for sampling locations) and conducted Local Knowledge Surveys in Ban Hatsaykham, Ban Hat Gniun, and Ban Somseun, with focus group discussion to identify flora species of the HSRA (Table D-1), including commonly utilised Timber Forest Products (Table D-2) and Non-Timber Forest Products (Table D-3). The results are presented below, including IUCN Red List Status and Forest Community Type where the species were identified.

**Table D-1 Flora identified in the Project Area including habit, habitat and international conservation significance (IUCN)**

Scientific Name	English Common Name	Habit	Family	IUCN Red List Status	Habitats
<i>Alangium kurzii</i>		T	Alangiaceae		UMD, B, YF
<i>Alpinia galanga</i>		H	Zingiberaceae		UMD, YF
<i>Alstonia scholaris</i>	White cheesewood	T	Apocynaceae	LR/LC	UMD
<i>Ancistrocladus tectorius</i>		C	Ancistrocladaceae		UMD, B, YF
<i>Anisoptera costata</i>		T	Dipterocarpaceae	EN	UMD
<i>Aporosa ficifolia</i>		TL	Phyllanthaceae		UMD, B, OF, YF
<i>Aporosa longifolia</i>		TL	Phyllanthaceae		UMD
<i>Aquilaria crassna</i>		TL	Thymealeaceae	CR	UMD
<i>Ardisia crispa</i>		TL	Myrsinaceae		UMD
<i>Ardisia helferiana</i>		TL	Myrsinaceae		UMD, OF
<i>Bombax anceps</i>		T	Bombacaceae		UMD
<i>Calamus javensis</i>		H	Arecaceae		UMD
<i>Calophyllum polyanthum</i>		T	Guttiferae		UMD
<i>Caryota mitis</i>		H	Arecaceae		UMD, B, YF
<i>Casearia sp.</i>			Salicaceae		UMD
<i>Catimbum bracteatum</i>		H	Zingiberaceae		UMD, B, YF
<i>Cephalostachyum virgatum</i>			Poaceae		B, OF
<i>Chromolaena odorata</i>	Siam weed	H	Asteraceae		YF
<i>Cinnamomum iners</i>		T	Lauraceae		UMD, B, YF
<i>Cissus assamica</i>		C	Vitaceae		YF
<i>Coscinium fenestratum</i>		C	Menispermaceae		UMD
<i>Costus speciosus</i>	Crape ginger	H	Costaceae		UMD
<i>Cratoxylum formosum var. prunifolium</i>		T	Guttiferae	LR/LC	UMD, B, OF, YF
<i>Croton cascarilliodes</i>		TL	Euphorbiaceae		OF
<i>Crypteronia paniculata</i>		T	Crypteroniaceae		UMD, OF, YF
<i>Curculigo orchioides</i>			Hypoxidaceae		UMD, OF



Scientific Name	English Common Name	Habit	Family	IUCN Red List Status	Habitats
<i>Cyclea barbata</i>			Menispermaceae		B, YF
<i>Cyclea sp.</i>			Menispermaceae		UMD
<i>Dalbergia cultrata</i>	Burma blackwood	T	Leguminosae	NT	UMD
<i>Dialium cochinchinense</i>	Velvet tamarind	T	Leguminosae	LR/NT	UMD
<i>Dioscorea triphylla</i>		C	Dioscoreaceae		UMD
<i>Diospyros sp.</i>			Ebenaceae		UMD
<i>Dipterocarpus costatus</i>		T	Dipterocarpaceae	EN	UMD
<i>Dipterocarpus turbinatus</i>			Dipterocarpaceae	CR	UMD
<i>Dracaena angustifolia</i>		H	Liliaceae		UMD, B, OF, YF
<i>Elaeocarpus siamensis</i>		T	Elaeocarpaceae		UMD
<i>Elaeocarpus stipularis</i>		T	Elaeocarpaceae		UMD
<i>Embelia libers</i>		C	Primulaceae		UMD, B, YF
<i>Engelhardtia spicata</i>		T	Juglandaceae	LR/LC	UMD
<i>Eurycoma longifolia</i>	Tongkat ali	TL	Simaroubaceae		UMD
<i>Fagraea fragrans</i>	Tembusu	T	Gentianaceae		UMD
<i>Forrestia griffithii</i>		H	Commelinaceae		OF
<i>Garcinia frangeoides</i>			Clusiaceae		UMD
<i>Gardenia philastreii</i>			Rubiaceae		UMD
<i>Globba reflexa</i>		H	Zingiberaceae	LC	B, YF
<i>Glochidion sphaerogynum</i>			Phyllanthaceae		UMD, B, OF, YF
<i>Gmelina arborea</i>	Malay beechwood	T	Lamiaceae		UMD
<i>Gonocaryum lobbianum</i>			Cardiopteridaceae		UMD, B, OF, YF
<i>Grewia paniculata</i>			Malvaceae		UMD
<i>Hedyotis lineata</i>		H	Rubiaceae		UMD
<i>Hopea ferrea</i>		T	Dipterocarpaceae	EN	UMD
<i>Irvingia malayana</i>		T	Irvingiaceae	LR/LC	UMD, OF
<i>Lagerstroemia sp.</i>			Lythraceae		UMD
<i>Lithocarpus rhabdostachyus</i>		T	Fagaceae		UMD
<i>Lithocarpus sp.</i>			Fagaceae		UMD
<i>Lygodium flexuosum</i>	Climbing fern	Fern	Lygodiaceae		B, OF
<i>Macaranga denticulata</i>		TL	Euphorbiaceae		B, YF
<i>Maesa ramentacea</i>		TL	Primulaceae		YF
<i>Mallotus paniculatus</i>		TL	Euphorbiaceae		UMD, B, YF
<i>Mallotus repandus</i>		C	Euphorbiaceae		UMD
<i>Mallotus thorelii</i>		TL	Euphorbiaceae		UMD, B, YF

Scientific Name	English Common Name	Habit	Family	IUCN Red List Status	Habitats
<i>Mangifera indica</i>	Mango	T	Anacardiaceae	DD	UMD
<i>Memecylon edule</i>	Kaayam	TL	Melastomataceae		UMD
<i>Memecylon scutellatum</i>		T	Melastomataceae		UMD
<i>Mesua ferrea</i>			Calophyllaceae		UMD
<i>Millettia pulchra</i>		TL	Leguminosae	LC	UMD
<i>Ormosia pinnata</i>		T	Fabaceae		UMD, B, OF, YF
<i>Oxytenanthera albociliata</i>	Bamboo	H	Poaceae		UMD, OF, YF
<i>Oxytenanthera parvifolia</i>	Bamboo	H	Poaceae		UMD, B, OF,
<i>Parinari anamensis</i>			Chrysobalanaceae		UMD
<i>Peltophorum dasyrrhachis</i>		T	Fabaceae		UMD, OF, YF
<i>Phoebe lanceolata</i>		TL	Lauraceae		UMD
<i>Phoebe sp.</i>			Lauraceae		UMD
<i>Pterocymbium dussaudii</i>		T	Malvaceae		B
<i>Pterospermum semisagittatum</i>			Malvaceae		UMD
<i>Quercus petelotii</i>		T	Fagaceae		UMD
<i>Rinorea boissieu</i>		TL	Violaceae		UMD, B
<i>Sapium discolor</i>		T	Euphorbiaceae		UMD, OF
<i>Schima wallichii</i>		T	Theaceae		UMD, B, OF, YF
<i>Scleria terrestris</i>		H	Cyperaceae	LC	UMD, B, OF, YF
<i>Sindora siamensis var. siamensis</i>		T	Leguminosae	LC	UMD
<i>Spondias pinnata</i>			Anacardiaceae		UMD
<i>Syzygium chloranthum</i>		T	Myrtaceae		UMD
<i>Syzygium cumini</i>	Jambul		Myrtaceae		UMD
<i>Syzygium zeylanicum</i>			Myrtaceae		UMD
<i>Thysanolaena maxima</i>		H	Poaceae		OF, YF
<i>Trema orientalis</i>	Charcoal-tree	TL	Cannabaceae		UMD, B, YF
<i>Uvaria macrophylla</i>		C	Annonaceae		UMD, OF
<i>Vatica cinerea</i>		T	Dipterocarpaceae	EN	UMD
<i>Vitex tripinnata</i>			Lamiaceae		B, OF
<i>Wrightia arborea</i>		T	Apocynaceae		B
<i>Xerospermum noronhianum</i>		T	Sapindaceae		UMD
<i>Zanthoxylum rhetsa</i>		TL	Rutaceae		UMD

Key: EN – Endangered; LC – Least Concern; LR – Lower Risk; T – Tree; TL – Treelet; H – Herb; PH – Perennial Herb; C – Creeper; V – Vine; S – Shrub; B – Bamboo; UMD – Upper Mixed Deciduous; OF – Old Fallow; YF – Young Fallow

**Table D-2 Timber products used by local villagers in the Project Area, including global and Lao PDR conservation significance, frequency of collection, who collects and use**

Scientific Name	English Common Name	Lao Name (English)	IUCN Red List Status	Lao PDR Status	Hatsaykham				Hat Gniun				Som Seun			
					When?	Who?	Where?	Use	When?	Who?	Where?	Use	When?	Who?	Where?	Use
<i>Trema orientalis</i>	Charcoal-tree	Mai po hou	N/A		D/W	B	F	C	D/W	B	F	C				
<i>Anisoptera costata</i>		Mai bark	EN	LR/CD/NT	D	B	UMD	C	D	M	UMD	C	D	M	UMD	C/S
<i>Dipterocarpus costatus</i>		Mai yang deng	EN	VU	D	B	UMD	C	D	M	UMD	C	D	M	UMD	C/S
<i>Hopea ferrea</i>		Mai khaen taek/Mai khaenhin	EN	VU	D	B	UMD	C	D	M	UMD	C	D	M	UMD	C/S
<i>Hopea odorata</i>		Mai khaen hua	VU	LR/CD/NT					D	M	UMD	C	D	M	UMD	C/S
<i>Peltophorum dasyrrhachis</i>		Mai sa phang	N/A	LR/LC	D	B	F	C	D/W	B	F	C				
<i>Cratoxylum formosum var prunifolium</i>		Mai tiw	LR/LC		D	B	F	C	D/W	B	F	C	D/W	B	F	C
<i>Lagerstroemia sp.</i>		Mai lan	N/A						D	M	UMD	C	D	M	UMD	C
<i>Aporosa ficifolia</i>		Mai muad	N/A		D	B	F	C	D/W	B	F	C				
<i>Cephalostachyum virgatum</i>	Bamboo	Mai hia	N/A						D/W	B	F	C	D	M	UMD	C
<i>Oxytenanthera albociliata</i>	Bamboo	Mai lay	N/A						D/W	B	F	C	D/W	B	F	C
<i>Oxytenanthera parvifolia</i>	Bamboo	Mai sord	N/A						D/W	B	F	C	D/W	B	F	C

Key: EN – Endangered; VU – Vulnerable; DD – Data Deficient; NT – Near Threatened; LR – Lower Risk; LC – Least Concern; CD – Conservation Dependent; N/A – Not Assessed; D – Daily; D/W – Daily and/or Weekly; B – Both Women & Men; M – Men; F – Fallow; UMD – Upper Mixed Deciduous forest; C – Consumption; S – Sale

**Table D-3 Non-timber forest products used by local villagers in the Project Area, including global and Lao PDR conservation significance, frequency of collection, who collects and use**

Scientific Name	English Common Name	Lao Name (English)	IUCN Red List Status	Lao PDR Status	Hatsaykham				Hat Gniun				Som Seun			
					When?	Who?	Where?	Use	When?	Who?	Where?	Use	When?	Who?	Where?	Use
<i>Amanita princeps</i>	Mushroom	Hed la ngok	N/A										W	B	F	C
<i>Hirneola polytricha</i>	Cloud ear fungus	Hed hou nou	N/A		W	B	F	C	W	B	F	C	W	B	F	C
<i>Xerocomellus chrysenteron</i>	Mushroom	Hed pheung	N/A										W	B	F	C
<i>Termitomyces robustus</i>	Mushroom termitomyces	Hed pouak	N/A		W	B	F	C	W	B	F	C	W	B	F	C
<i>Lentinus polychrous</i>	Mushroom lentinus	Hed bot	N/A		W	B	F, UMD	C	W	B	F	C	W	B	F	C
<i>Lentinus squarrosulus</i>	White rot fungus	Hed khao	N/A		W	B	F	C	W	B	F	C	W	B	F	C
<i>Schizophyllum commune</i>	Mushroom bee	Hed bee	N/A		W	B	F	C	W	B	F	C	W	B	F	C
<i>Diplazium esculentum</i>	Fern	Phak kood khao	LC		B	B	F	C	B	B	F	C	B	B	F	C
<i>Calamus spp.</i>	Rattan	Nor wai	N/A		B	B	F	C	B	B	F	C	B	B	F	C
<i>Rhapis micrantha</i>	Rhapis	San	N/A										B	B	F	C
<i>Eleusine indica</i>	Eleusin grass	Ya khouay	LC		B	B	F	C	B	B	F	C	B	B	F	C
<i>Irvingia malayana</i>	Irvingia	Mak ka bok	LR/LC	LR/CD/NT									B	B	F	C
<i>Coccinium fenestratum</i>	Yellow vine	Khua haem	N/A		B	B	F	Md	B	B	F	C	B	B	F	C
<i>Antiaris toxicaria</i>	Antiaris	Yang mak nong	N/A		B	B	F	Md	B	B	F	C	B	B	F	C
<i>Helminthostachys zeylanica</i>	Kamraj fern	Ton teen houng	N/A										B	B	F	Md
<i>Passiflora foetida</i>	Passiflora	Phak bouang	N/A										M	B	F	C
<i>Cephalostachyum virgatum</i>	Bamboo	Nor mai hia	N/A		W	B	F	C	W	B	F	C	W	B	F	C
<i>Oxytenanthera albociliata</i>	Bamboo	Nor mai lay	N/A		W	B	F	C/S	W	B	F	C/S	W	B	F	C/S



Scientific Name	English Common Name	Lao Name (English)	IUCN Red List Status	Lao PDR Status	Hatsaykham				Hat Gniun				Som Seun			
					When?	Who?	Where?	Use	When?	Who?	Where?	Use	When?	Who?	Where?	Use
<i>Oxytenanthera parvifolia</i>	Bamboo	Nor mai sord	N/A		W	B	F	C	W	B	F	C	W	B	F	C
<i>Zanthoxylum rhetsa</i>	Zanthoxylum	Mak khaen	N/A	VU	W	B	F	C/S	W	B	F	C/S	W	B	F	C/S
<i>Centella asiatica</i>	Centella	Phak nok	LC		B	B	F	C	B	B	F	C	B	B	F	C

Key: EN – Endangered; VU – Vulnerable; DD – Data Deficient; NT – Near Threatened; LR – Lower Risk; LC – Least Concern; CD – Conservation Dependent; N/A – Not Assessed; D – Daily; D/W – Daily and/or Weekly; W – Weekly; M – Monthly; B – Both Women & Men; M – Men; F – Fallow; UMD – Upper Mixed Deciduous forest; C – Consumption; S – Sale; Md – Medicine

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## Appendix E: Terrestrial Fauna

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# Appendix E

During Local Knowledge Surveys (Earth Systems, 2015), villagers from Ban Hatsaykham, Ban Hat Gniun, and Ban Somseun identified 86 species of fauna that reportedly inhabit the HSRA, with the majority sited in the Nam Ngiep Nam Mang PFA portion of the HSRA. Table E-1 lists the species reported as well as IUCN Red List status and Lao PDR status, with respect to conservation significance.

**Table E-1 Mammals, birds, amphibians and reptiles seen in the PFA by host villagers, including species global and national conservation status, frequency of sightings**

English Common Name	Scientific Name	Lao Name (English)	IUCN Red List Status	Lao PDR Status	Hatsaykham				Hat Gniun				Somseun			
					Seen?	Captured?	How often?	Habitat	Seen?	Captured?	How often?	Habitat	Seen?	Captured?	How often?	Habitat
<b>MAMMALS</b>																
Dhole	<i>Cuon alpinus</i>	Ma chok	EN	ARL									✓		R	F
Leopard cat	<i>Prionailurus bengalensis</i>	Hua nok/Sua pa	LC		✓		R	F,U	✓		R	F,U				
Hairy-nosed otter	<i>Lutra sumatrana</i>	Nak	EN	CARL									✓		R	F
Asiatic black bear	<i>Ursus thibetanus</i>	Mee	VU	ARL	✓		VR	F								
Masked palm civet	<i>Paguma larvata</i>	Ngen hang kho	LC		✓		R	F,U								
Common palm civet	<i>Paradoxurus hermaphroditus</i>	Ngen om	LC		✓		C	F,U	✓		C	F,U	✓		C	F
Large Indian civet	<i>Viverra zibetha</i>	Ngen hang kan	NT										✓		R	F
Southern red muntjac	<i>Muntiacus muntjak</i>	Fan	LC		✓		R	F,U	✓		R	F,U	✓		R	F,U
Sambar deer	<i>Rusa unicolor</i>	Kouang	VU	PARL	✓		R	F,U	✓		R	F,U	✓		R	F,U

English Common Name	Scientific Name	Lao Name (English)	IUCN Red List Status	Lao PDR Status	Hatsaykham				Hat Gniun				Somseun			
					Seen?	Captured?	How often?	Habitat	Seen?	Captured?	How often?	Habitat	Seen?	Captured?	How often?	Habitat
Wild boar*	<i>Sus scrofa</i>	Mou pah	LC	LKL	✓		C	F,U	✓	24/6	C	F,U	✓		C	F,U
Javan chevrotain mousedeer	<i>Tragulus javanicus</i>	Fan kai	DD		✓		R	F,U								
Great woolly horsehoe bat	<i>Rhinolophus luctus</i>	Chia na saek	LC										✓		R	F
Big-eared horseshoe bat	<i>Rhinolophus macrotis</i>	Chia na mou	LC	PARL	✓		C	F,U	✓		C	F,U	✓		R	F
Sunda pangolin	<i>Manis javanica</i>	Lin	EN	ARL	✓		VR	F	✓		VR	F	✓		VR	F
Crab-eating macaque	<i>Macaca fascicularis</i>	Ling mou	LC										✓		R	F
Greater slow loris	<i>Nycticebus coucang</i>	Ling lom noi	VU	LKL									✓		R	F
Asiatic brush-tailed porcupine	<i>Atherurus macrourus</i>	Horn	LC										✓		R	F
Malayan porcupine	<i>Hystrix brachyura</i>	Men	LC										✓		VR	F
Greater bandicoot rat	<i>Bandicota indica</i>	Nou phouk	LC		✓		C	F,U	✓		C	F,U	✓		C	F
Gairdner's shrewmouse	<i>Mus pahari</i>	Noi wai	LC		✓		C	F,U	✓		C	F,U	✓		C	F
Sladen rat	<i>Rattus karatensis</i>	Nou thong khao	N/A		✓		C	F,U	✓		C	F,U	✓		C	F
Pallas's squirrel	<i>Callosciurus erythraeus</i>	Ka hok daeng	LC										✓		C	F
Tree squirrel	<i>Callosciurus sp.</i>	Ka hok bao	N/A		✓		C	F,U	✓		C	F,U	✓		C	F
Tree squirrel	<i>Callosciurus sp.</i>	Ka hok lik	N/A		✓		C	F,U	✓		C	F,U	✓	24/6	C	F



English Common Name	Scientific Name	Lao Name (English)	IUCN Red List Status	Lao PDR Status	Hatsaykham				Hat Gniun				Somseun			
					Seen?	Captured?	How often?	Habitat	Seen?	Captured?	How often?	Habitat	Seen?	Captured?	How often?	Habitat
Black giant squirrel	<i>Ratufa bicolor</i>	Bang Lua	NT	PARL	✓		R	F,U								
Hoary bamboo rat	<i>Rhizomys pruinosus</i>	Onh	LC		✓		C	F,U	✓		C	F,U				
Common treeshrew	<i>Tupaia glis</i>	Ka nai	LC		✓		C	F,U	✓		C	F,U	✓		C	F
<b>BIRDS</b>																
Silver-backed needletail	<i>Hirundapus cochinchinensis</i>	Nok aen yai	LC										✓		C	F
Little swift	<i>Apus affinis</i>	Nok Aen Ban	LC		✓		C	F	✓		C	F	✓		C	F
Common snipe	<i>Gallinago gallinago</i>	Nok Khee Kadeuan	LC		✓		C	R-P					x		C	R-P
Striated heron	<i>Butorides striata</i>	Nok Chao	LC		✓		C	F	✓		C	S	✓		C	S
Little egret	<i>Egretta garzetta</i>	Nok Yang	LC		✓		C	R-P	✓		C	R-P	✓		C	R-P
Emerald dove	<i>Chalcophaps indica</i>	Nok pau kheo	LC										✓		C	F
Pale-capped pigeon	<i>Columba punicea</i>	Nok Khao Kheo	VU	LKL	✓		C	F	✓		C	F				
Green imperial-pigeon	<i>Ducula aenea</i>	Nok Mum	LC	ARL	✓		C	F	✓		C	F	✓		C	F
Eastern spotted dove	<i>Spilopelia chinensis</i>	Nok Khao Tou	LC		✓		C	F	✓		C	F	✓		C	F
Common kingfisher	<i>Alcedo atthis</i>	Nok Ten Seo	LC		✓		C	S				S	✓		C	S
Blyth's kingfisher	<i>Alcedo hercules</i>	Nok Ten	NT	PARL	✓		C	S	✓		C	S			C	S

English Common Name	Scientific Name	Lao Name (English)	IUCN Red List Status	Lao PDR Status	Hatsaykham				Hat Gniun				Somseun			
					Seen?	Captured?	How often?	Habitat	Seen?	Captured?	How often?	Habitat	Seen?	Captured?	How often?	Habitat
Crested kingfisher	<i>Megaceryle lugubris</i>	Nok ten	LC						✓		C	S			C	S
Oriental pied hornbill	<i>Anthracoceros albirostris</i>	Nok Keng	LC		✓		VR	U	✓		VR	U	✓		C	F
Greater coucal	<i>Centropus sinensis</i>	Nok Kod	LC		✓		C	F	✓		C	F	✓		C	F
Changeable hawk-eagle	<i>Nisaetus cirrhatus</i>	Leo Mum	LC		✓		C	F	✓		C	F	✓		C	F
Scaly-breasted partridge	<i>Arborophila chloropus</i>	Nok Kho	LC		✓								✓		C	F
Red junglefowl/chicken*	<i>Gallus gallus</i>	Kai Pah	LC		✓		C	F					✓		C	F
Siamese fireback	<i>Lophura diardi</i>	Kai khoua nin	LC	PARL	✓		VR	F,U					✓		VR	F
Silver pheasant	<i>Lophura nycthemera</i>	Kai Koua louang	LC		✓		VR	F,U	✓		VR	F,U	✓		VR	F
White-breasted waterhen	<i>Amauornis phoenicurus</i>	Nok vuk	LC										✓		C	F
Ruddy-breasted crake	<i>Porzana fusca</i>	Nok Kaina	LC		✓		C	F	✓		C	F	✓		C	F
Large-billed crow	<i>Corvus macrorhynchos</i>	Ka	LC						✓		C	F	✓		C	F
Lesser racket-tailed drongo	<i>Dicrurus remifer</i>	Nok Seo Sy Dam	LC		✓		C	F								
Pied wagtail and white wagtail	<i>Motacilla alba</i>	Non Ka Daep Dau	LC		✓		C	R-P								
Slender-billed oriole	<i>Oriolus tenuirostris</i>	Nok Khee Min	LC		✓		C	F	✓		C	F				
Black-crested bulbul	<i>Pycnonotus melanicterus</i>	Nok Kouak	LC		✓		C	F	✓		C	F	✓	24/6	C	F

English Common Name	Scientific Name	Lao Name (English)	IUCN Red List Status	Lao PDR Status	Hatsaykham				Hat Gniun				Somseun			
					Seen?	Captured?	How often?	Habitat	Seen?	Captured?	How often?	Habitat	Seen?	Captured?	How often?	Habitat
Common myna	<i>Acridotheres tristis</i>	Nok ieng mon	LC						✓		C	F				
Mountain tailorbird	<i>Orthotomus cuculatus</i>	Nok Ka Chip	LC		✓		C	F	✓		C	F	✓		C	F
Blue whistling-thrush	<i>Myophonus caeruleus</i>	Nok ka in	LC		✓		C	F					✓		C	F
Black-headed woodpecker	<i>Picus erythropygius</i>	Nok Sai Sy Dam	LC		✓		C	F								
Red-collared woodpecker	<i>Picus rabieri</i>	Nok Sai Sy Daeng	NT		✓		C	F								
Green-eared barbet	<i>Megalaima faiostricta</i>	Nok Khone Dok	LC		✓		C	F	✓		C	F	✓		C	F
Vernal hanging-parrot	<i>Loriculus vernalis</i>	Nok kee	LC						✓		C	F	✓		C	F
<b>AMPHIBIANS</b>																
Asian common toad	<i>Duttaphrynus melanostictus</i>	Khan Khak	LC		✓		C	S-P	✓		C	S-P	✓		C	F, S
Asian grass frog	<i>Fejervarya limnocharis</i>	Khiat	LC		✓		C	S-P	✓		C	S-P	✓		C	S-P
	<i>Quasipaa fasciculispina</i>	Kop	VU		✓		C	S-P	✓	✓	C	S-P	✓		C	S-P
	<i>Leptolalax sp.</i>	Kapad	N/A		✓		C	S-P	✓		C	S-P	✓		C	S-P
Burmese squat frog	<i>Calluella guttulata</i>	Oung	LC		✓		C	S-P	✓		C	S-P	✓		C	S-P
Beautiful pygmy frog	<i>Microhyla pulchra</i>	To Sa Ae	LC		✓		C	S-P	✓		C	S-P	✓		C	S-P
Sapgreen stream frog	<i>Hylarana nigrovittata</i>	Khiat Ta Ot	LC		✓		C	S-P	✓		C	S-P	✓		C	S-P

English Common Name	Scientific Name	Lao Name (English)	IUCN Red List Status	Lao PDR Status	Hatsaykham				Hat Gniun				Somseun			
					Seen?	Captured?	How often?	Habitat	Seen?	Captured?	How often?	Habitat	Seen?	Captured?	How often?	Habitat
Green cascade frog	<i>Odorrana livida</i>	Khia Lang Kheo	DD		✓		C	S-P	✓		C	S-P	✓		C	S-P
Common tree frog	<i>Polypedates leucomystax</i>	Kapad	LC		✓		C	S-P	✓		C	S-P	✓		C	S-P
<b>REPTILES</b>																
Emma gray's forest lizard	<i>Calotes emma</i>	Ka Pom	N/A		✓		C	F	✓		C	F	✓		C	F
Chinese water dragon	<i>Physignathus cocincinus</i>	Ka tang	N/A		✓		C	F	✓		C	F	✓		C	S
	<i>Zamenis sp.</i>	Ngou Sing Dong	N/A		✓		C	F,U	✓		C	F				
Radiated ratsnake	<i>Elaphe radiata</i>	Ngou Sa	N/A		✓		C	F	✓		C	F	✓		C	F
Monocled cobra	<i>Naja kaouthia</i>	Ngou Hau	LC	PARL	✓		C	F	✓		C	F	✓		C	F
King cobra	<i>Ophiophagus hannah</i>	Ngou Chong Ang	VU	PARL	✓		C	F	✓		C	F	✓		C	F
Today gecko	<i>Gekko gecko</i>	Kap Kae	N/A		✓		C	F	✓		C	F	✓		C	F
Red-necked keelback	<i>Rhabdophis subminiatus</i>	Ngou Dang Hae	LC		✓		C	F					✓		C	F,U
Diamond-backed water snake	<i>Sinonatrix aequifasciata</i>	Ngou Pah	LC		✓		C	S-P								
Asiatic reticulated python	<i>Python reticulatus</i>	Ngou Leum	N/A	PARL	✓		R	S-P					✓		R	F
Reeves' smooth skink	<i>Scincella reevesii</i>	Chikor	N/A		✓		C	F	✓		C	F	✓		C	F



English Common Name	Scientific Name	Lao Name (English)	IUCN Red List Status	Lao PDR Status	Hatsaykham				Hat Gniun				Somseun			
					Seen?	Captured?	How often?	Habitat	Seen?	Captured?	How often?	Habitat	Seen?	Captured?	How often?	Habitat
Spotted forest skink	<i>Sphenomorphus maculatus</i>	Chee Koh	N/A		✓		C	F	✓		C	F	✓		C	F
Bengal monitor lizard	<i>Varanus bengalensis</i>	Laen	LC		✓		C	F	✓				✓		C	F
Common water monitor	<i>Varanus salvator</i>	Hia	LC	PARL	✓		R	S					✓		C	F
White-lipped pitviper	<i>Cryptelytrops albolabris</i>	Ngou Keo Hang Haem	LC		✓		C	F	✓		C	F	✓		C	F
Brown sweetlips	<i>Platysternon megacephalum</i>	Pou Lu	EN		✓		VR	S					✓		R	S
Chinese softshell turtle	<i>Pelodiscus sinensis</i>	Pa Pha Ong	VU		✓		R	RI	✓		C	F	✓		R	RI

Key: \* - Introduced, not native; EN – Endangered; VU – Vulnerable; NT – Near Threatened; LR – Lower Risk; LC – Least Concern; N/A – Not Assessed; LKL – Little Known in Lao PDR; PARL – Potentially At Risk in Lao PDR; ARL –At Risk in Lao PDR; CARL – Conditionally At Risk in Lao PDR; C – Common; R – Rare; VR – Very Rare; F – Fallow; U – Upper Mixed Deciduous Forest; S – Stream; RI – River; S-P – Stream-Pond; R-P – River-Pond

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## **Appendix F: Fish and Aquatic Resources**

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# Appendix F: Fish of the HSRA

During focus group discussions / Local Knowledge Surveys, villagers from Ban Hatsaykham, Ban Hat Gniun, and Ban Somseun identified 106 fish species from photographs that reportedly inhabit streams of the HSRA as permanent residents or migratory fish. However, the list (refer to Table F-1) is likely an overrepresentation of HSRA fish occurrence and is considered inactive only, as direct sampling was not undertaken.

**Table F-1 Fish species identified during Focus Group Discussions for HSRA streams and IUCN status**

Scientific Name	Lao Name	IUCN Red List Status
<i>Acheilognathus barbatulus</i>	Pa jat	LC
<i>Acheilognathus deignani</i>	Pa jat	DD
<i>Acrossocheilus xammensis</i>	Pa jat	NE
<i>Anabus testudinieus</i>	Pa kheng	NE
<i>Babonimus schwanenfeldii</i>	Pa vienfai	NE
<i>Bagarius yarrellit</i>	Pa khare	NE
<i>Balitora cf. annamitica</i>	Pa kor	NE
<i>Balitora lancangjiangensis</i>	Pa korhin	LC
<i>Banana lippa</i>	Pa thon	NE
<i>Barbodes aurotaeniatus</i>	Pa khan haue	LC
<i>Barbodes gonionotus</i>	Pa pak na	LC
<i>Belodontichthys dinema</i>	Pa khop	NE
<i>Brachygobius sp.</i>	Pa boo	DD
<i>Channa aff. marulius</i>	Pa khap	DD
<i>Channa gachua</i>	Pa kang	LC
<i>Channa micropeltis</i>	Pa ka doo	NE
<i>Channa striata</i>	Pa khor	LC
<i>Chela laubuca</i>	Pa mark yar	NE
<i>Cirrhinus molitorella</i>	Pa kang	NT
<i>Cirrhinus proseion</i>	Pa kang	NE
<i>Clarias batrachus</i>	Pa dook	LC
<i>Cyclocheilichthys apogon</i>	Pa dork ngew	LC
<i>Danio chrysoaeniatus</i>	Pa sew oow	DD
<i>Danio sp</i>	Pa sew oow	NE
<i>Danioa crostomus</i>	Pa sew oow	NE
<i>Datnioides pulcher</i>	Pa seux	CR
<i>Datnioides undecimradiatus</i>	Pa seux	VU
<i>Epalzeorhynchus munense</i>	Pa pan dang	VU
<i>Esomus metallicus</i>	Pa sew oow	NE
<i>Glyptothorax aff. Zonaensis</i>	Pa kod	NE
<i>Glyptothorax horai</i>	Pa yyew here	NE
<i>Glyptothorax laosensis</i>	Pa kod	LC
<i>Hampala dispar</i>	Pa soud jum	LC
<i>Hampala macropidota</i>	Pa soud karn	NE
<i>Helicophagus waandersii</i>	Pa na nu	DD
<i>Hemibagrus nemurus</i>	Pa kod	LC
<i>Hemibagrus wyckiodes</i>	Pa kherng	NE
<i>Hemimyzon confluens</i>	Pa korhin	VU
<i>Hemisilurus mekongensis</i>	Pa nang dang	LC

Scientific Name	Lao Name	IUCN Red List Status
<i>Homalopterera yunnanensis</i>	Pa korhin	NE
<i>Hysibarbus malcolmi</i>	Pa pak nues	NE
<i>Krypterus cheveyi</i>	Pa pikkai	NE
<i>Labeo chrysophekadion</i>	Pa phea	LC
<i>Labiobarbus leptocheila</i>	Pa khilarm	LC
<i>Laides hexanema</i>	Pa yon talo	NE
<i>Macrogathus circumcinctus</i>	Pa lard fi	LC
<i>Macrogathus semiocellatus</i>	Pa lod	LC
<i>Macrogathus siamensis</i>	Pa lodna	LC
<i>Macrogathus sp. Long snout</i>	Pa lodnong	DD
<i>Macronema apongon</i>	Pa nang	NE
<i>Mastacembelus armatus</i>	Pa lard	LC
<i>Mekongena erythrospila</i>	Pa dork hoi	NE
<i>Monopterus albus</i>	Oien	LC
<i>Monotreta turgidus</i>	Pa pao	LC
<i>Mystacoluecus greenwayi</i>	Pa jard	NE
<i>Mystacoluecus marginatus</i>	Pa jard	NE
<i>Mystus albolineatus</i>	Pa kha yang	LC
<i>Mystus atrifasciatus</i>	Pa kha yang	NE
<i>Mystus bourti</i>	Pa kha yang to	NE
<i>Mystus multiradiatus</i>	Pa kha yang lai	LC
<i>Mystus mysticetus</i>	Pa kha yang	LC
<i>Mystus rhegma</i>	Pa kha yang	DD
<i>Nemacheilus platiceps</i>	Pa kheawkai	DD
<i>Neodontobotis auramus</i>	Pa boo	NE
<i>Neodontobotis tonkinnensis</i>	Pa boo	NE
<i>Neolissichilus blanci</i>	Pa song	NE
<i>Notopterus notopterus</i>	Pa tong dang	LC
<i>Ombok bimaculatus</i>	Pa searm	NE
<i>Onpe hypoethalms</i>	Pa pikkai	NE
<i>Opsarius pulchellus</i>	Pa kanhaue	LC
<i>Oreoglanis delacouri</i>	Pa kor	NE
<i>Osphronemus exedon</i>	Pa mene	NE
<i>Osteochilus hasselti</i>	Pa e thai	LC
<i>Osteochilus triatus</i>	Pa khilarm	DD
<i>Oynychostoma att. Gertachi</i>	Pa song	NE
<i>Panasius conchophilus</i>	Pa os	NE
<i>Pangasios micconemig</i>	Pa seay	NE
<i>Pangasius boccourti</i>	Pa phor	NE
<i>Pangsius polyuranodon</i>	Pa yon pon	NE
<i>Pangsius siamensis</i>	Pa yon ngem	NE
<i>Pao turgidus</i>	Pa pakapao	NE
<i>Papuligobius ocellatus</i>	Pa kang	LC
<i>Paralaubuca typus</i>	Pa tape	LC
<i>Parambassis siamensis</i>	Pa kupkhong	LC
<i>Poropuntius aff. carinatus</i>	Pa kang	NE
<i>Poropuntius normani</i>	Pa jard	LC
<i>Poropuntius sp.</i>	Pa pok	NE

Scientific Name	Lao Name	IUCN Red List Status
<i>Pristolepsis fasciata</i>	Pa ka	NE
<i>Pseudocheneis sympelvica</i>	Payangbon	NE
<i>Puntius brevis</i>	Pa pok	LC
<i>Rasbora atridorsalis</i>	Pa khanglai	LC
<i>Rasbora rubrodorsalis</i>	Pa sew oow	LC
<i>Rhinogobius albimaculatus</i>	Pa kang	VU
<i>Rhinogobius vermiculatus</i>	Pa korkang	DD
<i>Scaphiodonochthys acanthopterus</i>	Pa jard	NE
<i>Schistura aff. defectiva</i>	Pa muman	NE
<i>Schistura aff. ephelis</i>	Pamuman	NE
<i>Schistura corunscans</i>	Pa kheawkai	NE
<i>Schistura defectiva</i>	Pa kheawkai	NE
<i>Schistura dorsizona</i>	Pa kheawkai	LC
<i>Schistura sp. 'compact'</i>	Pamuman	NE
<i>Schistura sp. N. 'Nam Youak'</i>	Pa khanglai	NE
<i>Schistura sp. N. 'slender'</i>	Pamuman	NE
<i>Systemus jacobusboehilkei</i>	Pa pok	NE
<i>Tor laterivittatus</i>	Pa dang or Pa Song	DD
<i>Trichgaster trichopterus</i>	Pa ka durt	NE
<i>Xenentodon canciloides</i>	Pa sa thong	LC



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## Appendix G: Soils Analysis

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# Appendix G- HSRA Soil Laboratory Results

Soils were sampled in six (6) locations during a 2011 sampling campaign and 10 locations during a 2015 sampling campaign, and were analysed by NAFRI for various physio-chemical parameters. Table G-1 provides the results of 2011 sample analysis and Table G-2 the results of 2015 sample analysis.

**Table G-1 Physio-chemical soil properties of 2011 HSRA soil sample**

Site	Layer	pH		OM (%)	NH <sup>4+</sup> (ppm)	NO <sub>3</sub> <sup>+</sup> (ppm)	P <sub>2</sub> O <sub>5</sub> (%)	CEC (Cmol/kg)	Exchangeable cation (meq/100 g)				BS (%)	Soil particle size (hydrometer)			Texture class*
		H <sub>2</sub> O	KCL						Ca <sup>+2</sup>	Mg <sup>+2</sup>	K <sup>+</sup>	Na <sup>+</sup>		Sand (%)	Clay (%)	Silk (%)	
1	0-15	4.4	3.83	2.02	17.50	7.00	0.04	5.32	1.12	0.92	0.05	0.18	42.72	61.48	13.24	25.28	SL
	15-46	4.03	3.70	1.29	14.00	5.60	0.03	9.58	0.12	0.68	0.02	0.17	10.27	57.48	15.24	27.28	SL
	46-47	4.26	3.79	1.05	17.50	10.50	0.02	9.48	0.28	0.84	0.02	0.29	15.03	59.48	17.24	23.28	SL
	77-110	4.3	3.78	0.75	14.00	7.00	0.02	7.28	0.28	0.76	0.01	0.29	18.33	55.48	17.24	27.28	SL
2	0-14	4.2	3.69	2.23	16.10	7.70	0.04	11.58	0.16	0.76	0.07	0.24	10.58	51.48	15.24	33.28	L
	14-41	4.12	3.80	1.68	17.50	10.50	0.03	14.08	0.12	0.52	0.04	0.24	6.49	53.48	17.24	29.28	SL
	41-68	4.16	3.83	1.14	21.00	12.60	0.03	13.68	0.16	0.56	0.04	0.22	7.14	51.48	19.24	29.28	L
	68-110	4.3	3.88	1.31	16.80	7.00	0.03	9.88	1.52	3.48	0.22	0.22	55.02	49.48	21.24	29.28	L
3	0-16	4.29	3.75	2.59	14.00	7.00	0.03	6.88	0.20	0.72	0.05	0.25	17.76	53.48	11.24	35.28	SL
	16-52	4.31	3.85	1.43	14.00	6.30	0.03	4.38	0.04	1.16	0.02	0.27	33.97	49.48	19.24	31.28	L
	52-73	4.35	3.89	1.05	18.20	8.40	0.03	7.78	0.08	2.80	0.02	0.15	39.15	47.48	21.24	31.28	L
	73-120	4.42	3.89	1.12	21.00	10.50	0.03	6.78	0.12	0.76	0.02	0.20	16.2	45.48	23.24	31.28	L
4	0-16	4.45	3.76	1.80	10.50	7.00	0.03	6.38	0.36	0.88	0.09	0.22	24.48	51.48	15.24	33.28	L
	16-57	4.35	3.83	1.66	10.50	6.30	0.03	5.98	0.16	1.35	0.04	0.15	28.55	49.48	17.24	33.28	L
	57-83	4.44	3.88	1.30	10.50	4.90	0.02	5.38	0.20	1.04	0.06	0.15	26.92	43.48	23.24	33.28	L

Site	Layer	pH		OM (%)	NH <sup>4+</sup> (ppm)	NO <sub>3</sub> <sup>+</sup> (ppm)	P <sub>2</sub> O <sub>5</sub> (%)	CEC (Cmol/kg)	Exchangeable cation (meq/100 g)				BS (%)	Soil particle size (hydrometer)			Texture class*
		H <sub>2</sub> O	KCL						Ca <sup>+2</sup>	Mg <sup>+2</sup>	K <sup>+</sup>	Na <sup>+</sup>		Sand (%)	Clay (%)	Silt (%)	
	83-120	4.6	3.89	1.00	14.00	7.00	0.02	6.18	0.12	1.16	0.06	0.15	24.08	45.48	25.24	29.28	L
5	0-14	4.43	3.99	2.77	17.50	7.00	0.04	7.28	1.12	3.60	0.23	0.17	70.25	47.48	11.24	41.28	L
	14-49	4.43	3.82	1.43	14.00	5.60	0.03	3.72	0.32	1.48	0.19	0.15	57.38	43.48	21.24	35.28	L
	49-74	4.43	3.80	1.02	15.40	6.30	0.03	12.38	0.44	2.36	0.07	0.13	24.24	49.48	25.24	25.28	SCL
	74-110	4.56	3.82	1.08	21.00	10.50	0.03	6.30	0.56	1.24	0.06	0.22	32.98	39.48	27.24	33.28	CL
6	0-15	4.56	3.74	2.41	22.40	11.90	0.06	10.28	1.20	3.36	0.07	0.18	46.82	41.48	21.24	37.28	L
	15-66	4.43	3.78	2.06	10.50	7.00	0.05	10.18	0.28	1.80	0.04	0.25	23.29	35.48	23.24	41.28	L
	66-87	4.39	3.83	1.59	11.90	5.60	0.04	9.72	0.16	1.52	0.04	0.29	20.64	37.48	25.24	37.28	L
	87-120	4.38	3.86	1.51	10.50	7.00	0.05	7.98	0.04	1.52	0.05	0.29	23.77	33.48	27.24	39.28	CL

\* CL = Clay loam; LL = Loam; SL = Sandy Loam; SCL = Sandy Clay Loam

Source: NAFRI, 2011.

**Table G-2 Physio-chemical soil properties of 2015 HSRA soil samples**

No.	Layer	pH		OM (%)	NH <sub>4</sub> <sup>+</sup> (ppm)	NO <sub>3</sub> <sup>+</sup> (ppm)	P <sub>2</sub> O <sub>5</sub> (%)	CEC (cmol/kg)	Exchangeable cation (meq/100 g)				Soil particle size (hydrometer)			Texture class*
		H <sub>2</sub> O	KCL						Ca <sup>+2</sup>	Mg <sup>+2</sup>	K <sup>+</sup>	Na <sup>+</sup>	Sand (%)	Clay (%)	Silk (%)	
1	0-13	4.6	4.0	2.70	9.80	4.20	0.03	6.75	0.17	0.28	0.29	0.03	51.7	21.1	27.2	SCL
	13-80	4.4	4.0	1.72	7.00	3.50	0.02	11.69	0.00	0.05	0.14	0.01	48.9	26.0	25.2	SCL
2	0-22	4.6	4.0	1.12	9.80	3.50	0.03	9.84	0.81	0.13	0.15	0.05	63.5	11.0	25.6	SL
	22-50	4.7	4.1	3.36	2.80	2.80	0.05	10.54	0.13	0.00	0.06	0.02	76.2	7.2	16.5	SL
3	0-14	4.7	4.0	2.44	4.90	7.70	0.03	8.46	0.27	0.42	0.32	0.02	66.6	14.0	19.4	SL
	14-50	4.4	4.1	2.24	7.70	2.80	0.04	11.82	0.00	0.07	0.25	0.02	63.8	19.5	16.7	SL
4	0-20	3.8	3.6	4.45	24.50	11.90	0.03	10.99	0.00	0.01	0.10	0.04	84.7	3.6	11.7	LS
	20-52	4.2	4.1	1.85	7.70	2.80	0.05	13.51	0.00	0.00	0.05	0.03	99.6	0.2	0.2	Sa
5	0-12	4.2	4.0	2.84	11.90	9.10	0.03	11.71	0.00	0.10	0.14	0.04	99.6	0.2	0.2	Sa
6	0-15	4.3	3.9	2.90	4.90	4.20	0.04	12.21	0.16	0.05	0.10	0.01	77.8	6.9	15.4	LS
	15-55	4.3	4.0	1.12	9.10	3.50	0.03	13.06	0.00	0.00	0.06	0.01	90.7	0.4	8.9	Sa
7	0-15	4.2	4.0	4.29	13.30	9.10	0.05	12.33	0.03	0.19	0.21	0.02	47.5	26.2	26.2	SCL
	15-55	4.2	4.1	2.70	14.70	6.30	0.04	18.01	0.00	0.00	0.16	0.01	21.4	34.4	44.2	CL
8	0-17	4.4	4.1	5.14	21.00	4.90	0.07	14.43	0.02	0.11	0.50	0.02	61.2	3.3	35.6	SL
	17-50	4.1	4.0	3.10	26.60	5.60	0.04	18.74	0.00	0.00	0.14	0.01	66.9	14.3	18.8	SL
9	0-13	4.4	4.1	3.82	19.60	6.30	0.05	19.52	0.42	0.85	0.15	0.01	34.4	32.8	32.8	CL
	13-53	4.5	4.1	2.90	15.40	2.80	0.05	14.37	0.04	0.39	0.15	0.01	31.0	42.3	26.7	C
10	0-12	4.3	3.9	3.03	16.10	6.30	0.03	12.14	0.04	0.02	0.13	0.01	68.8	26.4	4.9	SCL
	12-50	4.2	4.0	1.98	12.60	4.20	0.02	12.74	0.00	0.00	0.10	0.01	70.5	10.9	18.6	SL

\* CL = Clay loam; LL = Loam; SL = Sandy Loam; SCL = Sandy Clay Loam

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## **Appendix H: ESMMP-CP Sub-Plans**

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## SP01: EROSION AND SEDIMENT CONTROL

No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
<i>Design specifications for erosion and sediment control</i>					
SP01.1	Retention and preservation of existing vegetation along watercourses will be maximized to reduce flow velocities and act as a sediment filter.	Visual site inspection	Construction sites	Routine	SP07: Vegetation Clearing
<i>Site Preparation</i>					
SP01.2	<p>Erosion and Sediment Control Design Plans will be prepared prior to the commencement of works for each construction site to provide site-specific design details on:</p> <ol style="list-style-type: none"> <li>i. Erosion and sediment controls (to be implemented on-site in accordance with the requirements of this sub-plan.</li> <li>ii. Water quality monitoring points in accordance with the requirements of SP02 (as required).</li> </ol> <p>An Erosion and Sediment Control Plan will be included in the Environmental Management and Monitoring Plan prepared for each construction site.</p>	Plan to be verified prior to commencement of the construction by Owner.	-	Once	<p>SP02: Water Availability and Pollution Control</p> <p>BMP-01: Scheduling</p>
SP01.3	Initial erosion and sediment controls shall be installed prior to or as early as possible after the commencement of vegetation clearance/ earthworks. Major control measures such as sediment basins shall be surveyed and pegged. The Contractor or its nominated sub-contractor shall then seek approval for the major controls from the NNP1 Site Manager prior to constructing each measure. Following approval, the measure shall be installed immediately.	<p>The installed sediment basins shall be checked against the approved designs.</p> <p>Each site to be cleared shall be inspected by the NNP1 Site Manager or NNP1 Environment Officer prior to any clearance activities. This officer shall approve vegetation clearance if the site to be cleared has been</p>	Construction sites	Weekly during construction period and after runoff generating storm events.	-

No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
		clearly marked in accordance with the Felling Permit and the initial erosion and sediment controls have been correctly installed.			
SP01.4	Survey and peg all designed drainage works prior to the commencement of bulk earthworks. NNP1 and the Contractor shall then jointly inspect all pegged drainage works. Once approval has been granted by NNP1, the Contractor shall install site drains prior to, during or immediately following earthworks to minimise the erosion hazard.	Monitoring will be conducted to inspect erosion and sediment control facilities and ensure proper function/ protection, with maintenance/repair measures implemented as necessary.	Construction sites	Weekly during construction period and after runoff generating storm events.	-
SP01.5	All staff involved in earthworks shall be walked through the layout of control measures on site to familiarize themselves with the functioning of controls and to avoid the removal of or damage to these measures.	Monitoring will be conducted to inspect erosion and sediment control facilities and ensure proper function/ protection, with maintenance/repair measures implemented as necessary.	Construction sites	Weekly during construction period and after runoff generating storm events.	-
SP01.6	Each site to be cleared shall be inspected by the NNP1 Site Manager or NNP1 Environment Officer prior to any clearance activities. This officer shall approve vegetation clearance if the site to be cleared has been clearly marked in accordance with any Government permit and the initial erosion and sediment controls have been correctly installed.	Inspection of site to verify demarcation of clearing area and implementation of erosion and sediment controls.	All clearing sites.	Once for each site, prior to clearing commencing.	SP07: Vegetation Clearing
<i>Erosion Control Measures</i>					
<i>Site Disturbance</i>					
SP01.7	The extent of areas to be cleared will be minimized as far as deemed practical and the use of existing cleared areas will be maximized.	Visual site inspection	Construction sites	Routine	SP07: Vegetation Clearing

No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
SP01.8	Areas within the construction areas not required to be disturbed by construction activities will be maintained in their existing condition or equivalent to status quo ante.	Visual site inspection	Construction sites	Routine	SP07: Vegetation Clearing
SP01.9	Progressively clear vegetation / excavate / disturb the site in a controlled manner, minimizing the area of disturbance until that part of the site is required for construction or ancillary purposes.	Visual site inspection	Construction sites	Routine	SP07: Vegetation Clearing
SP01.10	Undertake earthworks strictly within marked areas, avoiding soil disturbance beyond these areas.	Visual site inspection	Construction sites	Routine	-
SP01.11	Strictly control access to and from the site via entry and exit points.	Visual site inspection	Construction sites	Routine	SP14: Traffic and Access
SP01.12	Clearing of sites will be undertaken in the same sequence as the initiation of construction sites in order to minimize disturbances.	Visual site inspection	Construction sites	Routine	BMP-01: Scheduling
<i>Sensitive Erosion Areas</i>					
SP01.13	'Sensitive erosion areas' are defined as follows: i. Areas with slopes > 30%. ii. Areas within 30 m of a bank of a natural watercourse. iii. Cut and fill slopes in areas of slope instability or erodible geology.	-	-	-	-
SP01.14	The location of works in sensitive erosion areas will be avoided where possible.	Visual site inspection	Construction sites	Routine	BMP-01: Scheduling
SP01.15	Where possible, works in sensitive erosion areas will be restricted to the dry season.	Visual site inspection	Construction sites	Routine	-
<i>Erosion Control</i>					
SP01.16	Erosion control measures shall be progressively installed and modified as each construction site is developed, adapting the controls to the changing site features and activities.	Visual site inspection	Construction sites	Routine	-

No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
SP01.17	Suitable soil erosion control measures (e.g., provision of cofferdam and related structures to redirect flows around construction areas, use of silt curtains, silt fences, fiber rolls, etc.) shall be implemented prior to excavation of the bridge pier foundation and construction activities at waterways to minimize the influx of sediment into surface water.	Visual site inspection	Construction sites	Routine	-
<i>Sediment Control</i>					
SP01.18	<p>Sedimentation controls will be implemented in the form of sedimentation traps and basins, and silt fences or similar where appropriate, depending upon the size of the disturbed area and upslope catchment area, and other physical and environmental constraints.</p> <p>Discharged water from drilling or excavation shall not be allowed to discharge directly into natural water source. A sediment/settling basin shall be designed, installed and maintained with good efficiency to remove suspended solid from water prior to discharging into natural watercourses. This will be routine inspected by Environmental Officer (with more frequency if there such works in rainy season). Where the natural settling rate is too slow a flocculant will be added to accelerate the settling of suspended material in the sediment pond.</p>	Visual site inspection	Construction sites	Routine	<p>BMP-13: Sediment trap</p> <p>BMP-14: Sediment basin</p>
SP01.19	Sediment/settling basin volume shall be designed based on catchment area, estimated storm discharge (2 year return period), sediment particle size, etc.	Visual site inspection	Sediment basins	Routine	<p>BMP-13: Sediment Trap</p> <p>BMP-14: Sediment Basin</p>
SP01.20	Release of discharge will only occur after monitoring of installation in accordance with approved design as required to meet the requirements of SP02.	Visual site inspection	Construction sites	Routine	SP02: Water Availability and Pollution Control

No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
SP01.21	Sediment controls shall be installed across construction sites based on the principle of dividing the catchment into manageable areas (rather than providing a single trap at the bottom of the site that may fail).	Visual site inspection	Construction sites	Weekly during construction period and after runoff generating storm events.	-
SP01.22	Sediment fences and traps with adequate capacity shall be provided at each construction site, material storage area, camp site, etc.	Visual site inspection	Construction sites	Weekly during construction period and after runoff generating storm events.	-
SP01.23	Sediment / settling basins shall be fitted with a runoff overflow pipe that either discharges into a secondary basin or to a watercourse.	Visual site inspection	Construction sites	Weekly during construction period and after runoff generating storm events.	-
SP01.24	Sediment shall be disposed of without creating a safety or erosion hazard, or degrading land (e.g. disposal on agricultural land will not be permitted).	Visual site inspection	Construction sites	Weekly during construction period and after runoff generating storm events.	-
SP01.25	Avoid or minimize grading during the rainy season to the maximum extent feasible, particularly in areas of steep topography/or adjacent to water courses.	Visual site inspection	Construction sites	Weekly during construction period and after runoff generating storm events.	-
SP01.26	Implement phased grading schedule to limit the area subject to erosion at any given time to maximum extent feasible.	Visual site inspection	Construction sites	Weekly during construction period and after runoff generating storm events.	-



No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
<i>Drainage</i>					
SP01.27	The site erosion hazard shall be minimized with the installation of adequate permanent and temporary drainage: <ul style="list-style-type: none"> <li>i. Catch drains (spoon drains or banks) installed above disturbed areas to prevent runoff entering the site.</li> <li>ii. Permanent drains installed as soon as possible;</li> <li>iii. Existing stable drainage lines used for trunk drains where possible;</li> <li>iv. Flow velocities in unlined drains kept low to prevent scouring; and</li> <li>v. Temporary drains (earth spoon drains or banks) installed across large construction sites to reduce overland runoff distances/ volumes/ velocities.</li> </ul>	Visual site inspection	Construction sites	Routine	-
SP01.28	In case construction works cause obstruction of watercourses, such obstruction shall be immediately cleared to restore channel flow.	Visual site inspection	Construction sites	Routine	-
<i>Stockpile management measures</i>					
<i>General</i>					
SP01.29	Erodible construction material (soil, sand, etc) shall be stockpiled: <ul style="list-style-type: none"> <li>i. On relatively flat and flood-free areas;</li> <li>ii. At least 20 m from drainage lines and rivers where topographical conditions allow;</li> <li>iii. On sites already devoid of trees and at least 10 m away from retained vegetation; and</li> <li>iv. Not directly upslope of houses and other structures.</li> </ul>	Visual site inspection	Construction sites	Routine	-
SP01.30	Stockpiling on privately used land shall only occur if written permission has been obtained from the land user and the NNP1 Site Manager has approved the site.	Visual site inspection	Construction sites	Routine	-

No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
SP01.31	The Contractor shall seek approval from NNP1 to use any proposed stockpile sites prior to commencing stockpiling. NNP1 shall inspect and approve all correctly located sites. NNP1 shall inspect and approve all correctly located sites.	Visual site inspection	Construction sites	Routine	-
SP01.32	Long term spoil placement sites will be managed in accordance with the requirements of SP10.	-	-	-	SP10: Spoil Disposal
<i>Topsoil Management</i>					
SP01.33	All topsoil shall be stripped off construction areas and ancillary sites and stockpiled for later reuse for site rehabilitation.	Visual site inspection	Construction sites	Routine	-
SP01.34	Topsoil shall be stockpiled separately from other materials in flood-free areas at least 20 m where practicable from drainage lines and rivers.	Visual site inspection	Construction sites	Routine	-
SP01.35	Topsoil stockpiles that are retained through the rainy season shall be treated by appropriate seasonal measures to minimize the erosion hazard (e.g. seeding with a cover crop or covered with a fortnight of stockpile formation or compaction of slope with backhoe bucket).	Visual site inspection	Construction sites	Routine	-
SP01.36	Temporary topsoil stockpiles will be developed in accordance with the following: <ul style="list-style-type: none"> <li>i. Stockpiles will be constructed with smooth slopes, compacted using backhoe bucket. The creation of stockpiles with steep, smooth slopes minimized the area required for construction.</li> <li>ii. Topsoil shall be stockpiled separately from other materials in flood-free areas at least 20 m from drainage lines and rivers where topographic conditions allow.</li> <li>iii. Stockpiles will be deeply ripped to provide for moisture retention and re-growth.</li> <li>iv. Stockpiles will be constructed and stabilized, including provision of drainage and erosion</li> </ul>	Visual site inspection	Construction sites	Routine	-

No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
	<p>control measures.</p> <p>v. The height of stockpile with a berm will be determined appropriately by the locations occupied.</p> <p>vi. In windy conditions, watering of stockpiles will be carried out if excessive dust generation is evident.</p> <p>vii. Diversion banks will be constructed uphill of stockpiles where there is a potential for run-on to erode the stockpile.</p> <p>viii. Appropriate measures will be installed in between the stream and the stockpile to control runoff where necessary.</p>				
<i>Works in and near watercourses</i>					
SP01.37	If in-stream diversion is required for any diversion infrastructure must be made of suitable materials that will not contribute to turbidity or salinity.	Owner to verify	Watercourses	Routine (at least once for each construction event in or near a watercourse)	-
SP01.38	At watercourse crossings, machinery will operate from the streambank wherever possible, not within the stream channel, creating minimal streambed and bank disturbance. If disturbance occurs to the streambed or banks they shall be stabilised as soon as possible.	Owner to verify	Watercourses	Routine (at least once for each construction event in or near a watercourse)	-
SP01.39	If vegetation clearing is required on streambanks, cut vegetation near or at ground level to leave root mass in the ground. This helps to reinforce soil stability and reduce erosion.	Owner to verify	Watercourses	Routine (at least once for each construction event in or near a watercourse)	-
SP01.40	For areas in direct runoff path sediment and erosion control devices will be installed and maintained until vegetation replanting can occur to stabilise disturbed surfaces.	Owner to verify	Watercourses	Routine	-

No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
<i>Maintenance and inspection of erosion and sediment controls</i>					
SP01.41	Sediment collection devices will be built prior to the commencement of any construction works which may cause soil disturbance at the site, and will be maintained until the completion of the activity and site stabilisation.	Visual site inspection	Construction sites	Contractor to monitor daily during wet season and weekly during dry season.	-
SP01.42	Sediment collection devices (including sediment basins, silt trap fences or similar) will be cleaned out when 60% of capacity is filled.	Visual site inspection	Construction sites	Routine	BMP-13: Sediment Trap
SP01.43	At least one month prior to the anticipated commencement of the rainy season, a review of the effectiveness and adequacy of the existing erosion and sediment controls will be made and any necessary modification and/or augmentation of controls carried out.	Owner to verify and review	-	Once prior to rainy season	-
<i>Site Stabilisation</i>					
SP01.44	All saved topsoil shall be used for site re-vegetation. Topsoil shall be spread over final landformed areas prior to seeding/planting.	Visual site inspection	Construction sites	Routine	-
SP01.45	All disturbed areas shall be rehabilitated as soon as possible following the completion of construction activities on that site. The Contractor shall seek permission from NNPI to commence site rehabilitation.	Visual site inspection	Construction sites	Once per site at completion of construction.	SP08: Landscaping and Re-vegetation
SP01.46	Use appropriate erosion control and stabilizing measures such re-vegetation on most disturbed areas, and more specialized control measures on sites with a high erosion hazard such as river banks (e.g. geotextile mat, natural fiber matting, soil binders that are not toxic to the environment, or vegetation measures/temporary landscaping in disturbed areas and on graded slopes.	Visual site inspection	Construction sites	Routine	-

No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
SP01.47	Construction works (for bridges, culverts, drainage, etc.) on or near watercourse shall not cause obstruction of channel flow. Slopes along the channel shall be stabilized and dumping of soil, rocks, construction materials and debris onto watercourses shall be prohibited.	Visual site inspection	Construction sites	Weekly during construction period and after runoff generating storm events.	-
<i>Supervision and Remedial Action</i>					
SP01.48	The NNP1 Environment Officer shall inspect clearance activities at each site once a day, advising the Contractor or its nominated sub-contractor of any non-conformances against the permit or SSES MMP, and specifying any required remedial action.	Visual site inspection	Construction sites	Daily	-
SP01.49	The Contractor or its nominated sub-contractor shall implement the remedial action specified by the NNP1 Environment Officer within the time frame advised.	Visual site inspection	Various	Within timeframe required by EO	-
SP01.50	The NNP1 Environment Officer shall sign off on site clearance activities only after all remedial actions have been implemented by the Contractor or its nominated sub-contractor. No other site work will be permitted to occur until sign off has occurred.	Review sign off sheet	Various	As required	-



## SP02: WATER AVAILABILITY AND POLLUTION CONTROL

No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
<i>Pollution Control</i>					
SP02.1	Prior to operation of 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 Appendix 3 of the ESMMP-CP); and are appropriate to site conditions. For example settling/retention ponds with sufficient specifications/capacity for treatment of wastewater (e.g., from washing of equipment such as mixer drums, trucks and chute, contact storm water, etc.)	Owner to verify	At all sites under construction.	Weekly during construction period.	-
SP02.2	Properly operate and maintain settling/retention ponds to ensure effluent quality meets applicable effluent standards. Wastewater shall be retained in settling ponds to allow silt to settle and lower concentration of to acceptable levels. Water can be reused for dust suppression in construction sites and casting yard.	Owner to verify	At all sites under construction.	Weekly during construction period.	SP01: Erosion and Sediment Control
SP02.3	Bentonite slurry, bentonite sludge, mud and other materials and wastes from drilling will be collected and processed to avoid pollution of surface water. Discharge of such materials into watercourses shall be prohibited.	Owner to verify	At all sites under construction.	Weekly during construction period.	-
SP02.4	Drilling solutions (e.g., bentonite slurry) for bridge construction, abutment construction, piling, etc. will be processed in a closed system, especially for abutments and foundations at the riverbed.	Owner to verify	At all sites under construction.	Weekly during construction period.	-
SP02.5	Proper disposal of bentonite containing spoils as fill material in appropriate sites shall occur.	Owner to verify	At all sites under construction.	Weekly during construction period.	-
SP02.6	Spillage of bentonite mud in agricultural land shall be cleaned immediately to prevent caking and hardening.	Owner to verify	At all sites under construction.	Weekly during construction period.	-

No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
SP02.7	Water from dewatering of foundation excavation for bridges shall not be disposed directly into a water body. It shall be pumped into a settling pond or allowed to flow in a grassed swale specifically constructed for the Project to separate solids and then into a retention pond to allow finer solids to settle. The total suspended solids concentration of water when discharged into a waterbody shall comply with applicable standards.	Owner to verify	At all sites under construction.	Weekly during construction period.	-
SP02.8	Equipment service and maintenance yards shall be provided with impermeable flooring and collection sump.	Owner to verify	At all sites under construction.	Weekly during construction period.	-
SP02.9	Restricting paving operations during wet weather and using sediment control devices downstream of paving activities.	Owner to verify	At all sites under construction.	Weekly during construction period.	-
SP02.10	Implement solid and septic system waste management efforts, such as proper location, containment and disposal of construction debris and construction worker camp trash (e.g., use of watertight dumpsters and weekly trash collection/removal), and appropriate location (at least 30 m from drainage courses or other sensitive areas) and containment of portable septic systems. Maintain such facilities to ensure proper working order.	Owner to verify	At all sites under construction.	Weekly during construction period.	-
Sewage					
SP02.11	The construction of work camps, offices and construction sites will be equipped with adequate temporary sanitary facilities to avoid potential discharge both of gray and black wastewaters) to ground or nearby surface watercourses. These may include; <ul style="list-style-type: none"> <li>i. Grease trap for canteen wastewater</li> <li>ii. Septic tanks</li> </ul>	Visual site inspection	Construction of work camps and construction sites	Once	SP13: Construction of Work Camps BMP-04: Concrete Waste Management BMP-06: Sanitary/Septic Waste Management

No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
SP02.12	The contractors shall provide sanitation facilities/toilets with septic tanks with sufficient capacity to handle and treat domestic wastewater generated by workers.	Owner to verify	At all sites under construction.	Weekly during construction period.	-
<i>Hazardous Materials</i>					
SP02.13	Watertight receptacles shall be provided in all the equipment maintenance shops for waste oil, oily rags, spent oil filters, solvents and oily containers. Disposal shall be through authorized waste handlers and recyclers, as available.	Owner to verify	At all sites under construction.	Weekly during construction period.	SP06: Hazardous Material Management
SP02.14	Whenever feasible, use mobile fuelling/maintenance units for construction equipment to avoid/reduce on-site fuel/lubricant storage.	Owner to verify	At all sites under construction.	Weekly during construction period.	SP06: Hazardous Material Management
SP02.15	Maintain accurate and up-to-date written inventories and labels for all stored hazardous materials.	Owner to verify	At all sites under construction.	Weekly during construction period.	SP06: Hazardous Material Management
SP02.16	Using berms, ditches, and/or impervious lines (or other applicable methods) in material storage and vehicle/equipment maintenance and fuelling areas to provide containment and prevent discharge in the event of a spill, and restricting these uses to areas at least 30 m from storm drains and surface waters.	Owner to verify	At all sites under construction.	Weekly during construction period.	SP06: Hazardous Material Management
SP02.17	Place warning signs in areas of hazardous material use or storage and along drainages and storm drains (or other appropriate locations) to avoid inadvertent hazardous material disposal.	Owner to verify	At all sites under construction.	Weekly during construction period.	SP06: Hazardous Material Management
<i>Water quality monitoring</i>					
SP02.18	The reasonable treatment, which is suited to site condition, will be implemented toward the target of the water quality criteria which are as set out in Annex C of CA (Appendix 2 - Standards).	Owner verify designed treatment, criteria, and plan.	-	Once	-
SP02.19	The Erosion and Sediment Design Plans referred to in SP01 will include details of upstream and downstream water quality monitoring locations. Upstream and downstream monitoring locations will be identified in accordance with Annex C of CA (Appendix 2 - Standards).	Owner verify design plan.	-	Once	SP01: Erosion and Sediment Control

No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
SP02.20	Based on the results of water quality monitoring, EMO will be notified within 48 hours of the discovery of a condition that could cause harm to humans or the environment.	Owner review the monthly report.	-	Monthly	-
SP02.21	The results of water quality monitoring will be monthly reported to EMO.	Owner review the monthly report	-	Monthly	-
SP02.22	The presence of any groundwater wells or tube wells downstream of the waste disposal areas will be identified. If any wells are present, monthly monitoring of fecal coliform levels will be undertaken and reported in accordance with the above requirements.	Owner review the monthly report	The groundwater wells around construction sites	Monthly	-
SP02.23	Wastewater quality monitoring will be implemented toward the target of the water quality criteria which are as set out in Annex C of CA (Appendix 2 Standards).	Owner review the monthly report	Discharged water from Construction worker camps and construction sites	Monthly	-
<i>Hydrology</i>					
SP02.24	In-stream works shall be managed to avoid changes to downstream water supply. 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.	Construction contractor	-	Monthly	-
SP02.25	If stream diversion, or flow inhibition is required during in-stream works, this shall only occur during dry periods.	Construction contractor	-	Monthly	-
SP02.26	Construction materials and chemicals must be secured and locked down during rainy season.	Construction contractor	-	Weekly during rainy season.	-
SP02.27	Upon completion of construction, grade any disturbed outside the limits of dams, reservoir pools, permanent roads, and other permanent facilities to provide proper drainage and blend with natural contour with the land.	Owner to verify	All construction areas	Once at completion	-

### SP03: EMISSION AND DUST CONTROL

No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
<i>Minimization of dust generation</i>					
SP03.1	All vehicle movements will be confined to designated access routes and haul roads.	Visual site inspection by contractor	Access roads and haul roads	Routine	-
SP03.2	Management of short term and long term material stockpiles will be carried out in accordance with the requirements of SP01.	-	-	-	SP01: Erosion and Sediment Control BMP-02: Dust Control
<i>Dust management measures</i>					
SP03.3	Dust generating activities (particularly clearing, excavation and earth moving) will be avoided or minimized during windy conditions.	Visual site inspection by contractor	Access roads and haul roads	Routine	-
SP03.4	If visible dust emissions result from a construction activity, that activity will cease until water spraying has been undertaken to prevent dust emissions or the dust hazard passes.	Visual site inspection by contractor	Construction sites	Routine	-
SP03.5	Vehicles transporting material to and from the construction site via a public road will have their loads covered immediately after loading to prevent windblown dust emissions and spillage.	Owner to verify	Construction site	Weekly during construction period	-
SP03.6	Vehicle and machinery movements will be restricted to designated access ways and work areas.	Owner to verify	Construction site	Weekly during construction period	-
SP03.7	Speed limits (40 km/h or less) will be imposed on all construction vehicles to minimize dust emission along areas where sensitive receptors are located.	Owner to verify	Construction site	Weekly during construction period	-
SP03.8	Unsealed Project compounds and work areas accessible by vehicle will be regularly sprayed with water to suppress dust when dust is being generated or a dust hazard exists.	Owner to verify	Construction site	Weekly during construction period	-
SP03.9	High use construction compounds will be gravelled to reduce dust and erosion and improve all-weather accessibility.	Owner to verify	Construction site	Weekly during construction period	-



No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
SP03.10	Crushing and batching plants will employ suitable dust suppression measures to ensure that emissions are not excessive (e.g. unloading tubes).	Owner to verify	Construction site	Weekly during construction period	-
SP03.11	Topsoil stockpiles to be retained during rainy season shall be treated by appropriate seasonal measures to minimize the erosion hazard (e.g. seeding with a cover crop or covered with a fortnight of stockpile formation or compaction of slope with backhoe bucket).	Owner to verify	Construction site	Weekly during construction period	-
SP03.12	Rumble grids and/or wheel wash facilities or other appropriate mud-removal measures will be used at the main construction site exit points onto sealed public roads to remove mud from vehicles and minimize material being transferred onto road surfaces if necessary.	Owner to verify	Construction site	Weekly during construction period	-
SP03.13	Work sites and workforce camps will be managed to minimize odour generation.	Owner to verify	Construction site	Weekly during construction period	-
SP03.14	Exposed surfaces will be progressively rehabilitated within one month following the completion of use to reduce site dust and erosion hazards.	Owner to verify	Construction site	Weekly during construction period	-
SP03.15	In the event of a spillage, spilled material will be removed as soon as practicable that day.	Owner to verify	Construction site	In event of a spill	-
SP03.16	Ensure that borrow areas, casting yard and other facilities to be used for the Project are duly licensed and have all the necessary environmental approvals.	Owner to verify	Construction site	Weekly during construction period	-
SP03.17	All construction equipment and machinery on the site works will be regularly maintained and will be repaired as necessary to ensure compliance with safety and emission standards.	Owner to verify	Construction site	Weekly during construction period	-
SP03.18	For storage areas of construction materials such as sand, gravel, cement, etc., provisions will be made to prevent materials from being blown away towards sensitive receptors.	Owner to verify	Construction site	Weekly during construction period	-
SP03.19	Regularly clean roadways to remove tracked in mud, cement, etc. from construction works.	Owner to verify	Construction site	Weekly during construction period	-

No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
SP03.20	Areas within the Project where there is a regular movement of vehicles shall have an acceptable hard surface and be kept clear of loose surface material.	Owner to verify	Construction site	Weekly during construction period	-
SP03.21	Cement and other fine-grained materials delivered in bulk shall be stored in closed containers.	Owner to verify	Construction site	Weekly during construction period	-
SP03.22	Weigh hoppers shall be vented to a suitable filter.	Owner to verify	Construction site	Weekly during construction period	-
SP03.23	Wheel washers shall be provided in active construction sites so that haul/delivery trucks can be cleaned of mud and dirt as they exit the work area if necessary.	Owner to verify	Construction site	Weekly during construction period	-
SP03.24	To minimize/avoid impacts to nearby sensitive receptors, wind fences, high barriers, or water spraying will be implemented at construction sites and other locations of construction-related activities where there are sources of high dust levels.	Owner to verify	Construction site	Weekly during construction period	-
<i>Exhaust Emissions</i>					
SP03.25	All vehicles and equipment will be maintained in accordance with manufacturers' specifications. A maintenance program for the construction vehicle fleet will be implemented which will include consideration of the following issues: <ul style="list-style-type: none"> <li>i. General condition and safety of vehicles</li> <li>ii. Check of vehicle brakes and tires</li> <li>iii. Vehicle exhaust emissions visibly</li> <li>iv. Vehicle noise emissions</li> </ul> Each construction vehicle in the fleet will be inspected regularly and a written certificate provided by a qualified mechanic as to its fitness for service.	Owner to verify	Construction site	Weekly during construction period	-
SP03.26	All construction vehicles and equipment shall be tested for compliance with the relevant emission standard and shall be properly licensed, where applicable.	Owner to verify	Construction site	Monthly	-
SP03.27	Adequate ventilation will be provided in all confined areas (i.e. tunnels and power station cavern).	Owner to verify	Construction site	Weekly during construction period	-

No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
SP03.28	All vehicles, while parked on the site works, will be required to have their engines turned off.	Owner to verify	Construction site	Weekly during construction period	-
SP03.29	Unnecessary engine idling of vehicles and equipment will be prohibited.	Owner to verify	Construction site	Weekly during construction period	-
SP03.30	Smoke belching vehicles and equipment shall not be used for the Project.	Owner to verify	Construction site	Weekly during construction period	-
SP03.31	Minimize construction vehicle trips and reduce transport distances for material deliveries and other construction-related trips to the maximum extent feasible (e.g., by using local materials and labour sources).	Owner to verify	Construction site	Weekly during construction period	-
<i>Burning of waste</i>					
SP03.32	<p>The burning of waste materials shall be minimized on site and only take place under the following conditions:</p> <ul style="list-style-type: none"> <li>i. Burning will only be undertaken in the presence of a trained fire protection officer.</li> <li>ii. Burning will not be undertaken during severe wind conditions</li> <li>iii. Appropriate fire protection equipment will be available on-site during the burn.</li> <li>iv. Burning will be undertaken at a safe distance from vegetated areas.</li> <li>v. Burning will not be undertaken near a village.</li> <li>vi. Following completion of the burn, the trained fire protection officer will inspect and certify that the fire has been extinguished.</li> </ul>	Visual site inspection by contractor	Construction sites	Routine	SP05: Waste Management
<i>Worker health</i>					
SP03.33	Appropriate breathing masks will be provided to staff working in areas where they may be exposed to poor air quality.	Owner to verify	Construction site	Weekly during construction period	-

No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
<i>Monitoring of dust level</i>					
SP03.34	Dust monitoring shall include visual assessment at sensitive receptors (e.g., community, labour camp, schools, health centre, temple, and national park) in the vicinity of borrow pits, Project camps and construction camps to ensure that associated impacts are being adequately addressed. If it is determined that significant dust-related impacts are occurring, additional dust control measures shall be implemented.	Visual site inspection by contractor	Construction site and sensitive area	Daily	SP13: Traffic and Access  BMP-02: Dust Control
<i>Supervision and Remedial Action</i>					
SP03.35	The Owner shall inspect each waste site once a week, advising the Contractor or its nominated contractor of any non-conformances and required remedial action in accordance with approved SSESMMMP.	Visual site inspection by Owner	Construction site and sensitive area	Daily	BMP-02: Dust Control
SP03.36	The Contractor or its nominated sub-contractor shall undertake reasonable remedial action as directed by the Owner within the required period in accordance with approved SSESMMMP.	Visual site inspection by Owner	Construction site and sensitive area	Daily	BMP-02: Dust Control

## SP04: NOISE AND VIBRATION

No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
<i>Activity Siting</i>					
SP04.1	Stationary noise sources (e.g. generators) that generate noise levels well above background levels (i.e. 45 dB(A) and above) shall be set back as far as possible from dwellings, workforce camps, schools, offices, businesses and other receptor sites.	Visual site inspection by contractor	Stationary noise sources/sensitive receptors	Weekly	-
SP04.2	The siting of noisy activities and equipment shall consider natural buffers (e.g. hills) and/or the potential to install barriers around the source to reduce noise levels at nearby receptor sites where siting options exist.	Visual site inspection by contractor	All construction areas	Weekly	-
SP04.3	The proposed siting of noise sources that can be located at the discretion of the Project (i.e. not site-dependant such as blasting) shall be reviewed by the NNP1 Site Manager. This officer shall either approve the proposed sites of noisy activities or request the Contractor to consider alternative sites.	Visual site inspection by contractor	All construction areas	Weekly	-
SP04.4	Asphalt concrete batching plants and crushing plant shall be located at least 500 m away from inhabited areas and other sensitive receptors such as schools, places of worship and medical facilities, facilities unless there is a topographical feature (e.g. hill) between the noise source and sensitive site that adequately attenuates noise levels. If batching and crushing plants are located less than 500 m from sensitive receptors, appropriate noise barriers will be installed to comply with relevant noise standards (Appendix 3 of the ESMMP-CP).	Visual site inspection by contractor	Batching and crushing plants	Once when plants established	-
<i>Minimize noise generation at source</i>					
SP04.5	For any particular construction activity, the vehicles and/or equipment which are equipped with appropriate muffles and /or other noise control equipment will be selected for use.	Contractor to verify through visual inspection	All construction areas	Weekly	-



No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
SP04.6	Construction equipment and vehicles will be subjected to regular inspections to check noise emissions and noise control equipment in accordance with the requirements of SP14.	Contractor to verify through visual inspection	All construction areas	Weekly	SP14: Traffic and Access
SP04.7	Fitting mufflers to road vehicles and construction equipment, and, where applicable, engine shrouds (acoustic lining) to construction equipment.	Contractor to verify through visual inspection	All construction areas	Weekly	-
SP04.8	Using plant and equipment appropriately, including no extended periods of 'revving', idling or 'warming up' within the proximity of existing residential receivers, and no use of air horns in settlement areas unless required for safety purposes.	Contractor to verify through visual inspection	All construction areas	Weekly	-
SP04.9	Maintaining all equipment in good working order to manufacturers' specifications, including mufflers, enclosures and bearings to ensure unnecessary noise emissions are minimized. All equipment used on-site will need to demonstrate compliance with the noise levels provided in Appendix 3 of the ESMMP-CP.	Contractor to verify through visual inspection	All construction areas	Weekly	-
SP04.10	Only vehicles and equipment that are registered and have necessary permits will be used for the Project.	Contractor to verify through visual inspection	All construction areas	Weekly	-
SP04.11	Impose speed limits on construction vehicles to minimize noise emission along areas where sensitive receptors are located.	Contractor to verify through visual inspection	Access roads	Weekly	-
SP04.12	To minimize noise and nuisance, construction traffic routes will be defined in cooperation with local communities and traffic police.	Owner to verify	All construction areas	Weekly	-
<i>Reduce transmission of noise to receivers</i>					
SP04.13	Stationary noise sources will be sited as far as possible from villages, construction camps and settlement areas.	Owner to verify site layout plans for quarries, spoil disposal area and construction camps.	-	Once	SP10: Spoil Disposal SP11: Quarry and Construction Layout SP13: Construction of Work Camps

No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
SP04.14	Where possible, topographic features will be used to provide shielding between stationary noise sources and villages and construction camps.	Owner to verify site layout plans for quarries, spoil disposal area and construction camps.	-	Once	SP10: Spoil Disposal SP11: Quarry and Construction Layout SP13: Construction of Work Camps
SP04.15	All construction personnel working in the vicinity of noisy construction activities (defined as those activities generating noise levels greater than 80 dB (A)), or any construction personnel who requests hearing protection, will be provided with hearing protection.  Training will be provided to personnel in relation to the need for hearing protection to be used.	Visual site inspection to monitor availability and use of PPE and training register.	Construction sites	Routine	SP15: Training and Awareness
SP04.16	Suitable noise level reduction measures (e.g., equipment enclosures, barriers) shall be installed by the contractor if noise from construction activities is excessive and disrupts school activities or local residents.	Contractor to verify through visual inspection	All construction areas	Weekly	-
<i>Reducing Vibrations</i>					
SP04.17	Operation of heavy equipment near sensitive areas will be avoided wherever possible.	Contractor to verify through visual inspection	Sensitive areas	Weekly	-
SP04.18	Avoid simultaneous activities such as demolition, ground impacting activities and earthmoving since vibration level is considerably less if these activities do not occur at the same time.	Contractor to verify through visual inspection	All construction areas	Weekly	-
SP04.19	Use alternative equipment if conditions allow.	Contractor to verify through visual inspection	All construction areas	Weekly	-
SP04.20	Avoid use of vibrating rollers near vibration level sensitive structures.	Contractor to verify through visual inspection	All construction areas	Weekly	-

No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
<i>Reducing the impact on communities</i>					
SP04.21	Informing potentially affected nearby residents of construction activities, scheduled commencement and completion dates, hours of activities and noise reduction measures to be implemented prior to the commencement of noisy activities.	Owner to verify	All construction areas	Monthly	-
SP04.22	During school examination periods, noisy construction activities will be avoided near schools. The contractor will closely coordinate with the school administration on construction schedules to ensure that noise level from site works will be adequately mitigated so as not to be disruptive during school hours.	Owner to verify, including discussion with school administration	Areas near schools	During examination periods	-
<i>Construction hours</i>					
SP04.23	General construction activities at major construction sites are likely to be undertaken 24 hours a day, with suitable noise mitigation measures implemented.	Visual site inspection to ensure compliance with construction hours	Construction sites	Routine	-
SP04.24	Undertaking controlled blasting.	Contractor to verify through visual observation	All construction areas	Weekly	-
SP04.25	Avoid noisy construction activities in the vicinity of sensitive receivers (e.g., residential areas) at night-time or other sensitive periods (e.g. during school hours in vicinity of schools). Suitable noise level reduction measures (e.g., noise barriers or equipment enclosures) shall be installed by the contractor if construction activities will be disruptive during normal school hours and/or during night time in residential areas.	Owner to verify	Vicinity of sensitive receptors	Weekly	-
SP04.26	As much as possible, noisy construction activities will be limited to daytime when within 200 m of a community settlement. Otherwise, prior notification and consultation shall be made with affected people and local officials, and suitable noise attenuation measures shall be implemented.	Owner to verify	Construction areas within 200 m of settlement.	Weekly	-

No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
SP04.27	Restricting activities that will raise noise levels above background level plus 10 dB(A) at receptors to daylight hours only. Any excessively loud activities will be scheduled during periods of the day when higher ambient noise levels are apparent.	Owner to verify	Vicinity of sensitive receptors	Weekly	-
SP04.28	Blasting activities excluding tunneling will be restricted to between 06.00 and 19.00. Residents will be provided with at least 24 hours notice that blasting is to take place and given information on the likely timing and number of blasts.	Visual site inspection to ensure compliance with construction hours	Blasting sites	Routine	-
SP04.29	The movement of vehicles to and from the construction sites and within construction sites will only take place subject to the restrictions identified in SP04.23.	Visual site inspection	Construction sites	Routine	-
SP04.30	If the need arises for construction work to occur outside approved hours then approval shall be sought by the Contractor from the Owner Environment Manager.	Owner to verify that approvals have been sought for all out-of-hours work.	All construction areas.	Monthly	-
<i>Response to complaints about noise generation</i>					
SP04.31	If complaints are received about excessive noise levels in the vicinity of villages, the Owner will consult with the complainant to identify appropriate additional mitigation measures (e.g. additional shielding, change of equipment type, restriction of construction hours in particular area) to be implemented.	Owner and contractor to verify complaints action	-	Per case	-
SP04.32	Monthly reports will be prepared identifying any complaints received in relation to construction noise and documenting the actions that were undertaken to resolve such complaints.	Contractor to prepare report and Owner to review reports	-	Monthly	--
<i>Worker Health and Safety</i>					
SP04.33	Providing ear muffs to workers operating high decibel equipment or working in close proximity to this equipment.	Contractor to verify through visual observation	All construction areas	Weekly	SP16: Project Personnel Health Program

No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
<i>Supervision and Remedial Action</i>					
SP04.34	An Owner Environment Officer shall review all noise monitoring data and any complaints received about excessive noise levels, and periodically inspect the main noise-generating activities and facilities advising the Contractor or its nominated contractor of any non-conformances and required corrective action.	Owner to verify	-	Fortnightly	-



## SP05: WASTE MANAGEMENT

No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
<i>General requirements</i>					
SP05.1	Waste management sites shall be surveyed and clearly pegged by the Contractor or its nominated sub-contractor prior to the commencement of site preparation and waste.	Contractor to verify	Construction sites and ancillary areas	Once	-
SP05.2	All necessary waste site preparation activities shall be completed prior to the commencement of waste, material handling, processing and stockpiling.	Contractor to prepare and implement Pre-Commencement Checklist	Construction sites and ancillary areas	As each new site for disturbance	-
SP05.3	The Consultant shall prepare the Pre-Commencement Checklist.				
SP05.4	Each Project waste storage and disposal site shall be inspected by the nominated Owner Environment Officer prior to waste storage and disposal. This officer shall approve waste from a specific site or approve crushing plant operation at the site/facility and issue a Notice to Proceed if the site or facility is set up in accordance with the Waste Management Plan and any variations required by the Owner Environment Manager.	Owner to verify	Construction sites and ancillary areas	Once each site	-
SP05.5	The Consultant shall prepare the Pre-Commencement Checklist.	Owner to verify	Construction sites and ancillary areas	Once	-
SP05.6	A sufficient number of waste containers or similar one will be made available at construction site.	Visual site inspection	Construction sites	Routine	BMP-06: Sanitary/ Septic Waste Management
SP05.7	Waste containers (or similar disposal receptacles) will be marked clearly for "Hazardous Waste" and for "Non-Hazardous Waste" for separation and sorting of waste.	Visual site inspection	Construction sites	Routine	BMP-07: Hazardous Waste Management  BMP-08: Spill Prevention and Control

No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/BMPs
SP05.8	Project waste will be minimized by applying the waste minimization hierarchy principles of 'avoid/reduce/re-use/recycle/dispose'. Any waste material that is unable to be re-used, re-processed or recycled will be disposed at a facility approved to receive that type of waste.	Owner and Contractor to verify	Construction sites and ancillary areas	Routine	-
SP05.9	Undertake regular collection and disposal of wastes (by contractor or authorized third party) to sites approved by local authorities.	Visual site inspection	Construction sites	Routine	-
SP05.10	Complaints will be investigated promptly and appropriate action initiated to reduce impact	Owner to verify	Construction sites	Routine	-
SP05.11	Prohibit dumping of wastes into watercourses, agricultural land and surrounding areas.	Visual site inspection	Construction sites	Routine	-
<i>Hazardous waste disposal</i>					
SP05.12	Hazardous waste will be disposed of according to appropriate best practices.	Visual site inspection	Construction sites	Routine	BMP-09: Contaminated soil Management
<i>Non-hazardous waste disposal</i>					
SP05.13	Burning of non-hazardous waste will be minimized by reusing and recycling waste where possible, and delivering waste to a designated waste disposal site.  If burning of waste is to occur, incineration will conform to the measures outlined in SP03 Emission and Dust Control.	Visual site inspection	Construction sites	Routine	SP03: Emission and Dust Control
SP05.14	When designated waste disposal areas are full or no longer used, they will be covered by soil at the appropriate depth from the ground surface.	Visual site inspection.	Waste disposal area	Routine	BMP-05: Solid Waste Management  BMP-06: Sanitary/ Septic Waste Management
<i>Training of workers</i>					
SP05.15	All workers responsible for handling hazardous waste will receive appropriate training in accordance with SP15.	Review of training register.	-	Routine	SP15: Training and Awareness

No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/BMPs
<i>Waste separation and provision of facilities</i>					
SP05.16	Waste segregation will occur at source to the maximum extent possible, separating re-usable/recyclable material from non-hazardous waste (packing timber, steel, wire, cables, aluminium, bricks, plaster, roofing material, glass, clay/sand/gravel, concrete, insulation material, tiles, fibreglass, cured asphalt, paper, cardboard, plastic, food waste) and hazardous waste (waste oils, oil filters, oily rags, used absorbent, old chemical/paint/fuel/oil drums, batteries, acids, alkalis, welding rods, sewerage sludges, and used tyres).	Visual site inspection	Construction sites and construction worker camps	Routine	BMP-05: Solid Waste Management
SP05.17	Recyclable waste (including batteries, tyres, glass, paper, scrap metal, aluminium cans and timber) will be transferred to appropriate recycling facilities where possible.	Contractor to verify	Construction sites and construction worker camps	Routine	-
SP05.18	Waste will be stored in appropriate facilities (e.g. bins, stockpiles, secure compounds), with hazardous waste stored away from streams and rivers in secure areas.	Visual site inspection	Construction sites and construction worker camps	Routine	-
SP05.19	Secure lids will be fitted to bins that store food waste to prevent scavenging by birds and animals.	Visual site inspection	Construction sites and construction worker camps	Routine	-
SP05.20	All hazardous and industrial waste generated on site will be stored and disposed of in a manner that minimises the impact on the environment.	Contractor to verify	Construction sites and construction worker camps	Routine	-
SP05.21	Each construction site and construction worker camp shall be provided with bins for the following types of waste: <ul style="list-style-type: none"> <li>- Non-recyclable domestic waste (i.e. general litter and rubbish);</li> <li>- Recyclable domestic waste (i.e. metal, glass bottle, plastic bottle, cardboard);</li> <li>- Hazardous waste (i.e. used oil, oil contaminated waste, fluorescent, batteries, color spray, etc);</li> <li>- Bio waste (i.e. waste from first aid and medic); and</li> <li>- Construction waste (i.e. scrap metal, concrete, debris, etc).</li> </ul>	Visual site inspection	Construction sites and construction worker camps	Routine	-

No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/BMPs
SP05.22	Temporary storage facilities for hazardous wastes shall be managed to limit accidental discharge to the environment.  Safety equipment shall be installed, in particular, labeling the waste, a concrete floor, oil weir and sunshade or roof.	Visual site inspection	Construction sites	Routine	SP06: Hazardous Material Management
<i>Sewage</i>					
SP05.23	Where sewerage toilet facilities are provided, sewage shall be treated to the level defined in Appendix 3 of the ESMMP-CP before being released (or treated effluent shall be used for site watering).	Contractor to verify	Construction sites	Routine	-
SP05.24	Treated wastewater will be released into the Nam Ngiep River.	Contractor to verify	Construction sites	Routine	-
SP05.25	Pit latrines will be installed for the workforce at isolated construction areas.	Contractor to verify	Construction sites	Routine	-
SP05.26	Workers will be instructed to use the toilets provided.	Visual inspection	Construction sites	Routine	-
<i>Sediment</i>					
SP05.27	Sediment-laden effluent from drilling, tunneling and other construction activities shall be treated in a settling system to settle out suspended particles prior to effluent discharge.	Contractor to verify	Sediment basins	Routine	-
SP05.28	The settling system shall consist of a minimum of two basins for primary and secondary (overflow) treatment. Settling basins shall: <ul style="list-style-type: none"> <li>i. be adequately sized to settle out fine soil particles over a short period</li> <li>ii. be structurally sound, capable of withstanding saturation and normal rainfall events</li> <li>iii. be isolated from local overland runoff, only subject to inflow from the intended source and direct rainfall.</li> </ul>	Contractor to verify	Sediment basins	Routine	-
SP05.29	A safety fence and signage shall be erected around settling basins to prevent unauthorized access.	Visual inspection	Sediment basins	Routine	-

No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/BMPs
SP05.30	The use of non-contaminating flocculants shall be considered where basin settling is inadequate to treat the volume of residue generated. Flocculants shall only be used as directed by NNP1.	Contractor to verify	Sediment basins	Routine	-
SP05.31	Basins shall be cleared of sediment when 60% of their capacity is reached. Removed sediment shall be disposed of in a landfill or used as fill material.	Contractor to verify	Sediment basins	Routine	-
SP05.32	The quality of water to be released from basins shall be monitored to ensure that it is of acceptable quality prior to release.	Owner Environmental Officer to monitor water quality	Sediment basins	Routine	-
SP05.33	Water shall be used to spray areas for dust suppression and for other construction purposes where the quality is suitable. Excess water shall be released into the Nam Ngiep River.	Contractor to verify	Dust suppression locations	Routine	-
SP05.34	The release of water from sediment basins shall be optimised according to site conditions during: <ul style="list-style-type: none"> <li>i. the rainy season when river sediment levels are high and</li> <li>ii. larger rainfall events in the dry season when raised river sediment levels occur.</li> </ul>	Contractor to verify	Dust suppression locations	Routine	-
<i>Contaminated Material</i>					
SP05.35	Soil contaminated by fuel or oil will be managed as hazardous waste, except where such soil may be remediated on-site.	Contractor to verify	All construction areas	Routine	-
<i>Landfill Sites</i>					
SP05.36	Non-hazardous waste will be disposed of in a landfill site approved by the Environment Manager.	Contractor to verify	All construction areas	Routine	-
SP05.37	Landfill sites will be located at least 50 m from any drainage lines, streams or rivers.	Contractor to verify	All construction areas	Routine	-
SP05.38	Waste disposed of in landfills will be covered with soil on a weekly basis to prevent scavenging and wind-blown rubbish.	Contractor to verify	All construction areas	Routine	-
<i>Supervision and Remedial Action</i>					



No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
SP05.39	The Owner Environment Officer shall inspect each waste site, advising the Contractor or its nominated sub-contractor of any non-conformances and required remedial action.	Owner Environmental Officer inspection	Construction sites	Once per week	-
SP05.40	The Contractor or its nominated sub-contractor shall undertake remedial action as directed by the Owner within the required period.	Contractor to verify	Construction sites	As needed	-

## SP06: HAZARDOUS MATERIAL MANAGEMENT

No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
<i>Management of Hazardous Materials</i>					
SP06.1	<p>Registration of Hazardous Materials</p> <p>All chemicals and waste considered as potentially hazardous materials will be registered in order to follow up type, quantities stored, quantities used or generated. Movements from storage and to waste disposal site will be registered.</p> <p>Information will be logged in a register, which will be available in each hazardous materials storage area.</p> <p>A register of fuel dispensed will be kept along with the records of fuel deliveries in order to reconcile the quantities used.</p> <p>The list of hazardous substances to be used in construction activities are as follow:</p> <ul style="list-style-type: none"> <li>• Paint and solvents</li> <li>• Petroleum products such as oils, fuels and grease</li> <li>• Herbicides, Pesticides</li> <li>• Acids for cleaning masonry</li> <li>• Concrete curing and repair compounds</li> <li>• Contaminate waste materials</li> <li>• Concrete admixture</li> <li>• Flocculants</li> <li>• Adhesive</li> <li>• Release agent</li> </ul>	Visual site inspection by contractor to check if hazardous materials register appropriately filled and updated.	-	Weekly	SP15: Training and Awareness
SP06.2	<p>Selection of safer chemical types</p> <p>Chemicals to be used on any construction site will be selected, where possible, in accordance with general best practices and recommendations for environmental conservation.</p> <p>Pesticides for vector control (i.e., mosquitoes) and for vegetation control will be selected in accordance with the list of recommended pesticides provided by the Environment Manager.</p>	Contractor to review and inspect list of product to be imported on site and provide advice to Construction manager.	Storage of Hazardous materials	Routine	SP16: Project Personnel Health Program

No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
SP06.3	<p>Labelling of Hazardous Materials</p> <p>Containers of hazardous chemical or waste must be labelled with:</p> <ul style="list-style-type: none"> <li>i. The words "Hazardous Waste"</li> <li>ii. Name of the CC user or generator</li> <li>iii. The date of storage of the chemical, or initial date that waste accumulation began in the container</li> <li>iv. The name of the material and its physical state (solid or liquid)</li> <li>v. The hazard characteristics of the waste (ignitable, corrosive, toxic, reactive)</li> <li>vi. Main danger for user (poison, burning, dangerous for eyes, skin, lungs, etc.)</li> </ul>	Visual site inspection by contractor	Storage of Hazardous materials	Weekly	SP5: Training and Awareness
SP06.4	<p>Handling Safety Procedures and Personal Protective Equipment.</p> <p>Safety procedures applicable to the handling and use of hazardous materials will be established and become a part of the training program. Safety rules will be translated in Lao languages and printed on posters to be posted on the walls of the dedicated buildings where hazardous materials are to be used.</p> <p>Personal protective equipment (PPE) will be provided to concerned workers and the use of such equipment will be enforced.</p>	Visual site inspection by contractor	Construction sites	Routine	<p>SP15: Training and Awareness</p> <p>SP16: Project Personnel health Program</p> <p>BMP-08: Spill Prevention and Control</p> <p>BMP-10: Vehicle and Equipment Clearing</p> <p>BMP-11: Vehicle and Maintenance</p> <p>BMP-12: Vehicle and Refuel</p>
SP06.5	Refueling procedures	Visual site inspection by	Construction sites	weekly	SP15: Training and

No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/BMPs
	All refueling of heavy equipment and machinery will be undertaken by a service vehicle, with appropriate safeguards and protection measures to prevent any spillage or contamination by chemical wastes or maintenance oils, lubricants etc. Appropriate service vehicles are dedicated to the refueling of heavy equipment and machinery. Safety procedures regarding fire and accidental spill management are posted on-site. "No Smoking" labels and posters will be placed wherever fuel is handled or stored.	contractor to check refueling procedures implemented, particularly in the tunnel area.			Awareness SP16 Project Personnel Health Program BMP-11: Vehicle and Maintenance BMP-12: Vehicle and Refuel
SP06.6	<p>Selection, Handling &amp; Application of Pesticides</p> <p>Pesticides for vector control (mosquitoes) and for vegetation control will be utilized in accordance with:</p> <ol style="list-style-type: none"> <li>i. Authorized pesticides, in accordance with the list approved by EMO</li> <li>ii. Labelling and storage of pesticides, which will satisfy measures SP05.03, SP05.04 and SP05.05 of this sub-plan</li> <li>iii. The translation of all information related to toxicity of pesticides, including user instructions, to commonly used Lao language (s)</li> </ol> <p>Safe handling of pesticides will rely on training users; specific training programs and supporting communication materials will be supplied for this purpose.</p>	<p>Visual site inspection by contractor to check pesticide selection is in accordance with authorized list.</p> <p>To check availability and enforcement for pesticides users.</p> <p>To ensure users have received training on pesticide use.</p>	Storage of Hazardous materials	Weekly	SP16: Project Personnel Health Program
<i>Storage of Hazardous Materials</i>					
SP06.7	All the fuel and hazardous material storage will be adequately bounded to prevent any spillage problem.	<p>Visual site inspection by contractor</p> <ul style="list-style-type: none"> <li>- To check conditions of bunded area, of fuel/oil separators on storm water drainage system, of container conditions.</li> <li>- To record incidents observed during week.</li> <li>- All employees working</li> </ul>	Storage of Hazardous materials	Weekly	SP05: Waste Management SP15: Training and Awareness BMP-08: Spill Prevention and Control BMP-10: Vehicle and Equipment

No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
		<p>with chemicals shall also perform the following.</p> <ul style="list-style-type: none"> <li>- Conduct regular inspections of valves, pumps etc.</li> <li>- Carry out preventative maintenance.</li> <li>- Fire fighting if appropriate.</li> <li>- Stop substances escaping to the environment in the event of a spill.</li> </ul>			Clearing
SP06.8	Provide maintenance shops, fuel and oil depot with impermeable flooring or sheets with sump where wash water and sludge can be collected for proper disposal.	Visual site inspection by contractor	Construction sites	Routine	-
SP06.9	Only minimal chemicals, hazardous substances and fuel will be stored on site works, within an enclosed and covered secure area that has an impervious floor and impervious bund around it (with capacity at least 120% of the total capacity of the tanks). The storage area will be located away from watercourses, flood-prone areas, offices and barracks/accommodation, and danger areas.	Visual site inspection by contractor	Construction sites	Routine	-
SP06.10	Oil stained refuse such as oily rags, spent oil filters and used oil shall be collected and disposed of through recyclers/authorized waste handlers and disposal in authorized waste facilities.	Visual site inspection by contractor	Construction sites	Routine	-
SP06.11	Check containers (at least weekly) for leakage and undertake necessary repair or replacement.	Visual site inspection by contractor	Construction sites	Routine	-
SP06.12	Store hazardous materials above flood level.	Visual site inspection by contractor	Construction sites	Routine	-
SP06.13	Equipment maintenance areas and fuel storage areas shall be provided with drainage leading to an oil-water separator that will be regularly skimmed of oil and maintained to ensure efficiency.	Visual site inspection by contractor	Construction sites	Routine	-



No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
SP06.14	Store waste oil, used lubricant and other hazardous wastes in tightly sealed containers to avoid contamination of soil and water resources. Transport and off-site disposal of such wastes shall comply with applicable laws and regulations.	Visual site inspection by contractor	Construction sites	Routine	-
SP06.15	The hazardous materials and chemical used in the construction shall be separated and kept in a suitable storage and the Material Safety Data Sheet (MSDS) shall be in place.	Visual site inspection by contractor to check hazardous materials are separated and kept into a suitable storage.  To ensure MSDS be in place.	Storage of hazardous materials and chemical.	Weekly	BMP-03: Material Delivery and Storage
SP06.16	Proper equipment shall be installed at hazardous material storage facilities, including temporary construction sites (i.e. concrete floor, roof or sunshade, oil weir or trap and closed valve).	Visual site inspection	Storage of hazardous materials.	Weekly	BMP-03: Material Delivery and Storage
SP06.17	Explosives will be stored in facilities located underground or sufficiently protected by bunding and will be located close to areas for use, where possible.  Site storage facilities will be kept locked, and access limited to authorized staff. A log book at each facility will register movements of explosives (e.g., quantity, name of user and date).  Explosive boxes will be labelled with an "explosive sign", and explosive sign posters will be dispatched at each site storage facility. Fire-fighting equipment will be kept available next to each storage facility.	Visual site inspection to be conducted to ensure explosive is stored locked permanently with watchman.  Control of explosive register in each storage facility to check if document is filled and up-dated.  Check presence of posters and if firefighting equipment is appropriate and operational.	Explosive storages	Weekly	SP15: Training and Awareness  SP16: Project Personnel Health Program
<i>Spill Response</i>					
SP06.18	Ensure availability of spill clean-up materials (e.g., absorbent pads, etc.) specifically designed for petroleum products and other hazardous substances where such materials are being stored and used. If spills or leaks do occur, undertake immediate clean up. Spill response kits will be located at the workshop(s) where the servicing will take place and also at the refueling point(s).	Fortnightly monitoring by owner to check presence of spill response kits and operational condition of equipment.  To request new equipment where and when considered necessary.	Storage of Hazardous materials	Fortnightly	SP16: Project Personnel Health Program  BMP-12: Vehicle and Refuel

No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
SP06.19	All personnel involved with refueling and with the servicing of equipment will be familiar with the use of the spill response kits and will be trained in the emergency procedures as described in the Emergency Response for Hazardous Materials Sub Plan.	Visual site inspection	Refuelling locations	Weekly	BMP-12: Vehicle and refuel
<i>Disposal of Hazardous Materials</i>					
SP06.20	Discharge of oil contaminated water into the environment shall be prohibited.	Visual site inspection	All construction areas	Weekly	SP02: Water Availability and Pollution Control
<i>Completion</i>					
SP06.21	Restoration of temporary work sites shall include removal and treatment or proper disposal of oil contaminated soils.	Visual site inspection	Temporary work sites	Weekly	-

## SP07: VEGETATION CLEARING

No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
<i>Principles</i>					
SP07.1	Keeping clearance to the minimum area required for the proposed Project activity.	Owner to verify	Construction areas	-	-
SP07.2	Strictly controlling clearing activities by site marking, fencing off significant trees/habitat, etc.	Owner to verify	Construction areas	-	-
SP07.3	Making cleared vegetation available to local users where permitted by the relevant authorities of GOL such as Forestry Department (FD).	Owner to verify	Construction areas	-	
<i>Permits and Permission</i>					
SP07.4	The permit application shall contain: estimated number of trees to be felled / lopped; marking process; party responsible for cutting and transport of trees; monitoring process; involvement of FD staff in tree clearance and construction monitoring; compensatory planting proposal and budget estimate.	Owner to verify	Construction area	Once	-
SP07.5	A copy of the permit shall be provided to the Construction site manager prior to any vegetation clearance.	Owner to verify	Construction area	Once	-
SP07.6	Permission' to fell trees in community controlled forests shall be obtained in writing from each affected community group prior to commencing vegetation clearance.	Owner to verify	Construction area	Once	-
<i>Identification of vegetation to be cleared</i>					
SP07.7	<p>Areas of 'critical habitat' will be determined and boundaries mapped. These areas will be subject to management in accordance with the Biodiversity Action Plan (BAP) and Biodiversity Offset Design (BOD) Report.</p> <p>No clearing of natural habitat will occur until critical habitat status is determined and approved by relevant government body.</p>	<p>ADB to approve mapping of critical habitat areas or assessment prior to commencement of construction.</p> <p>Visual site inspections to limit any clearing to modified habitat prior to this time.</p>	Construction areas	Routine	BOD

No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
SP07.8	A plan will be prepared including: <ul style="list-style-type: none"> <li>i. Mapped boundaries of vegetation to be cleared, including identification of which clearing will be undertaken by the Forestry Department and which will be undertaken by the project.</li> <li>ii. Any areas of 'sensitive vegetation' located on-site which require specific protection (e.g. vegetation within and adjoining watercourses/ drainage lines).</li> <li>iii. Any required temporary timber storage sites for placing prior to its removal from site.</li> </ul>	Owner to verify mapping prior to commencement of construction.	-	Once	-
SP07.9	Marking of the clearance area boundary and trees to be retained shall be clearly visible, ideally with the use of marking tape along the boundary to create a visual 'barrier'.	Visual site inspection of clearly marked trees prior to clearing.  Visual site inspection during construction	Construction areas	Routine	-
SP07.10	A plan will be prepared to show the location of all IUCN endangered tree species and individual trees will be clearly marked at the site using tape or similar. These trees will be avoided during final design and where possible during construction.	Visual site inspection of clearly marked trees prior to clearing.  Visual site inspection during construction	Tree locations	Routine	-
SP07.11	All staff involved in vegetation clearance shall be walked through the pegged area and instructed on strict adherence to clearing within this boundary by the Contractor or its nominated sub-contractor prior to the commencement of clearance.	Owner to verify that all staff have undertaken site walk-through	Construction area within the Protected Areas	Once	SP15: Training and Awareness
SP07.12	Each site to be cleared shall be inspected by the Owner Site Environment Manager or nominated Owner Environment Officer prior to the commencement of vegetation clearance. This officer shall approve vegetation clearance if the site to be cleared has been clearly marked in accordance with the permit to clear issued by FD.	Owner to verify	Construction areas	Each construction area as cleared	-

No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
SP07.13	No clearing of vegetation outside of those areas identified in the plans will occur. Cutting of trees for firewood or for project use will be prohibited.	Visual site inspection	Construction sites	Routine	-
SP07.14	No construction works, storage of materials/equipment or access by construction personnel will be permitted in 'sensitive vegetation' areas.	Visual site inspection	Sensitive vegetation area	Routine	-
<i>Clearing methods</i>					
SP07.15	Progressively clear vegetation in a controlled manner, salvaging and stockpiling cleared vegetation in accordance with permit conditions and the approved SSES MMP.	Contractor to verify	Clearing areas	Each construction area as cleared	SP09: Biodiversity Management
SP07.16	Vegetation clearing will be undertaken by a combination of manual and mechanical methods. Chemical methods will not be used.  Soil disturbance will be minimised as much as possible during vegetation clearance.  Hand clearing will occur near vegetation to be protected, on environmentally sensitive sites where directional felling is required, and on excessively steep sites where it is hazardous to use machinery.  Herbicides shall be selected on the basis of being non-residual and with regard to human health.	Visual site inspection	Construction sites and sensitive vegetation area	Per case	-
SP07.17	No material should be stockpiled at the base of trees.	Visual site inspection	Construction sites	Routine	-
SP07.18	Chemicals and construction materials should not be stored under or immediately upslope of trees.	Visual site inspection	Construction sites	Routine	-
SP07.19	Alternative fuel sources other than fuelwood should be provided at workforce camps for cooking, heating and lighting.	Visual site inspection	Construction sites	Routine	-
SP07.20	A nursery shall be established by NNP1 within 12 months of the commencement of construction for the propagation of re-vegetation of species seedlings.	Visual site inspection	Construction sites	Routine	-



No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
SP07.21	Hand clearing shall be undertaken using appropriate safety equipment. Strict supervision of hand clearance activities will be undertaken to provide a safe working environment.	Visual site inspection	Construction sites	Routine	-
SP07.22	Machinery clearance shall be strictly controlled to ensure safe working conditions, and machinery shall not be parked underneath trees.	Visual site inspection	Construction sites	Routine	
<i>Use of herbicides</i>					
SP07.23	Herbicide use and management will be undertaken in accordance with the requirements of SP06.	-	-	-	SP06: Hazardous Material Management
<i>Tree cutting</i>					
SP07.24	The contractor will arrange for the employment of construction contractor and locally licensed logging firms to log and clear as far as practicable within approved construction sites.	Owner to verify compliance with clearance permit	Construction sites and sensitive vegetation area	Per case	-
SP07.25	Any required temporary timber storage sites will be designed to ensure that they are stable and protected from the risk of fire.	Visual site inspection	Timber storage sites	Routine	-
SP07.26	Timber products that are not to be removed from site will be disposed of in accordance with the Forestry Department guidelines and the requirements of SP05.	Owner to verify procedure of disposal	-	-	SP05: Waste Management
<i>Stockpiling</i>					
SP07.27	Cleared vegetation shall be stockpiled in accordance with permit conditions and the SSES MMP, to minimize site erosion and to enable the salvaging of trees as required in the permit conditions. This shall include only stockpiling cleared vegetation on previously disturbed areas to avoid further vegetation disturbance, and windrowing stockpiled vegetation along the contour to reduce erosion.	Visual inspection	Stockpile areas	Routine	SP01: Erosion and Sediment Control
<i>Salvage and Disposal</i>					
SP07.28	The FD shall be notified about stockpiled salvaged trees.	Owner to verify	Stockpiled areas	As needed	-

No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
SP07.29	Residual (non-salvaged) waste vegetation shall be stockpiled for later use in site re-vegetation where the material is suitable as a mulch or seed source, or, where surplus to needs, disposed of safely in accordance with FD approval. The disposal of residual, non-salvaged vegetation may involve making the material available to outside interests or burning it.	Visual site inspection	Construction areas	Routine	SP08: Landscaping and Re-vegetation
SP07.30	Burning of residual cleared vegetation will require the establishment of a fire control zone around the vegetation. Burning will not be permitted at times of the year when a high fire danger exists. In particular, burning will not be permitted when there is high grass fire hazard late in the dry season.  Burning of waste vegetation will only take place in accordance with the requirement of SP03.	Visual site inspection	Construction sites and sensitive vegetation area	Once	SP03: Emission and Dust Control
<i>Supervision</i>					
SP07.31	Each site to be cleared shall be inspected by the Owner Environment Manager or nominated Environment Officer prior to the commencement of vegetation clearance. This officer shall approve vegetation clearance if the site to be cleared has been clearly marked in accordance with the permit by the relevant authority.  The relevant government authority shall be notified of the proposed vegetation clearance.	Visual site inspection	Clearing sites	Once	-
SP07.32	The Owner Environment Officer shall inspect clearance activities at each site once a day, advising the Contractor or its nominated sub-contractor of any non-conformances against the permit or SSESMMMP and specifying any required remedial action.	Owner Environmental Officer	Construction sites	Daily	-
SP07.33	The Contractor or its nominated sub-contractor shall implement the remedial action in accordance with the SSESMMMP specified by the Owner Environment Officer within the time frame advised.	Contractor to verify	Construction sites where remediation is required	As needed	-

No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
SP07.34	The Owner Environment Officer shall sign off on site clearance activities only after all remedial actions have been implemented by the Contractor or its nominated sub-contractor. No other site work will be permitted to occur until sign off has occurred.	Owner Environmental Officer to sign off.	All clearing sites.	Once, after all remedial actions implemented	-
<i>Impacts on agricultural land use</i>					
SP07.35	All works will be designed and implemented in a manner that minimizes the impact on agricultural land use.	Visual site inspection	Construction sites and sensitive vegetation area	Per case	BMP-02: Dust Control

## SP08: LANDSCAPING AND RE-VEGETATION

No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
<i>Landscaping and re-vegetation work</i>					
SP08.1	All area disturbed by construction activity will be, as far as reasonably possible, landscaped to reflect natural contours and restore suitable drainage paths.	Visual site inspection	Re-vegetation area	Per case	-
SP08.2	Undertake replanting of Project cleared areas at appropriate locations agreed with local authorities. Re-establishment of vegetation will be implemented in disturbed areas except surface of rock, if necessary, and commenced at the earliest possible opportunity. Appropriate local species of vegetation will be used. Replanting will use locally native plant species.	Visual site inspection	Re-vegetation area	Per case	-
SP08.3	Monitoring and marking of vegetation that will be removed, as agreed with forest authority prior to commencement of construction.	Visual site inspection	Re-vegetation area	Per case	-
SP08.4	Contractors shall not buy or use wood from illegal sources (that come from the illegal logging).	Visual site inspection	Re-vegetation area	Per case	-
SP08.5	Contractors will take all precautions necessary to prevent fires from their construction activities. If a fire occurs contractors will immediately suppress it with appropriate methods.	Visual site inspection	Re-vegetation area	Per case	
SP08.6	Local depressions created by construction activities will be either backfilled or drained to prevent ponding wherever possible.	Visual site inspection	Depression areas	Per case	-
SP08.7	Watercourses, which have been temporarily diverted by the contraction activities, will be restored to their former flow paths and riparian zones rehabilitated.	Visual site inspection	Diversion reach	Three occasions - 1 upon restoration and 2 other occasions to confirm restoration success	-
SP08.8	Rehabilitation activities will be in accordance with the Biodiversity Action Plan (BAP)	As per BAP	All areas of rehabilitation		-

No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
SP08.9	Residual impacts to natural habitat areas and threatened species habitat will be managed through implementation of the Biodiversity Offset Design (BOD) Report	As per BOD	-	-	-
SP08.10	Conduct monitoring and maintenance to ensure a high survival rate of seedlings. Reasonable remedial measures (e.g. replacing dead or damaged replanted trees and other vegetation types) shall be implemented in case of the damage due to project activities.	As per BOP	All areas of rehabilitation		-
SP08.11	Use grading methods and facilities such as rounding benching, terracing, and retaining walls (as appropriate) to reduce the amount and/or severity of earthwork and related topographic alteration/vegetation removal.	As per BOP	All areas of rehabilitation	As per BAP	As per BAP
SP08.12	Install suitable wildlife crossing structures at locations agree with the relevant government authority as required.	Visual site inspection	Re-vegetation area	Per case	-
<i>Restoration of other land uses</i>					
SP08.13	Land used for agricultural activities prior to use for construction activities will be, as much as reasonably possible, restored to a state to allow the same agricultural activity to continue.	Visual site inspection at completion of works in relevant areas.	Re-vegetation area	Per case at completion of works	-



## SP09: BIODIVERSITY MANAGEMENT

No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
<i>General</i>					
SP09.1	Implement the recommended offset package outlined in the Biodiversity Offset Design (BOD) Report.	As per BOD		As per BOD	BOD
SP09.2	Implement the recommended actions outlined in the Biodiversity Action Plan (BAP)	As per BAP	All construction areas	As per BAP	BAP (to be prepared)
<i>Site Survey and Preparation</i>					
SP09.3	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).	Owner to verify outcomes of the on-ground survey and resultant actions in accordance with related sub-plans/BMPs.	All construction areas	Once	BAP, BOD,  SP07: Vegetation Clearing
SP09.4	The extent of all works shall be surveyed and clearly pegged prior to the commencement of any construction activities.	Owner and the Contractor to jointly inspect the pegged work areas to identify management measures required	All construction areas	Once per clearing area	SP07: Vegetation Clearing
SP09.5	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.	Owner Environmental Officer to visually inspect	All construction areas	Routine prior to clearing	SP07: Vegetation Clearing
<i>Avoidance of Weed Spread or Encouragement of Pests</i>					
SP09.6	Construction wastes will be appropriately stored and disposed of such that pest and/or native fauna cannot access hazardous or domestic waste items.	Contractor to verify waste disposal facilities are adequate and monitor construction sites are maintain in a tidy manner	All construction areas	Routine	SP05: Waste Management,  SP06: Hazardous Material Management
SP09.7	Landscaping and re-vegetation will utilise locally native species.	Owner to verify	All re-vegetation areas	Routine	SP08: Landscaping and Re-vegetation

No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/BMPs
SP09.8	To avoid the spread of non-endemic species between different areas of the construction site, topsoil and vegetation (for mulching) removed from an area during site-clearing activities will as far as practical only be reused on that area.	Contractor to verify	All construction areas	Routine	SP08: Landscaping and Re-vegetation
<i>Wildlife Protection</i>					
SP09.9	The Contractor shall develop a construction procedure that allows/encourages wildlife to move off-site before and during construction activities to avoid deaths.	Owner to approve procedure prior to construction and monitor implementation during clearing activities	All construction areas	Routine	SP07: Vegetation Clearing
SP09.10	For 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.	Owner to verify	All construction and ancillary areas	Routine	-
SP09.11	A speed limit of 40 km/hr shall apply to all project vehicle movements.	Owner to verify appropriate signage is established and information is included in staff training and awareness	All roads in Project site	Once	SP15: Training and Awareness
SP09.12	All project staff prohibited from harvesting any forest products and hunting wildlife (terrestrial and aquatic).	Owner to verify information is included in staff training and awareness. Owner Site Manager to monitor for illegal activities	All construction areas	Routine	SP15: Training and Awareness
SP09.13	Re-vegetation adjacent to the road to occur upon completion of construction	Owner Environmental Officer to monitor re-vegetation progress	All construction areas	Routine	SP08: Landscaping and Re-vegetation
SP09.14	Raise awareness of the protection of threatened species to trade, poaching and hunting through education of construction team members	Owner to verify	-	Once	SP15: Training and Awareness
<i>Management of Habitat Degradation</i>					
SP09.15	Dust suppression techniques will be utilised during construction, to control the dispersion of dust created by clearing lands	Visual inspection	All construction areas	Routine	SP01: Erosion and Sediment Control

No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
SP09.16	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	Visual inspection	All construction areas	Routine	SP01: Erosion and Sediment Control
SP09.17	Construction materials and chemicals will be appropriately secured and locked down during rainy season to avoid accidental release to the natural environment;	Visual inspection	All construction areas	Routine	SP06: Hazardous Material Management
SP09.18	Implement emergency response procedures in accordance with SP17 Emergency Preparedness	Owner to verify	All construction areas	Routine	SP17: Emergency Preparedness
SP09.19	Wherever practicable, topsoil shall be stripped off construction and ancillary sites and stockpiled for later reuse for site rehabilitation.	Visual inspection	All construction areas	Routine	SP01: Erosion and Sediment Control
SP09.20	Temporary topsoil stockpiles will be developed in accordance with SP01 Erosion and sediment control.	Visual inspection	All construction areas	Routine	SP01: Erosion and Sediment Control

## SP10: SPOIL DISPOSAL

No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
<i>Design of Soil Areas</i>					
SP10.1	The volume of spoil that will be (i) generated by construction, (ii) used in construction (e.g. for aggregate, fill) and (iii) remaining and requiring disposal shall be estimated for all sites where excess spoil will be generated.	Design of spoil area to be verified prior to commencement of the construction by Owner.	-	Once	-
SP10.2	Spoil disposal sites shall be identified during the detailed design phase, with site capacities estimated and stabilisation works (retaining walls and drains) designed.	Design of spoil area to be verified prior to commencement of the construction by Owner.	-	Once	-
<i>Principles of spoil management</i>					
SP10.3	The volume of excess spoil will be minimised by appropriate Project design, including the maximum use of spoil for such purposes as concrete aggregate, road gravelling, and landforming for Project sites, community facilities or private uses.	Design of spoil area to be verified prior to commencement of the construction by Owner.	-	Once	-
SP10.4	Spoil disposal sites shall generally be located on: <ul style="list-style-type: none"> <li>- lower slope land so that stable landforms can be created. If possible, land with a slope more than 10% shall generally not be used for spoil disposal, where possible;</li> <li>- degraded or lower value land (e.g. grasslands, poor quality cultivation land);</li> <li>- land devoid of forest or with highly degraded forest cover; and</li> <li>- areas where improved final landforms can be created, either for Project, community or private use.</li> </ul>	Design of spoil area to be verified prior to commencement of the construction by Owner.	-	Once	-
SP10.5	Temporary stockpiling of spoil shall only be permitted where the final spoil disposal site cannot be used for a period of time due to other construction activities.	Visual site inspection	Spoil areas	Routine	-

No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
<i>Site Preparation</i>					
SP10.6	The spoil disposal site boundary and associated sediment traps or settling basins shall be surveyed and clearly pegged / marked by the Contractor or its nominated sub-contractor prior to the commencement of related excavation/tunnelling and spoil generation, handling and disposal.	Visual site inspection	Spoil areas	Once, prior to commencement of spoil generation	-
SP10.7	All necessary spoil disposal site preparation activities shall be completed prior to the commencement of the related spoil generation, handling and disposal, to ensure that disposal sites are fully prepared prior to use, thereby avoiding temporary stockpiling wherever possible. This shall include the construction of the initial retaining walls and sediment basins where required.	Visual site inspection	Spoil areas	Once, prior to commencement of spoil generation	-
SP10.8	If the temporary stockpiling of spoil is required, temporary stockpile sites shall be pegged and temporary control measures shall be installed prior to the use of each site.	Visual site inspection	Spoil areas	Once, prior to use of spoil site	-
SP10.9	All staff involved in spoil handling and disposal shall be walked through the pegged disposal sites and instructed on strict adherence to planned spoil handling and disposal at the site.	Discussion with foreman and personnel to verify that staff have undertaken site walk-through	Spoil areas	Weekly	-
SP10.10	Topsoil shall be removed from spoil disposal and settling basin sites prior to use and stockpiled nearby, to be utilised for eventual landform re-vegetation, if possible.	Visual site inspection	Spoil areas	Weekly	-
<i>Verification</i>					
SP10.11	Each temporary or permanent spoil disposal site and associated facilities (e.g. retaining walls, drains) shall be inspected by the Owner Environment Manager or the nominated Owner Environment Officer prior to any disposal activities. This officer shall approve spoil	Verification that notice to proceed has been obtained for each spoil disposal site.	Spoil areas	Once for each site	-



No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
	handling and disposal for a specific area if the handling and disposal facilities and sites are in accordance with the Spoil Management Plan and any variations required by the Owner Environment Manager.				
<i>Spoil handling</i>					
SP10.12	Spoil shall be handled as little as possible to avoid creating an additional erosion hazard, additional sources of sediment and water quality and dust hazards.	Visual site inspection	Spoil areas	Weekly	-
SP10.13	Temporary stockpiling shall only be permitted when the final disposal site is temporarily unavailable due to use for another purpose.	Visual site inspection	Spoil areas	Weekly	-
SP10.14	Wherever possible, dry spoil shall be transported and disposed of in its final location in a single operation when it is removed from the point of generation.	Visual site inspection	Spoil areas	Weekly	-
SP10.15	Wet residue shall be kept separate from dry spoil and treated at a location as close as possible to the source, depending on condition of fine sediment.	Visual site inspection	Spoil areas	Weekly	-
<i>Procedure</i>					
SP10.16	Dry spoil shall be trucked to the disposal site and progressively laid.	Visual site inspection	Spoil areas	Weekly	-
SP10.17	In windy conditions, dust generation shall be suppressed during spoil handling, placement and compaction using such measures as water spraying if excessive dust generation is expected.	Visual site inspection	Spoil areas	Weekly	-
<i>Spoil Treatment</i>					
SP10.18	Settling basins shall be adequately sized to settle out fine soil particles over a short period.	Visual inspection of settling basin	Settling basin	Once prior to use	-
SP10.19	Settling basins shall be isolated from local overland runoff, only subject to direct rainfall.	Visual inspection of settling basin	Settling basin	Once prior to use	-

No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
SP10.20	A safety fence and signage shall be erected around settling basins to prevent unauthorized access.	Visual inspection	Settling basin	Once prior to use	-
SP10.21	The settling system shall consist of at least two connected basins that provide (i) primary treatment and (ii) overflow treatment.	Visual inspection of settling basin	Settling basin	Once prior to use	-
SP10.22	Settling basins shall be structurally sound, capable of withstanding saturation and normal rainfall events.	Visual inspection of settling basin	Settling basin	Once prior to use	-
SP10.23	The use of non-contaminating flocculants shall be considered where basin settling is inadequate to treat the volume of effluent / residue generated. Flocculants shall only be used with the approval of and as directed by the Owner.	Verification of approval by the Owner	Settling basin	When use of flocculants is proposed	-
SP10.24	Settled sediment within each basin shall be removed and disposed of at an approved site when 75% of the capacity of settling basing capacity has been reached.	Visual inspection	Settling basin	Monthly	-
SP10.25	Water/effluent to be released from the site from secondary basins shall be monitored to ensure that it is of acceptable quality prior to release.	Monitoring of parameters defined in Annex C of the ESMMP-CP.	Settling basin	At each release.	SP02: Water Availability and Pollution Control
<i>Spoil Disposal</i>					
SP10.26	Workers responsible for spoil handling and disposal shall be instructed by the Contractor or its nominated sub-contractor about the correct/approved placement and compaction of spoil.	Discussion with personnel to verify understanding of requirements.	Spoil areas	Weekly	SP15: Training and Awareness
SP10.27	Spoil shall be used on Project sites where possible (e.g. to create the power station platform).	Visual verification	Spoil areas	Weekly	-
SP10.28	Excess spoil shall be disposed of at approved sites, with landforms created as per the Spoil Management Plan.	Visual verification	Spoil areas	Weekly	-
SP10.29	The Owner Environment Officer shall inspect each pegged spoil disposal site with the Contractor or its nominated sub-contractor and approve each site prior to the commencement of site preparation works.	Visual verification	Spoil areas	Once prior to disposal.	-

No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
SP10.30	Topsoil shall be stripped off spoil disposal sites and stockpiled prior to spoil placement on the site.	Visual verification	Spoil areas	Once prior to disposal.	-
SP10.31	Ancillary works required at spoil disposal sites such as gabion retaining walls and drains shall be constructed prior to filling each site, either entirely or progressively as each site develops, ensuring that placed fill is retained within the designated area.	Visual verification	Spoil areas	Once prior to disposal, then monthly if required.	-
SP10.32	Erosion and sediment controls shall be installed at each spoil disposal site and progressively adjusted as the landform changes, to minimise on-site erosion and prevent off-site sedimentation.	Visual verification	Spoil areas	Weekly	-
SP10.33	Spoil shall be shaped into stable landforms, with permanent drains installed to maintain landform stability and prevent erosion. Final landform slopes shall not exceed 1:2.0 (V:H). A bench shall be installed at vertical intervals of no greater than 10 m to provide slope stability, provided that sufficient slope stability would be expected considering actual site condition.	Visual verification	Spoil areas	Weekly	-
SP10.34	Adequate compaction of all placed fill shall be provided. This will generally be achieved by laying the fill in horizontal layers not exceeding 50 - 100 cm depth and compacting with bulldozer.	Visual verification	Spoil areas	Weekly	-
<i>Site Stabilisation</i>					
SP10.35	Final landforms shall be progressively stabilized within one month of completion during the dry season and within one week of completion during the rainy season.	Visual verification	Spoil areas	One month following completion during dry season, or one week following completion during rainy season.	-
SP10.36	Where topsoil is available, final landforms shall be covered in topsoil to promote re-vegetation.	Visual verification	Spoil areas	Once, after completion of final landform	SP08: Landscaping and Re-vegetation
SP10.37	Following topsoiling, each landform shall be treated to promote re-vegetation. Minimum treatment shall include sowing a cover crop and perennial species. Additional treatment may include planting tree and shrub seedlings and mulching the ground surface, if necessary.	Visual verification	Spoil areas	Once, after topsoiling	SP08: Landscaping and Re-vegetation

No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
SP10.38	The Contractor or its nominated sub-contractor shall monitor the condition of re-vegetated areas periodically, and may seed with insufficient ground cover, if necessary.	Visual verification	Rehabilitating spoil areas	Monthly for at least one year	SP08: Landscaping and Re-vegetation

## SP12: UNEXPLODED ORDNANCE (UXO) SURVEY AND DISPOSAL

No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
<i>Appropriately qualified organization to undertake work</i>					
SP12.1	An appropriately qualified organization will be engaged to undertake survey and disposal of UXO in areas where Project activity are to take place, prior to the commencement of any construction works on-site.	Owner to verify qualifications of organization	-	-	BMP-01: Scheduling
<i>Requirements for survey and disposal</i>					
SP12.2	The priority method of UXO disposal shall be in-situ explosion. Where this is not possible, due to potential danger to personnel or nearby population or damage to infrastructure, alternative proven methods of disposal may be implemented.	Contractor and owner to review site clearance report	-	Routine	-
<i>Appropriately qualified organization to undertake work</i>					
SP12.3	Where disposal of UXO may cause physical damage to infrastructure, protective measures such as sandbagging, burial and trenching will be undertaken.	Visual site inspection	Construction site	Per case	-
SP12.4	Storage and handling of explosives will be undertaken in accordance with the requirements of SP06.	Contractor to undertake and Owner to review the post clean-up report	-	Per case	SP06: Hazardous Material Management
<i>Marking of cleared areas and clearance reports</i>					
SP12.5	All cleared areas will be semi-permanently marked with concrete posts or similar. Within 30 days of completion of the clearing work at a site, a clearance report will be prepared and will contain the following information: <ul style="list-style-type: none"> <li>i. Description (using GPS coordinate system or similar) and mapping of boundaries of the cleared area - area identifiers will be in keeping with the overall identification process used for engineering design drawings</li> <li>ii. Description of the survey, disposal and QC processes that were implemented on the site</li> </ul>	Visual site inspection	Cleared areas	Routine	-



No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
	<ul style="list-style-type: none"> <li>iii. Description of UXO located, UXO destroyed and amount of scrap metal recovered</li> <li>iv. Certification that the area has been cleared of UXO and is suitable for its intended purpose</li> </ul>				
<i>Construction worker training</i>					
SP12.6	As part of the construction worker training program contained in SP15. Workers, construction workers will be trained in the potential risks associated with disturbance of UXO and procedures to be followed if potential items of UXO are identified during construction activities.	-	-	-	SP15: Training and Awareness
<i>Notification of local communities</i>					
SP12.7	<p>A UXO notification will be implemented in communities that are located in the vicinity of survey and disposal works at the time that the survey and disposal works are being undertaken. UXO notification will include:</p> <ul style="list-style-type: none"> <li>i. Notification of local communities of the commencement and likely duration of UXO disposal activities in their area and any likely precautions that should be taken.</li> <li>ii. Information to communities about the location of cleared areas and the meaning of the cleared area markings or signage (i.e., the delineation between cleared and un-surveyed areas).</li> </ul>	Contractor to review six month report.	-	Six month	-

### SP13: CONSTRUCTION OF WORK CAMPS

No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
<i>Use of camps</i>					
SP13.1	All workers who are based on the construction site will be accommodated by one of the construction camps.	Visual site inspection	Construction camps	Routine	-
SP13.2	Appropriate sanitation facilities will be installed in accordance with SP02.	Visual site inspection	Construction camps	Routine	SP02: Water Availability and Pollution Control
<i>Disease control, health and safety issues</i>					
SP13.3	Buildings in Residence camps and sub-camps will be made 'mosquito-proof' as far as possible through ensuring adequate sealing of doors and windows, provision of suitable ventilation and as necessary, installing mosquito-nets and other prevention devices.	Visual site inspection	Construction camps	Routine	-
SP13.4	Medical, sanitary and disease prevention measures for each camp will be implemented in accordance with the requirements of SP16.	-	-	-	SP16: Project personnel health program
SP13.5	Pesticide use in the camps and sub-camps will be carried out in accordance with the requirements of SP16.	-	-	-	
SP13.6	Waste generated at the construction camps will be managed in accordance with the requirements of SP05.	-	-	-	SP05: Waste management
SP13.7	Construction workers will be trained in health and safety issues relating to the camps in accordance with the requirements of SP15.	-	-	-	SP15: Training and Awareness
<i>Camp access</i>					
SP13.8	In general, access to the camps will be restricted to construction workers and visitors with an authorized access pass.	Visual site inspection	Construction camp	Routine	-

No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
<i>Potable water supply</i>					
SP13.9	All potable water storage facilities will be secured, with access limited to authorized personnel. Local rivers or underground water will be used as the source of the potable water supply. The intake for the potable water storage will be located a suitable distance upstream of any wastewater discharge point.	Visual site inspection	Construction camp	Routine	-
SP13.10	Water quality monitoring of the potable water storage in camps and sub-camps will be carried out in accordance with the requirements of SP02.	Review monthly monitoring report and test results.	-	Monthly	SP02: Water Availability and Pollution Control
<i>Camp rules and regulations</i>					
SP13.11	A set of rules and regulations applicable to camps and sub-camps will be developed. The rules and regulations will include: <ul style="list-style-type: none"> <li>i. Prohibitions on hunting and poaching of wildlife, purchasing wildlife meat, fishing, gathering and harvesting medicinal or valued plants and trees, and possessing firearms, snares, traps and other hunting equipment</li> <li>ii. Access restrictions for non-construction personnel</li> <li>iii. Housecleaning and waste management requirements</li> <li>iv. Other prohibitions</li> <li>v. Measures for preserving health and the dissemination of vectors and transmissible diseases</li> </ul>	Documented rules to be verified	-	Once	-
SP13.12	Residents of the camps shall be provided with written information and training on camp rules and regulations. Camp rules and regulations will be prominently displayed in the camp areas.	Review of training register.	-	Routine	-

## SP15: TRAINING AND AWARENESS

No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
SP15.1	<p>All workers will complete the environmental training programs. The goal of programs will be to educate all workers on the requirements of the environmental management plans (Owner ESMMP-CP, sub-plans, Contractor ESMMP-CP and Contractor Thematic Plans. In particular, the following issues will be addressed:</p> <ul style="list-style-type: none"> <li>i. Fire arms possession</li> <li>ii. Traffic regulations</li> <li>iii. Illegal logging &amp; collection of non-timber forestry products</li> <li>iv. Non disturbance of resettlement communities</li> <li>v. Hunting &amp; fishing restrictions</li> <li>vi. Waste management</li> <li>vii. Erosion control</li> <li>viii. General health</li> </ul>	Review of training register.	-	Routine	<p>BMP-03: material delivery and storage</p> <p>BMP-04: Concrete waste management</p> <p>BMP-05: Solid waste management</p> <p>BMP-06: Sanitary/ Septic waste management</p> <p>BMP-07: Hazardous waste management</p> <p>BMP-09: Contaminated soil management</p>
SP15.2	<p>Health Awareness Training will be mandatory for all personnel. Training will cover the following topics:</p> <p>Health:</p> <ul style="list-style-type: none"> <li>i. Anti-malaria precautions</li> <li>ii. Precautions for HIV/ AIDS and other venereal diseases</li> <li>iii. Diarrhea precautions</li> <li>iv. Symptoms of other diseases typical of the area (such as dengue fever)</li> <li>v. Recommendations regarding proper disposal of all wastes</li> <li>vi. Use of proper drinking water</li> <li>vii. Use of appropriate toilets</li> </ul> <p>Safety:</p> <ul style="list-style-type: none"> <li>i. Use of Personal Protective Equipment (PPE)</li> <li>ii. Use of specific equipment according to the</li> </ul>	Inspection of manual.	-	Once	-

No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
	safety procedures iii. Use of appropriate clothing iv. Use of appropriate ladders v. Use of appropriate slinging vi. Attention to signals of danger vii. Attention to suspended weights viii. Attention to unprotected pits ix. Attention to buried cables x. Attention to overhead power cables xi. Attention to all flammable items xii. Procedure for fire extinguishing Miscellaneous safety issues				
SP15.3	Where necessary, participants in job-specific training will be identified on the basis of their skills and capacity to undertake the training.	Review of training register.	-	Per case	-
SP15.4	All training sessions will be conducted in Lao language for Lao personnel and as appropriate for foreign staff. All written materials will be provided in Lao language and other languages as appropriate.	Inspection of training materials/courses.	-	Per case	-
SP15.5	A training register will be maintained that will contain details of the following: i. Name of training session ii. Date of training session iii. List of attendees and signatures iv. Name of trainer	Review of training register.	-	Routine	-
SP15.6	Upon completion of each relevant training course, each participant will be issued with a certificate of successful completion. A copy of the certificate will also be placed on each participant's employment file.	Review of training register.	-	Routine	-
SP15.7	The EMO will implement a rolling program of refresher courses in environmental, health and safety awareness issues through the use of 'tool-box' sessions at construction sites.	Review of training register.	-	Routine	-



No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
SP15.8	During audits of the construction areas, workers' knowledge of environmental, health and safety issues will be examined.	Review of training register.	-	Per case	-
SP15.9	Workers who have undergone job-specific training will be examined in relation to their knowledge and skills and are subject to re-training, if necessary. Records of examination results and any re-training will be kept as part of the training register.	Review of training register.	-	Per case	-
SP15.10	All new employees will complete relevant training prior to commencement of any activities on the construction site.	Review of training register.	-	Routine	-
SP15.11	The key messages from the training sessions will be produced in both poster and leaflet form, in Lao and English language. Posters will be displayed prominently in construction work camps and construction areas and leaflets will be distributed to staff on a regular basis.	Visual site inspection	Construction sites	Routine	-
SP15.12	All Contractor employees and its nominated sub-contractor/s carrying out vegetation clearance, earthworks, spoil disposal, stockpiling or installing erosion and sediment control works shall complete the Environmental Induction Course incorporating an erosion and sediment Control measures. Appropriate training program will be established according to employee tasks and training of all employees and sub-contractors shall be recorded in the Contractor's Training Register.	Contractor to verify	Construction sites	Once	-
SP15.13	All Contractor employees and its nominated sub-contractor/s carrying out vegetation clearance activities (site survey and pegging, vegetation clearance and cleared vegetation management) shall have completed the General Environmental Awareness Training (incorporating Vegetation Clearing controls). Appropriate training program will be established according to employee tasks and training of all employees and sub-contractors shall be recorded in the Contractor's Training Register.	Contractor to verify	Construction sites within the Protected Areas	Once	-

No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
SP15.14	All Contractor employees and its nominated sub-contractor/s carrying out Project activities within Protected Areas shall have completed the Environmental Induction Course incorporating Protected Areas Unit. Appropriate training program will be established according to employee tasks and sub-contractors shall be recorded in the Contractor's Training Register.	Contractor to verify	Construction sites within the Protected Areas	Once	-

## SP16: PROJECT PERSONNEL HEALTH PROGRAM

No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
<i>Training</i>					
SP16.1	<p>Health Awareness Training will be mandatory for all personnel. Training will cover the following topics:</p> <p>Health:</p> <ul style="list-style-type: none"> <li>i. Anti-malaria precautions</li> <li>ii. Precautions for HIV/ AIDS and other venereal diseases</li> <li>iii. Diarrhea precautions</li> <li>iv. Symptoms of other diseases typical of the area (such as dengue fever)</li> <li>v. Recommendations regarding proper disposal of all wastes</li> <li>vi. Use of proper drinking water</li> <li>vii. Use of appropriate toilets</li> </ul> <p>Safety:</p> <ul style="list-style-type: none"> <li>i. Use of Personal Protective Equipment (PPE)</li> <li>ii. Use of specific equipment according to the safety procedures</li> <li>iii. Use of appropriate clothing</li> <li>iv. Use of appropriate ladders</li> <li>v. Use of appropriate slinging</li> <li>vi. Attention to signals of danger</li> <li>vii. Attention to suspended weights</li> <li>viii. Attention to unprotected pits</li> <li>ix. Attention to buried cables</li> <li>x. Attention to overhead power cables</li> <li>xi. Attention to all flammable items</li> <li>xii. Procedure for fire extinguishing</li> <li>xiii. Miscellaneous safety issues</li> </ul>	Inspection of manual.	-	Once	SP15: Training and Awareness
SP16.2	Additional material, including a "Health and Safety Manual" will be distributed to the personnel attending training in the language used by the workers during trainings. Health and safety related posters will be provided in visible locations at worker camp, canteen and offices.	Inspection of manual and verification of educational materials provided in worker camp.	-	Monthly	SP15: Training and Awareness

No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
<i>First Aid</i>					
SP16.3	First aid teams will be specifically trained and assigned in groups of two to three persons to the different sites.	Review of training register.	-	Per case	-
SP16.4	First aid stations will be provided and will be appropriately equipped.	Visual site inspection	First aid stations	Monthly	-
SP16.5	First aid kits will be readily accessible by workers.	Visual site inspection	All work sites, and worker camp.	Routine	-
SP16.6	A doctor shall be reached when an accident occurs.	-	-	-	-
<i>Disease Control</i>					
SP16.7	Vector control of mosquitoes and other pests will be managed according to the following actions: <ul style="list-style-type: none"> <li>i. Effective storm water drainage systems implemented to avoid stagnant water</li> <li>ii. Storm water drains and borrow pits will be kept free of vegetation</li> <li>iii. Minimizing the presence stagnant water within containers and other pools of water</li> <li>iv. Providing mosquito nets to buildings</li> <li>v. Safe application of pesticides when necessary</li> <li>vi. Removal of discarded items that could contain water</li> </ul>	Visual site inspection	Construction sites and camps	Routine	-
SP16.8	Solid waste that might attract pests such as domestic rubbish and food waste shall be managed properly.	Visual site inspection	Construction sites and camps	Routine	SP05: Waste management
SP16.9	The water supply and sewage system, especially in camp sites, will be maintained in good working condition through regular monitoring according to the required standards.	Visual site inspection	Construction sites and camps	Routine	SP02: Water Availability and Pollution Control
SP16.10	The use of pesticides to control pests will be limited to only those cases deemed necessary.  Use and handling of pesticides will be conducted on the appropriate manners.	Visual site inspection	Construction sites and camps	Routine	-

No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
SP16.11	Provide adequate drainage in workers camps to avoid water logging/accumulation of stagnant water and formation of breeding sites for mosquitoes.	Visual observation	Worker Camp	Weekly	-
SP16.12	Provide adequate and clean housing and sanitation facilities for all workers at the workers'/construction camps. Separate sleeping quarters shall be provided for male and female workers.	Visual observation	Worker Camp	Weekly	-
SP16.13	Provide reliable supply of water for drinking, cooking and washing purposes at the workers' camps.	Visual observation, water quality monitoring	Worker Camp	Weekly	SP02 Water Availability and Pollution Control Standards (Appendix 3)
SP16.14	Provide separate hygienic sanitation facilities/toilets and shower areas with sufficient water supply for male and female workers.	Visual observation	Worker Camp	Weekly	-
SP16.15	Ensure that all wastewater emanating from workers camps, construction camps and other Project-related activities and facilities are treated consistent with national regulations. Methods of wastewater treatment will be selected based on site conditions.	Visual observation	Construction sites and camps	Weekly	SP02 Water Availability and Pollution Control Standards (Appendix 3)
SP16.16	Ensure proper collection and disposal of solid wastes within the workers'/construction camps consistent with local regulations.	Visual observation	Construction sites and camps	Weekly	SP05 Waste Management
<i>Health and Safety</i>					
SP16.17	Workers at the bridge site shall be provided with life vests/buoyancy devices when river conditions dictate. Stable footpaths/access with sturdy guardrails to the bridge work sites shall be provided.	Visual observation	Construction sites and camps	Weekly	-
SP16.18	As part of navigation safety and as applicable, the contractor will comply with waterway traffic safety during construction. Prior to construction, the contractor will prepare a waterway safety plan. This will be submitted to and approved by a relevant government agency if required.	Visual observation	Waterways	Weekly	-



No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
SP16.19	Provide fire-fighting equipment at the work areas, as appropriate, and at construction camps where fire hazards and risks are present.	Visual observation	Construction sites and camps	Weekly	-
SP16.20	Provide sturdy fencing on all areas of excavation greater than 2 m deep.	Visual observation	Excavation areas	Weekly	-
SP16.21	Provide personnel with appropriate safety equipment such as safety boots, helmets, gloves, protective clothes, breathing mask, goggles, ear protection, etc. and ensure that these are properly worn as required.	Visual observation	Construction sites and camps	Weekly	-
SP16.22	Ensure reversing signals are installed on all construction vehicles.	Visual observation	Vehicles	Weekly	-
SP16.23	Implement fall prevention and protection measures whenever a worker is exposed to the hazard of falling more than two meters, falling into operating machinery or through an opening in a work surface. Based on a case-specific basis, fall prevention/protection measures may include installation of guardrails with mid-rails and toe boards at the edge of any fall hazard area, proper use of ladders and scaffolds by trained employees, use of fall prevention devices, including safety belt and lanyard travel limiting devices to prevent access to fall hazard, fall protection devices such as full body harnesses, etc.	Visual observation	Construction sites and camps	Weekly	-
SP16.24	Implement precautions to ensure that objects (e.g., equipment, tool, debris, pre-cast sections, etc.) do not fall onto or hit people, vehicle, and properties in adjoining areas.	Visual observation	Construction sites and camps	Weekly	-

## SP17: EMERGENCY PREPAREDNESS

No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
<i>Storage of hazardous materials</i>					
SP17.1	Hazardous materials will be stored on-site with the MSDS in accordance with the requirements of SP06.	Visual site inspection by contractor	Construction sites	Routine	SP06: Hazardous Material Management
<i>Spill response procedures</i>					
SP17.2	In the event of a spill of any hazardous material, work will be ceased in the immediate vicinity and the area will be cleared of all construction personnel except those involved in the clean-up activities, if necessary.	Contractor undertake and provide post clean-up report	-	Per case	-
SP17.3	In the event of a spill of any hazardous material, the following response hierarchy will apply and will be used in the development of the detailed emergency response procedures: <ul style="list-style-type: none"> <li>i. First priority is to seek medical attention for any injured personnel</li> <li>ii. Second priority is to prevent further injury to personnel</li> <li>iii. Third priority is to prevent environmental damage</li> <li>iv. Fourth priority is to clean-up spill</li> <li>v. Fifth priority is to remediate area of spill</li> <li>vi. Sixth priority is to complete reporting requirements</li> </ul>	Visual site inspection by contractor	-	Per case	SP06: Hazardous Material Management
SP17.4	For spills of hazardous materials, appropriate treatment and disposal methods for the known range of hazardous materials will be applied by trained personnel.	To be undertaken by contractor	-	Per case	SP06: Hazardous Material Management
<i>Emergency contact details</i>					
SP17.5	At each construction site, information on emergency response procedures, emergency contact numbers and communication and reporting procedures (to be implemented in case of an emergency situation) will be clearly displayed.	Visual site inspection by contractor	Construction sites	Routine	-

No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
<i>Training of personnel</i>					
SP17.6	At each construction site where hazardous materials are used and where there exists a potential for a spill, there will be at least two employees on-site at all times who are trained in appropriate emergency response procedures and communication and reporting procedures to be implemented in case of an incident (refer to SP15)	To be undertaken by contractor	-	-	SP15 Training and Awareness
SP17.7	All construction personnel will be trained in basic emergency response procedures including communication and reporting procedures to be implemented in case of an emergency situation.	To be undertaken by contractor	-	-	Emergency Response Procedure SP15: Training and Awareness
<i>Emergency incident communication processes</i>					
SP17.8	In the event of a personal emergency implement the Emergency Response Procedure (Appendix 6). All staff will be made aware of the procedure during Project induction	Owner to review procedure	-	Annual	Emergency Response Procedure,
SP17.9	In the event of an accidental release or spill of a hazardous material, the following communication processes will be implemented:  <ul style="list-style-type: none"> <li>i. Environmental Officer immediately notifies ESD</li> <li>ii. ESD immediately notifies emergency response team</li> <li>iii. ESD immediately notifies external emergency authorities (if required)</li> </ul> Communication will initially be verbal, with written communication as soon as practical.	Environment Officer undertake and provide post clean-up report	-	Per case	-
SP17.10	The communication processes will include the following information in relation to accidental releases or spills:  <ul style="list-style-type: none"> <li>i. Location of spill</li> <li>ii. Nature of material spilt</li> </ul>	-	-	-	SP06: Hazardous Material Management

No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
	<ul style="list-style-type: none"> <li>iii. Amount of material spilt</li> <li>iv. Clean-up processes to be implemented</li> <li>v. Any injuries to personnel</li> <li>vi. Need for emergency or external assistant</li> <li>vii. Any safety/evacuation requirements to be implemented on the construction site</li> </ul>				
SP17.11	Within 48 hours of the completion of a spill clean-up, a report will be submitted to the Owner. The report will be used to identify any required corrective or preventive actions and emergency response procedures and training programs will be modified accordingly.	Contractor undertake and provide post clean-up report	-	Per case	-
<i>General Emergency</i>					
SP17.12	First aid teams will be specifically trained and assigned in groups of two to three persons to the different sites.	Review of training register.	-	Per case	-
SP17.13	First aid stations will be provided and will be appropriately equipped.	Visual site inspection	First aid stations	Monthly	-
SP17.14	First aid kits will be readily accessible by workers.	Visual site inspection	All work sites, and worker camp.	Routine	-
SP17.15	A doctor shall be reached when an accident occurs.	-	-	-	-
<i>Emergency Preparedness</i>					
SP17.16	Prior to the rainy season, all construction site will be reviewed for slope stability and stability of infrastructure and management measures identified to prepare for incidents that may arise as a result of flash flooding for example machinery being dislodged or landslide	Contractor to review and implement preparation measures	Construction sites	One month prior to rainy season	-
SP17.17	All site plans to include clearly marked exclusion barriers around hazardous areas that must be separated from public access. Barriers will be installed as soon as is required to exclude access by non-working staff	Visual inspection	Construction sites	Routine	

## SP18: CULTURAL RESOURCES

No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
<i>Avoid impacts on significant cave network</i>					
SP18.1	Construction activities will be undertaken in such a manner as to avoid any physical effect on known sites of cultural or religious significance.	Owner inspection of protection measures.	-	Per case	SP15: Training and Awareness
<i>Definition of physical cultural resources</i>					
SP18.2	Physical cultural resources will be defined as: <ul style="list-style-type: none"> <li>i. Remains left by previous human inhabitants (e.g., middens, shrines, graveyards and burial sites)</li> <li>ii. Unique natural environmental features (e.g., canyons and waterfalls)</li> </ul>	-	-	-	-
<i>Training of construction workers</i>					
SP18.3	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.	Owner review of training register.	-	Routine	SP15: Training and Awareness
<i>Chance Finds</i>					
SP18.4	The Owner will employ a head of village who is familiar with cultural resources.	Verification that appropriate person is employed	-	Annually	-
SP18.5	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</li> </ul>	Visual inspection	Specific and construction area	Monthly during Construction	BMP-01: Scheduling



No.	Description of Measure	Monitoring	Location	Frequency	Links to sub-plans/ BMPs
	<p>Office to obtain advice regarding the next steps.</p> <p>iii. The contractor to recommence work only after the Culture and Tourism Office has provided official notification accordingly.</p>				
SP18.6	Any directions or requirements from the ESD in relation to measures to protect the site will be recorded and communicated by the ESD to the construction workforce. All such requirements will be strictly adhered to.	Visual site inspection.	Construction sites	Per case	BMP-01: Scheduling

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## **Appendix I: Applicable Project Standards (ESMMP-CP Appendix 3)**

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### 3.1 DRINKING WATER QUALITY STANDARDS

Lao PDR current standards for drinking water of the Lao PDR are provided below for reference.

**Table A3.1.1 Bacteriological Parameter**

Parameters	Units	Concentration
Faecal Coliform	MPN/100ml	0
Total Coliform	MPN/100ml	<2.2
Enterovirus	MPN/100ml	0

Source: Refer to CA - Annex C - Appendix 2 Standard, 1.8 Drinking Water Quality Standards, Bacteriological Parameters

**Table A3.1.2 Physical-Chemical Parameters**

Parameters	Symbol	Unit	Maximum Concentration
Aluminium	Al <sup>3+</sup>	mg/l	0.2
Ammonia	NH <sub>3</sub>	mg/l	1.5
Chloride	Cl <sup>-</sup>	mg/l	250
Copper	Cu <sup>2+</sup>	mg/l	2.0
Iron	Fe <sup>2+</sup> and Fe <sup>3+</sup>	mg/l	<1
Manganese	Mn <sup>2+</sup>	mg/l	0.5
Sodium	Na <sup>+</sup>	mg/l	250
Sulphate	SO <sub>4</sub> <sup>2-</sup>	mg/l	250
Hydrogen Sulphide	H <sub>2</sub> S	mg/l	0.1
Conductivity	EC	µS/cm	<1,000
Total dissolved solids	TDS	mg/l	600
Sodium Chloride	NaCl	mg/l	300-350
pH	pH	-	8.5
Temperature	T	°C	35
Hardness	-	mg/l	300
Turbidity	-	NTU	<10
Taste and Odour	-	-	Acceptable
Colour	-	TCU	5
Residual Chlorine (if Chlorine disinfection is used)	Cl <sub>2</sub>	mg/l	<0.2

Source: Refer to CA - Annex C - Appendix 2 Standard, 1.8 Drinking Water Quality Standards, Physical-Chemical Parameters

**Table A3.1.3 Health Significant Chemical Parameters**

Parameters	Symbol	Unit	Maximum Concentration
Antimony	Sb <sup>3+</sup>	mg/l	0.005
Arsenic	As <sup>3+</sup>	mg/l	0.01-0.05
Barium	Ba <sup>2+</sup>	mg/l	0.7
Boron	B	mg/l	0.50
Cadmium	Cd <sup>2+</sup>	mg/l	0.003
Chromium	Cr	mg/l	0.05
Cyanide	CN <sup>-</sup>	mg/l	0.07
Fluoride	F <sup>-</sup>	mg/l	1.5
Lead	Pb	mg/l	0.01
Mercury	Hg	mg/l	0.001
Nitrate	NO <sub>3</sub>	mg/l	50
Nitrite	NO <sub>2</sub>	mg/l	3
Selenium	Se	mg/l	0.01

Source: Refer to CA - Annex C - Appendix 2 Standard, 1.8 Drinking Water Quality Standards, Health Significant Chemical Parameters

**Table A3.1.4 Priority Parameters**

Parameters	Symbol	Unit	Maximum Concentration
Iron	Fe	mg/l	<1
Manganese	Mn	mg/l	<0.5
Arsenic	As	mg/l	<0.05
Fluoride	F <sup>-</sup>	mg/l	<1.5
Nitrate	NO <sub>3</sub> <sup>-</sup>	mg/l	50
Nitrite	NO <sub>2</sub> <sup>-</sup>	mg/l	3
Nitrite Nitrogen	NO <sub>2</sub> -N	mg/l	1
pH	pH	-	6.5-8.5
Coliform	-	MPN/100ml	0
Conductivity	EC	μS/cm	1000
Residual Chlorine (if Chlorine disinfection is used)	Cl <sub>2</sub>	mg/l	0.2
Total Hardness	-	mg/l	<300
Turbidity	-	NTU	<10
Taste and Odour	-	-	Acceptable

Source: Refer to CA - Annex C - Appendix 2 Standard, 1.8 Drinking Water Quality Standards, Priority Parameters

### 3.4 AMBIENT SURFACE WATER QUALITY STANDARDS

Deviation from these standards will only be allowed with the prior written approval of MONRE on a case by case basis, where the Company is able to demonstrate to MONRE's reasonable satisfaction that such deviation is caused by the inherent nature of the Nam Ngiep river or by the initial impoundment of the reservoir during the appropriate period as approved by MONRE. In applying for MONRE's approval, the Company shall clearly specify and justify all parameters, the proposed temporary standards for such parameters and the period during which such temporary standards are proposed to be in force together with appropriate monitoring plans and proposed steps promptly to address and resolve any failure to meet temporary standards. For the avoidance of doubt, the Company remains at all times responsible for Adverse Impacts related to approve deviations from the Ambient Water Quality Standards caused by the initial impoundment.

**Table A3.4.1 Ambient Surface Water Quality Parameter**

Parameters	Units	Standard
pH		5-9
Dissolved Oxygen	mg/l	>6.0
BOD <sub>5</sub>	mg/l	1.5
COD	mg/l	5.0
Nitrogen as nitrate (N-NO <sub>3</sub> )	mg/l	5.0
Nitrogen as ammonia (N-NH <sub>3</sub> )	mg/l	0.2
Sulfate	mg/l	500
Total coliform bacteria	MPN/ml	5,000
Total faecal coliform	MPN/ml	1,000
Phenols	mg/l	0.005
Arsenic (As)	mg/l	0.01
Cadmium (Cd) CaCO <sub>3</sub> ≤ 100 mg/l	mg/l	0.005
Cadmium (Cd) CaCO <sub>3</sub> ≥ 100 mg/l	mg/l	0.05
Chromium (VI) (Cr <sup>6+</sup> )	mg/l	0.05
Copper (Cu)	mg/l	0.1
Cyanide	mg/l	0.005
Lead (Pb)	mg/l	0.05
Mercury (Hg)	mg/l	0.002
Nickel (Ni)	mg/l	0.1
Zinc (Zn)	mg/l	1.0
Manganese (Mn)	mg/l	1.0
Alpha $\gamma$ -Radioactivity	Becquerel/l	0.1
Beta $\gamma$ -Radioactivity	Becquerel/l	1.0
Total Organochlorine	mg/l	0.05
DDT	mg/l	1.0
Alpha-BHC	mg/l	0.02
Dieldrin	mg/l	0.1
Aldrin	mg/l	0.1
Heptachlor and Heptachlor Epoxide	mg/l	0.2
Endrin	mg/l	0

Source: Refer to CA - Annex C - Appendix 2 Standard, 1.11 Ambient Surface Water Quality Standards



### 3.5 EFFLUENT STANDARDS

The Company is responsible for compliance with applicable effluent standards. This applies to all effluents and runoff from project activities, facilities, installations as well as discharges from resettlement sanitation and drainage.

Selected standards are listed below. All other parameters shall comply with the Lao National Standards and IFC Guidelines whichever is stricter.

Deviation from these standards will only be allowed

- (i) with the prior written approval of MONRE, and in circumstances where the Company and its contractors have applied an appropriate waste water treatment system used by international construction contractors in Lao PDR and applicable to the construction site or
- (ii) if the water from any project activities does not have an adverse effect on the existing water quality or
- (iii) to the extent that the deviations are present as a result of the existing water quality.

**Table A3.5.1 Effluent Standards**

Parameters	Units	Guidelines
pH		6-9
Biochemical Oxygen Demand -BOD	mg/l	30
Chemical Oxygen Demand -COD	mg/l	125
Total suspended solids	mg/l	50
Oils and grease	mg/l	10
Phenol	mg/l	0.5
Cyanide	mg/l	0.1
Ammonia -N	mg/l	10
Total Nitrogen	mg/l	10
Total phosphorus	mg/l	2
Residual chlorine	mg/l	0.2
Total coliforms	MPN/100ml	<400
Temperature increase	°C	<3
Arsenic	mg/l	0.1
Cadmium	mg/l	0.05
Chromium	mg/l	0.1
Copper	mg/l	0.3
Fluoride	mg/l	20
Iron	mg/l	2
Lead	mg/l	0.2
Mercury	mg/l	0.002
Nickel	mg/l	0.5
Selenium	mg/l	0.1
Silver	mg/l	0.5
Sulfides	mg/l	1
Zinc	mg/l	0.5
Total Toxic metals	mg/l	5-10

Source: Refer to CA - Annex C - Appendix 2 Standard, 1.13 Effluent Standards

### 3.6 NOISE STANDARDS

Noise emission and ambient noise levels shall be in compliance with the Lao National Environmental Standard for noise as provided below for reference.

**Table A3.6.1 Noise Standards**

Standards Method of Measurement	Standards Method of Measurement
Maximum Sound Level ( $L_{max}$ ) should not exceed 115 dB(A)	Maximum Sound Level ( $L_{max}$ ) should not exceed 115 dB(A)

Source: Refer to Agreement on the National Environmental Standards of Lao PDR, 2009

**Table A3.6.2 Noise Standards for Other Places**

Type of Area	Standard Value in dB(A)		
	6.00-18.00	18.00-22.00	22.00-6.00
Quiet areas: hospitals, libraries, treatment places, kindergarten and schools	50	45	40
Residential areas: hotels and houses	55	55	45
Commercial and service areas	70	70	50
Small industrial factories located in residential areas	70	70	50

Source: Refer to Agreement on the National Environmental Standards of Lao PDR, 2009

### 3.7 AIR STANDARDS

Air emission and ambient air levels shall be in compliance with the Lao National Environmental Standard for ambient air quality standard as provided below for reference.

**Table A3.7.1 Ambient Air Quality Standards**

Parameters	Symbol	Average Time Unit: mg/m <sup>3</sup>					Method of Measurement
		Hour			1	1	
		1 hr	8hr	24 hr	month	year	
Carbon monoxide	CO	30	10.26	-	-	-	Non dispersive infrared detection
Nitrogen dioxide	NO <sub>2</sub>	0.32	-	-	-	-	Chemiluminescence method
Sulphur dioxide	SO <sub>2</sub>	0.78	-	0.30	-	0.10	UV Fluorescence (1hr, 24hr, 1yr) or Pararosaniline (1hr, 4hr)
Total suspended Particulate	TSP	-	-	0.12	-	0.05	Gravimetric
Particulate Matter less than 10 microns	PM-10	-	-	0.12	-	0.05	Gravimetric or Beta Ray or Taper Element Oscillating Microbalance or Dichotomous
Ozone	O <sub>3</sub>	0.20	-	-	-	-	Chemiluminescence or UV Absorption Phoptometry
Lead	Pb	-	-	-	1.5	-	Atomic Absorption Spectrometer

Source: Refer to Agreement on the National Environmental Standards of Lao PDR, 2009



ສາທາລະນະລັດ ປະຊາທິປະໄຕ ປະຊາຊົນລາວ  
ສັນຕິພາບ ເອກະລາດ ປະຊາທິປະໄຕ ເອກະພາບ ວັດທະນາຖາວອນ

ກະຊວງຊັບພະຍາກອນທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມ  
ກົມຄຸ້ມຄອງທີ່ດິນ

1879

ເລກທີ...../ກຊສ.ກທດ

ນະຄອນຫຼວງວຽງຈັນ, ວັນທີ 27 JUL 2015

ຮຽນ : ທ່ານ ລັດຖະມົນຕີວ່າການກະຊວງຊັບພະຍາກອນທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມ ທີ່ນັບຖື,

ເລື່ອງ : ບໍລິສັດ ໄຟຟ້ານ້ຳງຽບ 1 ຈຳກັດ ສະເໜີຂໍອະນຸມັດເພີ່ມຕື່ມເນື້ອທີ່ດິນ ຈຳນວນ 648 ເຮັກຕາ ເພື່ອນຳໃຊ້  
ເປັນເຂດຍົກຍ້າຍຈັດສັນ ແລະ ພື້ນພູຊີວິດການເປັນຢູ່ ຂອງປະຊາຊົນທີ່ໄດ້ຮັບຜົນກະທົບຈາກໂຄງການ.

- ອີງຕາມ ຂໍ້ຕົກລົງຂອງລັດຖະມົນຕີວ່າການກະຊວງຊັບພະຍາກອນທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມ ສະບັບ  
ເລກທີ 3059/ກຊສ, ລົງວັນທີ 16 ພຶດສະພາ 2012 ວ່າດ້ວຍການຈັດຕັ້ງ ແລະ ການເຄື່ອນໄຫວຂອງກົມ  
ຄຸ້ມຄອງທີ່ດິນ;
- ອີງຕາມ ບົດລາຍງານຂອງກົມຄຸ້ມຄອງທີ່ດິນ ສະບັບເລກທີ 1565/ກຊສ.ກທດ, ລົງວັນທີ 19 ມິຖຸນາ  
2015;
- ອີງຕາມ ມະຕິຕົກລົງຂອງຄະນະປະຈຳສະພາແຫ່ງຊາດ ສະບັບເລກທີ 062/ຄປຈ, ລົງວັນທີ 04 ເມສາ  
2014;
- ອີງຕາມ ທິດຊີ້ນຳຂອງທ່ານ ລັດຖະມົນຕີວ່າການ ກຊສ ຄັ້ງວັນທີ 01 ກໍລະກົດ 2015;
- ອີງຕາມ ໜັງສືສະເໜີຂອງບໍລິສັດໄຟຟ້ານ້ຳງຽບ1 ຈຳກັດ ສະບັບເລກທີ 210/ NN1PC-VTE-OUT/15,  
ລົງວັນທີ 13 ກໍລະກົດ 2015.


ກົມຄຸ້ມຄອງທີ່ດິນ ກະຊວງຊັບພະຍາກອນທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມ ຂໍຖືເປັນກຽດຮຽນລາຍງານມາຍັງ  
ທ່ານຊາບວ່າ: ຜ່ານການລົງສຳຫຼວດ ເກັບກຳຂໍ້ມູນເນື້ອທີ່ດິນຕົວຈິງ ທີ່ບໍລິສັດ ໄຟຟ້ານ້ຳງຽບ 1 ຈຳກັດ ສະເໜີຂໍເພີ່ມຕື່ມ  
ເນື້ອທີ່ດິນ ຈຳນວນ 648 ເຮັກຕາ ເພື່ອນຳໃຊ້ເປັນເຂດຍົກຍ້າຍຈັດສັນ ແລະ ພື້ນພູຊີວິດການເປັນຢູ່ຂອງປະຊາຊົນ ຊຶ່ງມີ  
ເນື້ອໃນດັ່ງນີ້:

ສະພາບລວມ

1. ເນື້ອທີ່ຈຳນວນ 648 ເຮັກຕາ ແມ່ນນອນໃນປ່າປ້ອງກັນແຫ່ງຊາດ ແຫຼ່ງນ້ຳງຽບ-ນ້ຳມັງ ທັງໝົດ ຊຶ່ງເນື້ອທີ່ດັ່ງກ່າວ ໄດ້  
ຖືກຮັບຮອງການຫັນປ່ຽນທີ່ດິນປ່າໄມ້ ແລະ ໄດ້ຮັບການຍົກເວັ້ນການຫັນປ່ຽນປະເພດທີ່ດິນ ຕາມມະຕິຕົກລົງຂອງ  
ຄະນະປະຈຳສະພາແຫ່ງຊາດ ສະບັບເລກທີ 062/ຄປຈ, ລົງວັນທີ 04 ເມສາ 2014.
2. ບໍລິສັດເຫັນດີປະຕິບັດຕາມເງື່ອນໄຂຕ່າງໆທີ່ ກຊສ ໄດ້ກຳນົດອອກເຊັ່ນ:
  - ເຫັນດີໃຫ້ແຕ່ງຕັ້ງຄະນະກຳມະການລົງເກັບກຳຂໍ້ມູນໃນເນື້ອທີ່ດິນດັ່ງກ່າວ ເພື່ອກວດກາໄມ້ແຕ່ລະປະເພດ, ແຕ່  
ລະຊະນິດ ແລະ ເກັບກຳລະເບີດໃນເຂດດັ່ງກ່າວ;

- ກ່ອນຈະເຂົ້າບຸກເບີກ ບໍລິສັດຈະຕ້ອງສົມທົບກັບກອງເລຂາ ປະສານຫາແຂວງ, ເມືອງ ແລະ ອຳນາດການ ປົກຄອງບ້ານ ໃນການເກັບກຳຂໍ້ມູນລະອຽດຕື່ມ ກ່ຽວກັບເນື້ອທີ່ດິນທີ່ປະຊາຊົນໄດ້ເຂົ້ານຳໃຊ້ພື້ນທີ່ດັ່ງກ່າວ ເພື່ອ ໃຫ້ເປັນຂໍ້ມູນລະອຽດໃນການຊົດເຊີຍ;

ສະນັ້ນ, ກົມຄຸ້ມຄອງທີ່ດິນ, ກະຊວງຊັບພະຍາກອນທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມ ຈຶ່ງຮຽນສະເໜີມາຍັງທ່ານ ລັດຖະມົນຕີວ່າການ ເພື່ອພິຈາລະນາອະນຸມັດຕາມລະບຽບການ (ລະອຽດໄດ້ຮ່າງຂໍ້ຕົກລົງວ່າການອະນຸຍາດທີ່ດິນລັດ ເພື່ອເປັນເຂດຮອງຮັບການຍົກຍ້າຍຈັດສັນ ແລະ ພື້ນຟູຊີວິດການເປັນຢູ່ຂອງ ປະຊາຊົນ ທີ່ໄດ້ຮັບຜົນກະທົບຈາກໂຄງການ ກໍ່ສ້າງເຂື່ອນໄຟຟ້ານ້ຳງຽບ 1 ແລະ ຂໍ້ຕົກລົງວ່າດ້ວຍການຫັນປ່ຽນທີ່ດິນໃນເຂດປ່າປ້ອງກັນແຫ່ງຊາດ ແຫຼ່ງນ້ຳງຽບ ແລະ ນ້ຳ ມັງ ສະເພາະເຂດພື້ນທີ່ນຳໃຊ້ໃນການຍົກຍ້າຍຈັດສັນ ແລະ ພື້ນຟູຊີວິດການເປັນຢູ່ຂອງ ປະຊາຊົນ ທີ່ໄດ້ຮັບຜົນກະທົບ ຈາກໂຄງການກໍ່ສ້າງເຂື່ອນໄຟຟ້ານ້ຳງຽບ 1 (648 ເຮັກຕາ) ຕິດຄັດມາພ້ອມນີ້).

ດັ່ງນັ້ນ, ຈຶ່ງລາຍງານມາຍັງທ່ານເພື່ອຊາບ ແລະ ຂໍທົດຊີ້ນຳໃນການຈັດຕັ້ງປະຕິບັດໃນຂັ້ນຕໍ່ໄປດ້ວຍ. 

ຮຽນມາດ້ວຍຄວາມນັບຖື,

໒໔/1 ຫົວໜ້າກົມຄຸ້ມຄອງທີ່ດິນ



ຄຳເຫຼັກ ເພັດກິມມະລີ



Lao People's Democratic Republic

Peace Independence Democracy Unity Prosperity

Ministry of Natural Resources and Environment

The land management department

No. 1879/MoNRE.LD

Vientiane, date 27 July 2015

H.E. Minister of the ministry of natural resources and environment,

Topic: the NamNgiep 1 Hydro Power Co., Ltd would like to have

the addition land area of 648 hectares more in order to be used as the area for the resettlement and rehabilitation of people affected by the Project.

- Based on the decision of the Minister of ministry of natural resources and environment No. 3059/MoNRE, date 16 May 2012 on the establishment and responsibilities of the Land management department;
- Based on the report of the land management department No. 1565/MoNRE.LD, date 19 June 2015;
- Based on the resolution of the permanent committee for the National Assembly No. 062/PCNA, date 04 April 2014;
- Based on the direction of the minister of MoNRE date 01 July 2015;



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- Based on the proposal letter from the NamNgiep 1 Hydro Power Co., Ltd No. 210/NN1PC-VTE-OUT/15, date 13 July 2015.

The land management department of the Ministry of Natural Resources and Environment presents its compliments to report you that: after conducting the field survey in order to collect the actual data in which the NamNgiep 1 Hydro Power Co., Ltd proposes to have the addition land area of 648 hectares more so as to be used as the area for the resettlement and rehabilitation of people, it could be concluded as following:

General situation:

1. All the addition land area of 648 hectares located in the national forest protection area of the NamNgiep and NamMang which has been approved for the transformation and has been defined to be free from all fee for the transformation of the land area type in accordance to the resolution of the permanent committee for the National Assembly No. 062/PCNA, date 04 April 2014.
2. The company agreed to follow the terms and conditions defined by the MoNRE such as:

- Agreeing to set up the relevant committee to collect data on that land area in order to list and classify each type of trees and to remove the UXO in that area;

- Before conducting the land clearance activities, the company



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must coordinate with the secretariat in order to contact with the province, district and village authorities so as to collect the more detailed information about the land area there which has already been used by people and to be used as the detailed data in the compensation procedure;

Therefore, the land management department of the Ministry of Natural Resources and Environment presents its compliments to report and ask for Minister's approval (the drafts of the Decision on approving the state land to be used as the area for the resettlement and rehabilitation of people affected by The NamNgiiep 1 Hydro Power Project and the Decision on transforming the land area in the national forest protection area of the NamNgiiep and NamMang to be used as the specific area for the resettlement and rehabilitation of people affected by The NamNgiiep 1 Hydro Power Project (648 hectares) are attached herewith).

Therefore, this report is done in order to provide you some information and ask for your direction for the implementation.

With highly respectful,

Acting Director General of  
Land management department

(Sign and stamp)

Kham-lek Phet-kom-ma-ly



ນ.ແກ້ວຊົມພູ ສັກດາວົງ  
Keoxomphou SAKDAVONG



ສາທາລະນະລັດ ປະຊາທິປະໄຕ ປະຊາຊົນລາວ  
ສັນຕິພາບ ເອກະລາດ ປະຊາທິປະໄຕ ເອກະພາບ ວັດທະນາຖາວອນ

ກະຊວງຊັບພະຍາກອນທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມ

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ນະຄອນຫຼວງວຽງຈັນ, ວັນທີ 21 ກໍລະກົດ 2015

**ຂໍ້ຕົກລົງ**

**ວ່າດ້ວຍການອະນຸຍາດທີ່ດິນລັດ ເພື່ອເປັນເຂດຮອງຮັບການຍົກຍ້າຍຈັດສັນ ແລະ ພື້ນຟູຊີວິດການເປັນຢູ່ຂອງປະຊາຊົນ ທີ່ໄດ້ຮັບຜົນກະທົບຈາກໂຄງການກໍ່ສ້າງເຂື່ອນໄຟຟ້ານ້ຳງຽບ 1**

- ອີງຕາມ ກົດໝາຍວ່າດ້ວຍທີ່ດິນ ສະບັບປັບປຸງ ເລກທີ 04/ສພຊ, ລົງວັນທີ 21 ຕຸລາ 2003;
- ອີງຕາມ ດຳລັດຂອງນາຍົກລັດຖະມົນຕີ ສະບັບເລກທີ 435/ນຍ, ລົງວັນທີ 28 ພະຈິກ 2011 ວ່າດ້ວຍການຈັດຕັ້ງ ແລະ ການເຄື່ອນໄຫວຂອງກະຊວງຊັບພະຍາກອນທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມ;
- ອີງຕາມ ການຄົ້ນຄວ້າ ແລະ ລາຍງານຂອງກົມຄຸ້ມຄອງທີ່ດິນ ສະບັບເລກທີ 1879/ກຊສ.ກທດ, ລົງວັນທີ 27 ກໍລະກົດ 2015.

ລັດຖະມົນຕີວ່າການ ກະຊວງຊັບພະຍາກອນທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມ ຕົກລົງ:

- ມາດຕາ 1 :** ເຫັນດີອະນຸຍາດທີ່ດິນລັດ ເພື່ອເປັນເຂດຮອງຮັບການຍົກຍ້າຍຈັດສັນ ແລະ ພື້ນຟູຊີວິດການເປັນຢູ່ຂອງປະຊາຊົນ ທີ່ໄດ້ຮັບຜົນກະທົບຈາກໂຄງການກໍ່ສ້າງເຂື່ອນໄຟຟ້ານ້ຳງຽບ 1 ມີເນື້ອທີ່ຈຳນວນ 648 ເຮັກຕາ ຊຶ່ງຕັ້ງຢູ່ເຂດເມືອງ ບໍລິຄັນ, ແຂວງ ບໍລິຄຳໄຊ.
- ມາດຕາ 2 :** ມອບໃຫ້ພະແນກຊັບພະຍາກອນທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມ ແຂວງ ບໍລິຄຳໄຊ ອອກໃບຕາດິນໃຫ້ແກ່ບຸກຄົນ ແລະ ດິນລັດເພື່ອສາທາລະນະປະໂຫຍດ ຕາມທີ່ລັດໄດ້ຈັດສັນ ເພື່ອຮອງຮັບການຍົກຍ້າຍຈັດສັນດັ່ງກ່າວ.
- ມາດຕາ 3 :** ສຳລັບງົບປະມານໃຊ້ຈ່າຍໃນການອອກໃບຕາດິນ, ການຍົກຍ້າຍຈັດສັນ ແລະ ພື້ນຟູຊີວິດການເປັນຢູ່ຂອງປະຊາຊົນໃຫ້ຜູ້ທີ່ຖືກຜົນກະທົບໃນຄັ້ງນີ້ ແມ່ນເປັນພາລະ ແລະ ຄວາມຮັບຜິດຊອບຂອງ ບໍລິສັດໄຟຟ້ານ້ຳງຽບ 1 ຈຳກັດ.
- ມາດຕາ 4 :** ໃຫ້ການຈັດຕັ້ງຂອງລັດທຸກພາກສ່ວນທີ່ກ່ຽວຂ້ອງຈົ່ງຮັບຮູ້ ແລະ ຈັດຕັ້ງປະຕິບັດຕາມຂໍ້ຕົກລົງສະບັບນີ້ ຢ່າງເຂັ້ມງວດ.
- ມາດຕາ 5 :** ຂໍ້ຕົກລົງສະບັບນີ້ ມີຜົນສັກສິດນັບແຕ່ວັນລົງລາຍເຊັນເປັນຕົ້ນໄປ

ລັດຖະມົນຕີວ່າການ  
ກະຊວງຊັບພະຍາກອນທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມ



**ດຣ.ນຸສິນ ສິນບັນດິດ**



Lao People's Democratic Republic  
Peace Independence Democracy Unity Prosperity

Ministry of Natural Resources and Environment No. 4466/MoNRE

Vientiane, date 31 July 2015

Decision

on approving the state land to be used as the area for the resettlement and rehabilitation of people affected by the NamNgiiep 1 Hydro Power Project.

- Based on the revised version of the Law on Land No. 04/NA, date 21 October 2003;
- Based on the decree of the Prime Minister No. 435/PM, date 28 November 2011 on the establishment and responsibilities of the ministry of natural resources and environment;
- Based on the study and report of the land management department No. 1879/MoNRE.LD, date 27 July 2015.

Minister of the ministry of natural resources and environment  
makes the following decision:

Article 1: Agreeing to approve the state land with the total area of 648 hectares located in Bolikhan district, Bolikhamxay province to



ນ.ແກ້ວຊິມພູ ສັກດາວົງ  
Keoxomphou SAKDAVONG

be used as the area for the resettlement and rehabilitation of people affected by the NamNgiep 1 Hydro Power Project.

Article 2: Giving the authority to the division of natural resources and environment of Bolikhamxay province to issue the certificate on the land entitlement to the individual and the state land for the public benefit in accordance to the management plan of the government so as to be used for such a resettlement.

Article 3: All expense used in the procedure for issuing the land entitlement certificates, for the resettlement and rehabilitation of people affected by this project are bound by the NamNgiep 1 Hydro Power Co., Ltd.

Article 4: All relevant public organisations shall comprehend and strictly implement in accordance to this decision.

Article 5: This decision enters into its enforcement from the signed date.

Minister

of the ministry of natural resources and environment

(Sign and stamp)

Dr. Nulin Som-ban-dith



**ນ.ແກ້ວຊິມພູ ສັກດາວົງ**  
**Keoxomphou SAKDAVONG**





ສາທາລະນະລັດ ປະຊາທິປະໄຕ ປະຊາຊົນລາວ  
ສັນຕິພາບ ເອກະລາດ ປະຊາທິປະໄຕ ເອກະພາບ ວັດທະນາຖາວອນ

ກະຊວງຊັບພະຍາກອນທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມ

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ນະຄອນຫຼວງວຽງຈັນ, ວັນທີ 21 ກໍລະກົດ 2015.....

**ຂໍ້ຕົກລົງ**

ວ່າດ້ວຍການຫັນປ່ຽນທີ່ດິນ ໃນເຂດປ່າປ້ອງກັນແຫ່ງຊາດ ແຫຼ່ງນ້ຳງຽບ ແລະ ນ້ຳມັງ  
ສະເພາະເຂດພື້ນທີ່ນຳໃຊ້ ໃນການຍົກຍ້າຍຈັດສັນ ແລະ ພື້ນພູຊີວິດການເປັນຢູ່  
ຂອງປະຊາຊົນ ທີ່ໄດ້ຮັບຜົນກະທົບຈາກໂຄງການກໍ່ສ້າງເຂື່ອນໄຟຟ້ານ້ຳງຽບ 1

- ອີງຕາມ ດຳລັດຂອງນາຍົກລັດຖະມົນຕີ ສະບັບເລກທີ 435/ນຍ, ລົງວັນທີ 28 ພະຈິກ 2011 ວ່າດ້ວຍ  
ການຈັດຕັ້ງ ແລະ ການເຄື່ອນໄຫວຂອງກະຊວງ ຊັບພະຍາກອນທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມ;
- ອີງຕາມ ມະຕິຕົກລົງຂອງຄະນະປະຈຳສະພາແຫ່ງຊາດ ສະບັບເລກທີ 062/ຄປຈ, ລົງວັນທີ 04 ເມສາ 2014;
- ອີງຕາມ ກົດໝາຍວ່າດ້ວຍທີ່ດິນ ສະບັບປັບປຸງ ເລກທີ 04/ສພຊ, ລົງວັນທີ 21 ຕຸລາ 2003;
- ອີງຕາມ ການຄົ້ນຄວ້າ ແລະ ລາຍງານຂອງກົມຄຸ້ມຄອງທີ່ດິນ ສະບັບເລກທີ 1879/ກຊສ.ກທດ, ລົງວັນທີ 27  
ກໍລະກົດ 2015.

**ລັດຖະມົນຕີວ່າການ ກະຊວງຊັບພະຍາກອນທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມ ຕົກລົງ:**

- ມາດຕາ 1: ເຫັນດີໃຫ້ຫັນປ່ຽນທີ່ດິນ ໃນເຂດປ່າປ້ອງກັນແຫ່ງຊາດ ແຫຼ່ງນ້ຳງຽບ ແລະ ນ້ຳມັງ ສະເພາະເຂດພື້ນທີ່ນຳ  
ໃຊ້ໃນການຍົກຍ້າຍຈັດສັນ ແລະ ພື້ນພູຊີວິດການເປັນຢູ່ຂອງປະຊາຊົນ ທີ່ໄດ້ຮັບຜົນກະທົບຈາກ  
ໂຄງການ ກໍ່ສ້າງເຂື່ອນໄຟຟ້ານ້ຳງຽບ 1 ຈຳນວນ 648 ເຮັກຕາ.
- ມາດຕາ 2: ການຫັນປ່ຽນທີ່ດິນ ສຳລັບໂຄງການດັ່ງກ່າວນີ້ ແມ່ນຖືກຍົກເວັ້ນຄ່າທຳນຽມທີ່ບັງຄັບໃຊ້ສຳລັບການ  
ຫັນປ່ຽນປະເພດທີ່ດິນ ຕາມມະຕິຕົກລົງຂອງຄະນະປະຈຳສະພາແຫ່ງຊາດ ສະບັບເລກທີ 062/ຄປຈ,  
ລົງວັນທີ 04 ເມສາ 2014.
- ມາດຕາ 3: ໃຫ້ການຈັດຕັ້ງຂອງລັດທຸກພາກສ່ວນທີ່ກ່ຽວຂ້ອງຈົ່ງຮັບຮູ້ ແລະ ຈັດຕັ້ງປະຕິບັດຕາມຂໍ້ຕົກລົງສະບັບນີ້  
ຢ່າງເຂັ້ມງວດ.
- ມາດຕາ 4: ຂໍ້ຕົກລົງສະບັບນີ້ ມີຜົນສັກສິດນັບແຕ່ວັນລົງລາຍເຊັນເປັນຕົ້ນໄປ

ລັດຖະມົນຕີວ່າການ  
ກະຊວງຊັບພະຍາກອນທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມ



**ດຣ.ນຸລິນ ສິນບັນດິດ**

Lao People's Democratic Republic

Peace Independence Democracy Unity Prosperity

Ministry of Natural Resources and Environment

No. 4467/MoNRE

Vientiane, date 31 July 2015

### Decision

on transforming the land area in the national forest protection area of the  
NamNgiep and NamMang to be used as the specific area for the  
resettlement and rehabilitation of people affected by the NamNgiep 1  
Hydro Power Project.

- Based on the decree of the Prime Minister No. 435/PM, date 28 November 2011 on the establishment and responsibilities of the ministry of natural resources and environment;
- Based on the resolution of the permanent committee for the National Assembly No. 062/PCNA, date 04 April 2014;
- Based on the revised version of the Law on Land No. 04/NA, date 21 October 2003;
- Based on the study and report of the land management department No. 1879/MoNRE.LD, date 27 July 2015.

Minister of the ministry of natural resources and environment

makes the following decision:



ນ.ແກ້ວຊິມພູ ສັກດາວົງ  
Keoxomphou SAKDAVONG



Article 1: Agreeing to transform the land area in the national forest protection area of the NamNgiep and NamMang with the total area of 648 hectares to be used as the specific area for the resettlement and rehabilitation of people affected by the NamNgiep 1 Hydro Power Project.

Article 2: The transformation of the land area for this project is free from all fee for the transformation of the land area type in accordance to the resolution of the permanent committee for the National Assembly No. 062/PCNA, date 04 April 2014.

Article 3: All relevant public organisations shall comprehend and strictly implement in accordance to this decision.

Article 4: This decision enters into its enforcement from the signed date.

Minister

of the ministry of natural resources and environment

(Sign and stamp)

Dr. Nulin Som-ban-dith



ນ.ແກ້ວຊິມພູ ສັກດາວົງ  
Keoxomphou SAKDAVONG





ສາທາລະນະລັດ ປະຊາທິປະໄຕ ປະຊາຊົນລາວ  
ສັນຕິພາບ ເອກະລາດ ປະຊາທິປະໄຕ ເອກະພາບ ວັດທະນາຖາວອນ

ກະຊວງຊັບພະຍາກອນທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມ  
ກົມຄຸ້ມຄອງທີ່ດິນ

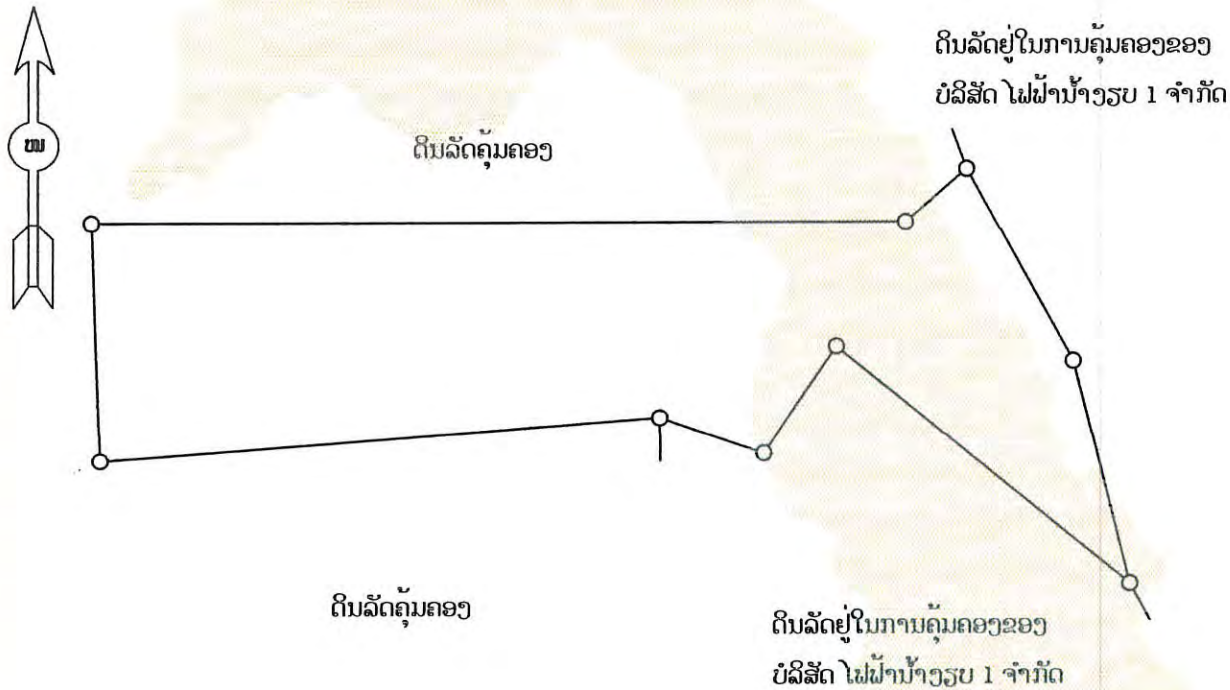
**ແຜນທີ່ດິນລັດ**

ລາຍການ 2103  
ເລກທີ: \_\_\_\_\_ / ກຊສ.ກທດ

ຄຸ້ມຄອງນຳໃຊ້ໂດຍ: ບໍລິສັດ ໄຟຟ້ານ້ຳງຽບ 1 ຈຳກັດ  
ຕາມເອກະສານຢັ້ງຢືນ: ຂໍ້ຕົກລົງຂອງທານລັດຖະມົນຕີວ່າການ ກະຊວງຊັບພະຍາກອນທຳມະຊາດ ແລະ  
ສິ່ງແວດລ້ອມ, ສະບັບເລກທີ 4466/ກຊສ.ລົງວັນທີ 31 ກໍລະກົດ 2015  
ເພື່ອນຳໃຊ້ເຂົ້າໃນເປົ້າໝາຍ: ກະສິກຳ (ປູກຕົ້ນໄມ້)

ທີ່ຕັ້ງຂອງຕອນດິນ

ຖະໜົນ: \_\_\_\_\_ ບ້ານ: ຫາດຍື່ນ (ຄົມຫາດຊາຍຄຳ)  
ເມືອງ: ບໍລິຄັນ ແຂວງ: ບໍລິຄຳໄຊ  
ໃບແຜນທີ່ຕາດິນເລກທີ: A 344-060, A 346-060, ... ຕອນດິນເລກທີ: \_\_\_\_\_  
ຈຸດທີ່ຕັ້ງພິກັດຕອນດິນ: N 2061025.550, E 347043.829  
ມາດຕາສ່ວນ: 1: 30 000 ເນື້ອທີ່ຂອງດິນ: 330 ເຮັກຕາ: 0000 ຕາແມັດ



ອອກໃຫ້ທີ່: \_\_\_\_\_ ນະຄອນຫຼວງວຽງຈັນ ວັນທີ: \_\_\_\_\_ ເດືອນ: 12 AUG 2015 ປີ: \_\_\_\_\_



ຄຳເຫຼັກ ເພັດກິມມະສີ





ສາທາລະນະລັດ ປະຊາທິປະໄຕ ປະຊາຊົນລາວ  
ສັນຕິພາບ ເອກະລາດ ປະຊາທິປະໄຕ ເອກະພາບ ວັດທະນະຖາວອນ  
\*\*\*\*\*

ກະຊວງຊັບພະຍາກອນທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມ  
ກົມຄຸ້ມຄອງທີ່ດິນ

ລາຍເລກທີ 2104 / ກຊສ.ກທດ

**ໃບອະນຸຍາດໃຫ້ສິດໃຊ້ທີ່ດິນລັດ**

- ອີງຕາມ ດຳລັດຂອງນາຍົກລັດຖະມົນຕີ, ສະບັບເລກທີ 135/ນຍ, ລົງວັນທີ 25 ພຶດສະພາ 2009 ວ່າດ້ວຍການເອົາທີ່ດິນຂອງລັດໃຫ້ເຊົ່າ ຫຼື ສຳປະທານ.
- ອີງຕາມ ຂໍ້ຕົກລົງຂອງລັດຖະມົນຕີວ່າການ ກະຊວງຊັບພະຍາກອນທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມ ສະບັບເລກທີ 3059/ກຊສ, ລົງວັນທີ 16 ພຶດສະພາ 2012 ວ່າດ້ວຍການຈັດຕັ້ງ ແລະ ການເຄື່ອນໄຫວ ຂອງກົມຄຸ້ມຄອງທີ່ດິນ.

**ກົມຄຸ້ມຄອງທີ່ດິນ ກະຊວງຊັບພະຍາກອນທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມ ຕົກລົງ :**

- ❖ ອະນຸຍາດໃຫ້: ບໍລິສັດ ໄຟຟ້ານ້ຳງຽບ 1 ຈຳກັດ ..... ໄດ້ຮັບສິດໃຊ້ທີ່ດິນຂອງລັດ, ເຊິ່ງມີກຳນົດການນຳໃຊ້.....ປີ, ນັບແຕ່ວັນທີ.....ເຖິງວັນທີ..... ເພື່ອນຳໃຊ້ເຂົ້າໃນເປົ້າໝາຍ.....ໃນການຍົກຍ້າຍຈັດສັນ ແລະ ພື້ນຟູຊີວິດການເປັນຢູ່ຂອງປະຊາຊົນທີ່ໄດ້ຮັບຜົນກະທົບ.....
- ❖ ທີ່ດິນຕັ້ງຢູ່ຖະໜົນ:.....ບ້ານ..... ຫາດຍື່ນ (ຄຸ້ມຫາດຊາຍຄຳ)..... ເມືອງ..... ບໍລິຄັນ ..... ແຂວງ..... ບໍລິຄຳໄຊ  
ໃບແຜນທີ່ຕາດິນເລກທີ..... A 344-060, A 346-060, A 348-060  
ຕອນດິນເລກທີ.....ແຜນທີ່ດິນລັດສະບັບເລກທີ..... 2103  
ລົງວັນ..... 12 AUG 2015
- ❖ ມີເນື້ອທີ່..... 330 .....ເຮັກຕາ..... 0000 .....ຕາແມັດ.
- ຜູ້ທີ່ໄດ້ຮັບອະນຸຍາດສິດໃຊ້ທີ່ດິນຂອງລັດ ຕ້ອງໄດ້ຄຸ້ມຄອງ ແລະ ປົກປັກຮັກສາທີ່ດິນຂອງລັດໃຫ້ດີ, ບໍ່ສ້າງຄວາມເສຍຫາຍໃຫ້ແກ່ຄຸນນະພາບຂອງດິນ, ບໍ່ທຳລາຍສິ່ງແວດລ້ອມ ແລະ ນຳໃຊ້ທີ່ດິນດັ່ງກ່າວໃຫ້ຖືກຕ້ອງຕາມລະບຽບກົດໝາຍທີ່ວາງອອກຢ່າງເຂັ້ມງວດ.
- ທຸກການປ່ຽນແປງ ຫຼື ການເຄື່ອນໄຫວກ່ຽວກັບສິດໃຊ້ທີ່ດິນເຊັ່ນ: ການຄ້າປະກັນເງິນກູ້, ການໂອນ, ການເອົາໃຫ້ຜູ້ອື່ນເຊົ່າຕໍ່ ແລະ ການປ່ຽນແປງເປົ້າໝາຍການພັດທະນາ ຕ້ອງໄດ້ຮັບຄວາມເຫັນດີຈາກລັດຖະບານ.
- ໃບອະນຸຍາດສະບັບນີ້ ມີຜົນສັກສິດນັບແຕ່ວັນລົງລາຍເຊັນເປັນຕົ້ນໄປ.

ທີ່..... ນະຄອນຫຼວງວຽງຈັນ, ວັນທີ 12 AUG 2015

561 ຫົວໜ້າກົມຄຸ້ມຄອງທີ່ດິນ



ຄຳເຫຼັກ ເພັດກົມມະລີ



**ແຜນທີ່ດິນສະເພາະຕອນ**

ຕອນດິນເລກທີ.....ແຜນທີ່ຕາດິນໃບທີ... **A 344-060, A 346-060, A 348-060** .....

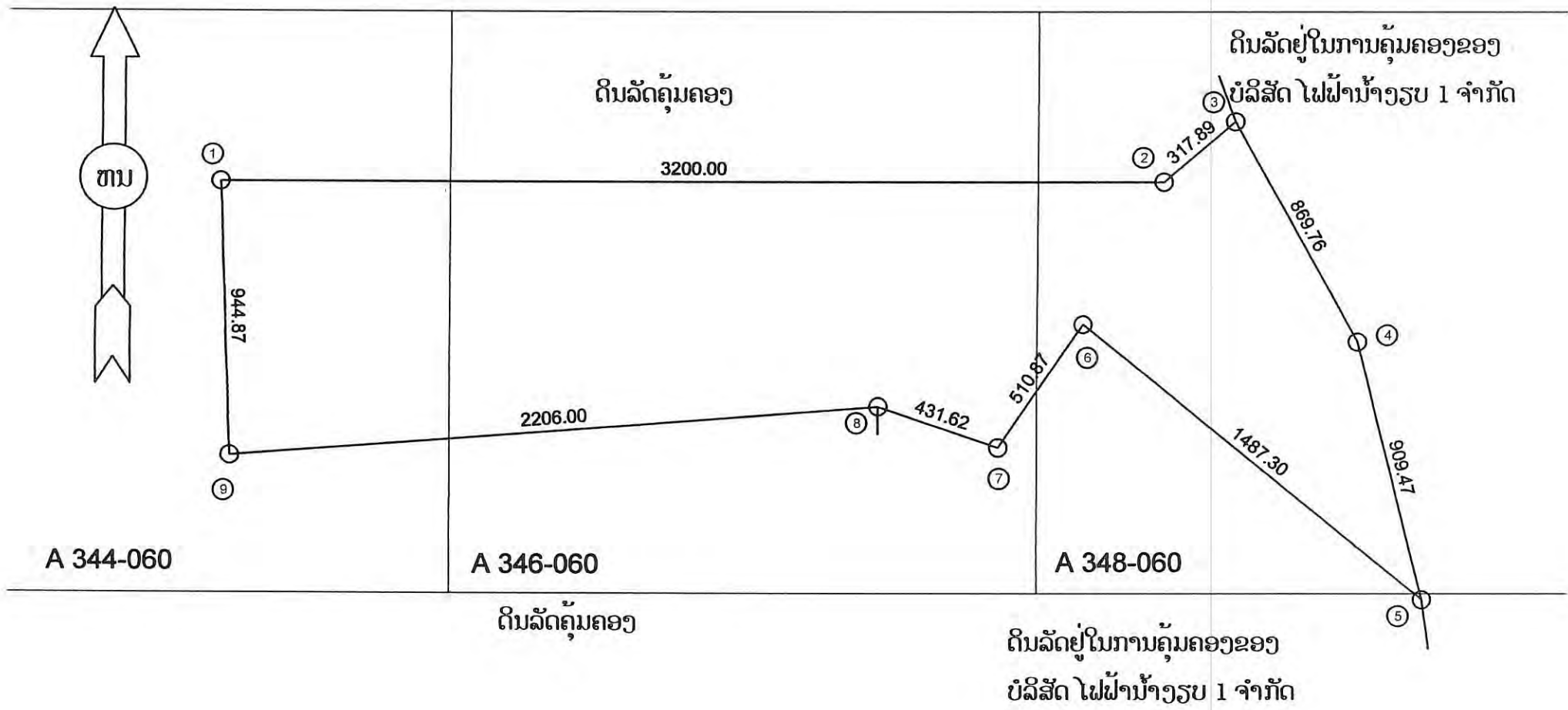
ປະເພດທີ່ດິນ... **ກະສິກຳ (ປູກຕົ້ນໄມ້)** .....ເຂດ... **ພູພຽງ ( ຊານເມືອງ )** .....

ຄຸ້ມຄອງນຳໃຊ້ໂດຍ : **ບໍລິສັດ ໄຟຟ້ານ້ຳງຽບ 1 ຈຳກັດ** .....

ຖະໜົນ:.....ບ້ານ: **ຫາດຍື່ນ (ຄຸ້ມຫາດຊາຍຄຳ)** .....

ເມືອງ..... **ບໍລິຄັນ** .....ແຂວງ..... **ບໍລິຄຳໄຊ** .....

ມາດຕາສ່ວນ:..... **1 : 20 000** .....ເນື້ອທີ່:..... **330** .....ເຮັກຕາ..... **0000** .....ຕາແມັດ



ສຳຫຼວດວັດແທກຄັ້ງວັນທີ **2-15/06/2015** .....ດ້ວຍກ້ອງ: **GPS** .....

ຈຸດທີ່ຕັ້ງຝັກຂອງຕອນດິນ: **N. 2061025.550, E. 347043.829** .....

- ສຳຫຼວດວັດແທກໂດຍ:**
1. ທ່ານ **ສຸທິກອນ, ທ່ານ ໂອລຳ**
  2. ທ່ານ **ສຸນາເຄນ** .....

**ກວກກາໂດຍ:**

*(Signature)*

**ຄຶດລາໄຊ ກອກບິລາ**

5591 ຫົວໜ້າກົມຄຸ້ມຄອງທີ່ດິນ



**ຄຳເຫຼັກ ເພັດກິມມະສີ**

ສາທາລະນະລັດ ປະຊາທິປະໄຕ ປະຊາຊົນລາວ  
 ສັນຕິພາບ ເອກະລາດ ປະຊາທິປະໄຕ ເອກະລາດ ວັດທະນາຖາວອນ  
 Lao People's Democratic Republic

**ເອກະສານຊ້ອນທ້າຍ II ຄຳນວນຄ່າພິກັດ**

Result of coordinates computations

ການສຳຫຼວດເນື້ອທີ່ດິນສຳປະທານເຂດບ້ານ: ຫາດຍືນ (ຄຸ້ມຫາດຊາຍຄຳ), ເມືອງ: ບໍລິຄັນ, ແຂວງ: ບໍລິຄຳໄຊ  
 ເຈົ້າຂອງສຳປະທານ: ບໍລິສັດ ໄຟຟ້ານ້ຳງຽບ 1 ຈຳກັດ  
 ເນື້ອທີ່: 330 ເຮັກຕາ: 0000 ຕາແມັດ.

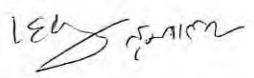
Point	Northing	Easting	Ell. Height	Point	Northing	Easting	Ell. Height
1	2061416.058	345226.000		31			
2	2061416.058	348426.000		32			
3	2061620.277	348668.321		33			
4	2060862.451	349085.125		34			
5	2059980.136	349305.704		35			
6	2060922.517	348155.058		36			
7	2060500.276	347867.478		37			
8	2060639.501	347458.932		38			
9	2060471.772	345259.314		39			
10				40			
11				41			
12				42			
13				43			
14				44			
15				45			
16				46			
17				47			
18				48			
19				49			
20				50			
21				51			
22				52			
23				53			
24				54			
25				55			
26				56			
27				57			
28				58			
29				59			
30				60			

ຄິດໄລ່ວັດແທກຄັ້ງວັນທີ: 2-5/06/2015

ຄິດໄລ່ໂດຍ

ຈຸດທີ່ຕັ້ງພິກັດຂອງຕອນດິນ: N 2061025.550, E 347043.829

ເຄົ້າມູນອ້າງອິງ: WGS 84, ສຳຫຼວດວັດແທກໂດຍ: ທ່ານ ສຸທິກອນ, ທ່ານ ໂອລຳ, ທ່ານ ສຸນາເຄນ



ສາທາລະນະລັດ ປະຊາທິປະໄຕ ປະຊາຊົນລາວ  
 ສັນຕິພາບ ເອກະລາດ ປະຊາທິປະໄຕ ເອກະລາດ ວັດທະນາຖາວອນ  
 Lao PeoPle's Democratic Repulic

**ເອກະສານຊ້ອນທ້າຍ II ຄຳນວນຄ່າພິກັດ**

**Result of coordinates computations**

ການສຳຫຼວດເນື້ອທີ່ດິນສຳປະທານເຂດບ້ານ: ຫາດຍື່ນ (ຄຸ້ມຫາດຊາຍຄຳ), ເມືອງ: ບໍລິຄັນ, ແຂວງ: ບໍລິຄຳໄຊ  
 ເຈົ້າຂອງສຳປະທານ: ບໍລິສັດ ໄຟຟ້ານ້ຳງຽບ 1 ຈຳກັດ  
 ເນື້ອທີ່: 42 ເຮັກຕາ: 0000 ຕາແມັດ.

Point	Northing	Easting	Ell. Height	Point	Northing	Easting	Ell. Height
1	2059491.464	348709.676		31			
2	2059297.411	348849.871		32			
3	2059074.93	349034.915		33			
4	2058805.609	348750.759		34			
5	2058318.321	348239.506		35			
6	2058513.465	348075.175		36			
7	2058871.798	348486.003		37			
8	2059078.496	348305.65		38			
9				39			
10				40			
11				41			
12				42			
13				43			
14				44			
15				45			
16				46			
17				47			
18				48			
19				49			
20				50			
21				51			
22				52			
23				53			
24				54			
25				55			
26				56			
27				57			
28				58			
29				59			
30				60			

ຄິດໄລ່ວັດແທກຄັ້ງວັນທີ: 2-5/06/2015

ຄິດໄລ່ໂດຍ

ຈຸດທີ່ຕັ້ງພິກັດຂອງຕອນດິນ: N 2058992.565, E 348663.249

ເຄົ້າມູນອ້າງອິງ: WGS 84, ສຳຫຼວດວັດແທກໂດຍ: ທ່ານ ສຸທິກອນ, ທ່ານ ໂອລຳ, ທ່ານ ສຸນາເຄນ







ສາທາລະນະລັດ ປະຊາທິປະໄຕ ປະຊາຊົນລາວ  
ສັນຕິພາບ ເອກະລາດ ປະຊາທິປະໄຕ ເອກະພາບ ວັດທະນາຖາວອນ

ກະຊວງຊັບພະຍາກອນທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມ  
ກົມຄຸ້ມຄອງທີ່ດິນ

**ແຜນທີ່ດິນລັດ**

ລາຍເລກ: 2101 / ກຊສ.ກທດ

ຄຸ້ມຄອງນຳໃຊ້ໂດຍ: ບໍລິສັດ ໄຟຟ້ານ້ຳງຽບ 1 ຈຳກັດ  
ຕາມເອກະສານຢັ້ງຢືນ: ຂໍ້ຕົກລົງຂອງທ່ານລັດຖະມົນຕີວ່າການ ກະຊວງຊັບພະຍາກອນທຳມະຊາດ ແລະ  
ສິ່ງແວດລ້ອມ, ສະບັບເລກທີ 4466/ກຊສ.ລົງວັນທີ 31 ກໍລະກົດ 2015

ເພື່ອນຳໃຊ້ເຂົ້າໃນເປົ້າໝາຍ: ປູກສ່າງ (ທີ່ຢູ່ອາໄສ)

ທີ່ຕັ້ງຂອງຕອນດິນ

ຖະໜົນ: ບ້ານ: ຫາດຍື່ນ (ຄຸ້ມຫາດຊາຍຄຳ)  
ເມືອງ: ບໍລິຄັນ ແຂວງ: ບໍລິຄຳໄຊ  
ໃບແຜນທີ່ຕາດິນເລກທີ: A 346-060, A 348-060, ... ຕອນດິນເລກທີ: \_\_\_\_\_  
ຈຸດທີ່ຕັ້ງພິກັດຕອນດິນ: N 2059488.816, E 349172.640  
ມາດຕາສ່ວນ: 1: 30 000 ເນື້ອທີ່ຂອງດິນ: 276 ເຮັກຕາ: 0000 ຕາແມັດ

ດິນລັດຢູ່ໃນການຄຸ້ມຄອງຂອງບໍລິສັດ ໄຟຟ້ານ້ຳງຽບ 1 ຈຳກັດ



ອອກໃຫ້: ນະຄອນຫຼວງວຽງຈັນ ວັນທີ: 12 AUG 2015 ເດືອນ: ປີ:

561 ຫົວໜ້າກົມຄຸ້ມຄອງທີ່ດິນ



ຄຳເຫຼັກ ເພັດກິມມະສີ





ສາທາລະນະລັດ ປະຊາທິປະໄຕ ປະຊາຊົນລາວ  
ສັນຕິພາບ ເອກະລາດ ປະຊາທິປະໄຕ ເອກະພາບ ວັດທະນະຖາວອນ

\*\*\*\*\*

ກະຊວງຊັບພະຍາກອນທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມ  
ກົມຄຸ້ມຄອງທີ່ດິນ

ລາຍການສົ່ງ 2102  
ເລກທີ...../ ກຊສ.ກທດ

**ໃບອະນຸຍາດໃຫ້ສິດໃຊ້ທີ່ດິນລັດ**

- ອີງຕາມ ດຳລັດຂອງນາຍົກລັດຖະມົນຕີ, ສະບັບເລກທີ 135/ນຍ, ລົງວັນທີ 25 ພຶດສະພາ 2009 ວ່າດ້ວຍການເອົາທີ່ດິນຂອງລັດໃຫ້ເຊົ່າ ຫຼື ສຳປະທານ.
- ອີງຕາມ ຂໍ້ຕົກລົງຂອງລັດຖະມົນຕີວ່າການ ກະຊວງຊັບພະຍາກອນທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມ ສະບັບເລກທີ 3059/ກຊສ, ລົງວັນທີ 16 ພຶດສະພາ 2012 ວ່າດ້ວຍການຈັດຕັ້ງ ແລະ ການເຄື່ອນໄຫວ ຂອງກົມຄຸ້ມຄອງທີ່ດິນ.

**ກົມຄຸ້ມຄອງທີ່ດິນ ກະຊວງຊັບພະຍາກອນທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມ ຕົກລົງ :**

- ❖ ອະນຸຍາດໃຫ້: ບໍລິສັດ ໄຟຟ້ານ້ຳງຽບ 1 ຈຳກັດ..... ໄດ້ຮັບສິດໃຊ້ທີ່ດິນຂອງລັດ, ເຊິ່ງມີກຳນົດການນຳໃຊ້.....ປີ, ນັບແຕ່ວັນທີ.....ເຖິງວັນທີ..... ເພື່ອນຳໃຊ້ເຂົ້າໃນເປົ້າໝາຍໃນການຍົກຍ້າຍຈັດສັນ ແລະ ພື້ນຟູຊີວິດການເປັນຢູ່ຂອງປະຊາຊົນທີ່ໄດ້ຮັບ
- ❖ ທີ່ດິນຕັ້ງຢູ່ຖະໜົນ:.....ບ້ານ..... ຫາດຍື່ນ (ຄຸ້ມຫາດຊາຍຄຳ) ເມືອງ..... ບໍລິຄັນ.....ແຂວງ..... ບໍລິຄຳໄຊ
- ❖ ໃບແຜນທີ່ຕາດິນເລກທີ..... A 348-058, A 350-058, A 346-060, A 348-060 ຕອນດິນເລກທີ.....ແຜນທີ່ດິນລັດສະບັບເລກທີ..... ລົງວັນທີ..... 12 AUG 2015
- ❖ ມິຕິເນື້ອທີ່..... 276.....ເຮັກຕາ..... 0000.....ຕາແມັດ.

- ຜູ້ທີ່ໄດ້ຮັບອະນຸຍາດສິດໃຊ້ທີ່ດິນຂອງລັດ ຕ້ອງໄດ້ຄຸ້ມຄອງ ແລະ ປົກປັກຮັກສາທີ່ດິນຂອງລັດໃຫ້ດີ, ບໍ່ສ້າງຄວາມເສຍຫາຍໃຫ້ແກ່ຄຸນນະພາບຂອງດິນ, ບໍ່ທຳລາຍສິ່ງແວດລ້ອມ ແລະ ນຳໃຊ້ທີ່ດິນດັ່ງກ່າວໃຫ້ຖືກຕ້ອງຕາມລະບຽບກົດໝາຍທີ່ວາງອອກຢ່າງເຂັ້ມງວດ.

- ທຸກການປ່ຽນແປງ ຫຼື ການເຄື່ອນໄຫວກ່ຽວກັບສິດໃຊ້ທີ່ດິນເຊັ່ນ: ການຄ້າປະກັນເງິນກູ້, ການໂອນ, ການເອົາໃຫ້ຜູ້ອື່ນເຊົ່າຕໍ່ ແລະ ການປ່ຽນແປງເປົ້າໝາຍການພັດທະນາ ຕ້ອງໄດ້ຮັບຄວາມເຫັນດີຈາກລັດຖະບານ.

- ໃບອະນຸຍາດສະບັບນີ້ ມີຜົນສັກສິດນັບແຕ່ວັນລົງລາຍເຊັນເປັນຕົ້ນໄປ.

ທີ່..... ນະຄອນຫຼວງວຽງຈັນ....., ວັນທີ..... 12 AUG 2015

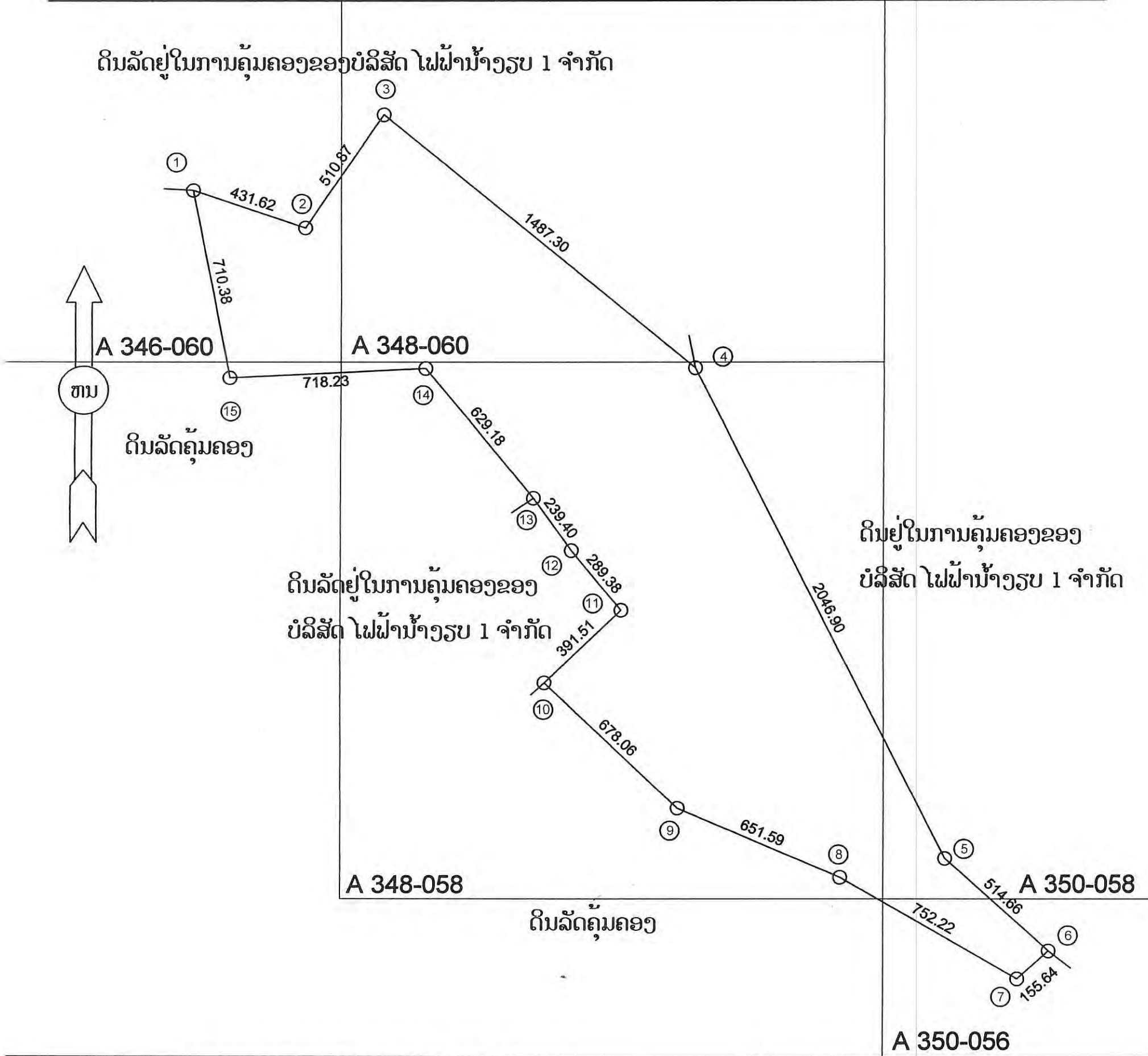


551 ຫົວໜ້າກົມຄຸ້ມຄອງທີ່ດິນ  
ຄຳເຫຼັກ ເພັດກົມມະລີ



**ແຜນທີ່ດິນສະເພາະຕອນ**

ຕອນດິນເລກທີ.....ແຜນທີ່ຕາດິນໃບທີ... **A 346-060, A 348-060, A 348-058, A 350-058**,.....  
 ປະເພດທີ່ດິນ...ປູກສ້າງ.....ເຂດ...ພູຮຽງ ( ຊານເມືອງ )  
 ຄຸ້ມຄອງນຳໃຊ້ໂດຍ : ..... ບໍລິສັດ ໄຟຟ້ານ້ຳງຽບ 1 ຈຳກັດ  
 ຖະໜົນ:.....ບ້ານ: ..... ຫາດຍິ້ນ (ຄຸ້ມຫາດຊາຍຄຳ)  
 ເມືອງ..... ບໍລິຄັນ ..... ແຂວງ..... ບໍລິຄຳໄຊ  
 ມາດຕາສ່ວນ:..... **1 : 16 000** .....ເນື້ອທີ່:..... **276** .....ເຮັກຕາ..... **0000** .....ຕາແມັດ



ສຳຫຼວດວັດແທກຄັ້ງວັນທີ **2-15/06/2015** .....ດ້ວຍກ້ອງ:GPS.....  
 ຈຸດທີ່ຕັ້ງພິກັດຂອງຕອນດິນ: **N 2059488.816, E 349172.640**

- ສຳຫຼວດວັດແທກໂດຍ:**
1. ທ່ານ ສຸທິກອນ, ທ່ານ ໂອລຳ
  2. ທ່ານ ສຸນາເຄນ

**ກວກາໂດຍ:**  
  
**ສິດລາໄຊ ກອກມິລາ**

561 ຫົວໜ້າກົມຄຸ້ມຄອງທີ່ດິນ  
  
**ຄຳເຫຼັກ ເພັດກິມມະລີ**

ສາທາລະນະລັດ ປະຊາທິປະໄຕ ປະຊາຊົນລາວ  
 ສັນຕິພາບ ເອກະລາດ ປະຊາທິປະໄຕ ເອກະລາດ ວັດທະນາຖາວອນ  
 Lao People's Democratic Republic

**ເອກະສານຊ້ອນທ້າຍ II ຄຳນວນຄ່າພິກັດ**

Result of coordinates computations

ການສຳຫຼວດເນື້ອທີ່ດິນສຳປະທານເຂດບ້ານ: ຫາດຍື່ນ (ຄຸ້ມຫາດຊາຍຄຳ), ເມືອງ: ບໍລິຄັນ, ແຂວງ: ບໍລິຄຳໄຊ  
 ເຈົ້າຂອງສຳປະທານ: ບໍລິສັດ ໄຟຟ້ານ້ຳງຽບ 1 ຈຳກັດ  
 ເນື້ອທີ່: 276 ເຮັກຕາ: 0000 ຕາແມັດ.

Point	Northing	Easting	Ell. Height	Point	Northing	Easting	Ell. Height
1	2060639.501	347458.932		31			
2	2060500.276	347867.478		32			
3	2060922.517	348155.058		33			
4	2059980.136	349305.704		34			
5	2058151.169	350224.783		35			
6	2057807.998	350608.327		36			
7	2057704.361	350492.215		37			
8	2058080.538	349840.807		38			
9	2058338.863	349242.612		39			
10	2058805.609	348750.759		40			
11	2059074.930	349034.915		41			
12	2059297.411	348849.871		42			
13	2059491.464	348709.676		43			
14	2059977.611	348310.261		44			
15	2059941.870	347592.919		45			
16				46			
17				47			
18				48			
19				49			
20				50			
21				51			
22				52			
23				53			
24				54			
25				55			
26				56			
27				57			
28				58			
29				59			
30				60			

ຄິດໄລ່ວັດແທກຄັ້ງວັນທີ: 2-5/06/2015

ຄິດໄລ່ໂດຍ

ຈຸດທີ່ຕັ້ງພິກັດຂອງຕອນດິນ: N 2059488.816, E 349172.640

ເຄົ້າມູນອ້າງອິງ: WGS 84, ສຳຫຼວດວັດແທກໂດຍ: ທ່ານ ສຸທິກອນ, ທ່ານ ໂອລຳ, ທ່ານ ສຸນາເຄນ





ສາທາລະນະລັດ ປະຊາທິປະໄຕ ປະຊາຊົນລາວ  
ສັນຕິພາບ ເອກະລາດ ປະຊາທິປະໄຕ ເອກະພາບ ວັດທະນາຖາວອນ

ກະຊວງຊັບພະຍາກອນທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມ  
ກົມຄຸ້ມຄອງທີ່ດິນ

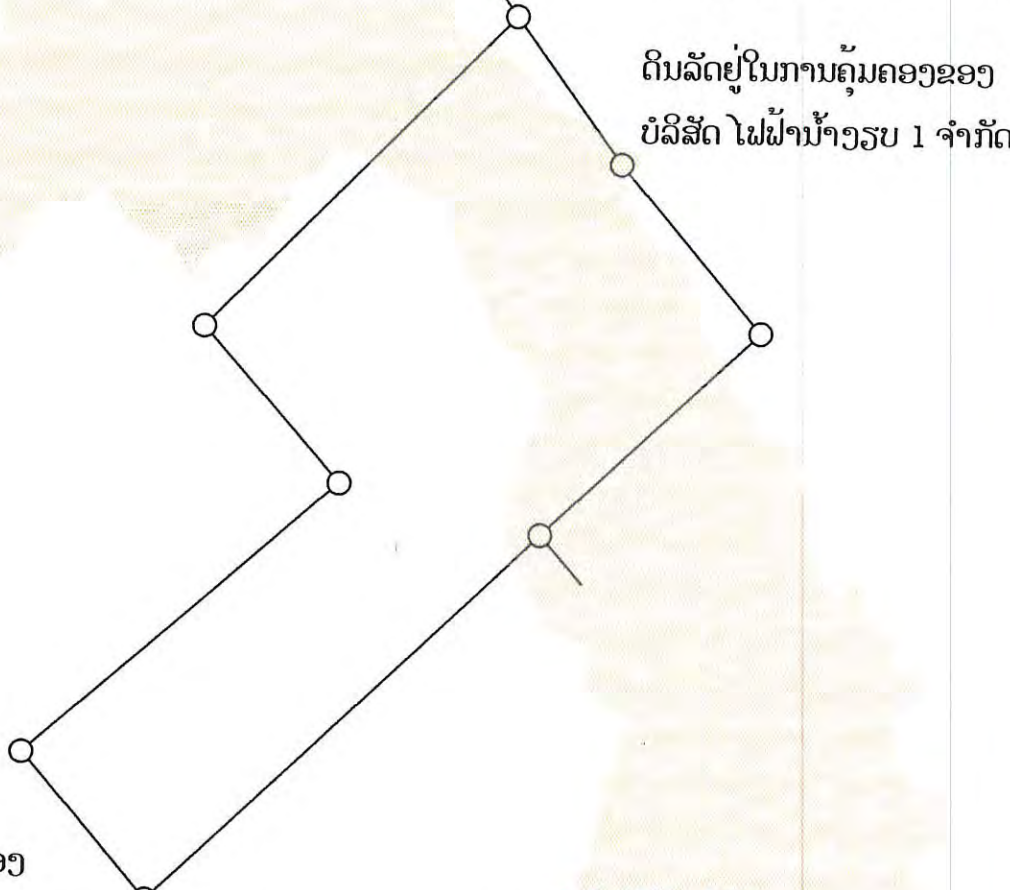
**ແຜນທີ່ດິນລັດ**

ເລກທີ: 2105 / ກຊສ.ກທດ

ຄຸ້ມຄອງນໍາໃຊ້ໂດຍ: ບໍລິສັດ ໄຟຟ້ານໍ້າງຽບ 1 ຈຳກັດ  
ຕາມເອກະສານຢັ້ງຢືນ: ຂໍ້ຕົກລົງຂອງທ່ານລັດຖະມົນຕີວ່າການ ກະຊວງຊັບພະຍາກອນທຳມະຊາດ ແລະ  
ສິ່ງແວດລ້ອມ, ສະບັບເລກທີ 4466/ກຊສ.ລົງວັນທີ 31 ກໍລະກົດ 2015  
ເພື່ອນໍາໃຊ້ເຂົ້າໃນເປົ້າໝາຍ: ປູກສ້າງ (ອ່າງເກັບນໍ້າເພື່ອຊົມໃຊ້)

ທີ່ຕັ້ງຂອງຕອນດິນ

ຖະໜົນ: ບ້ານ: ຫາດຍື່ນ (ຄຸ້ມຫາດຊາຍຄຳ)  
ເມືອງ: ບໍລິຄັນ ແຂວງ: ບໍລິຄຳໄຊ  
ໃບແຜນທີ່ຕາດິນເລກທີ: A 348-058 ຕອນດິນເລກທີ:  
ຈຸດທີ່ຕັ້ງພິກັດຕອນດິນ: N 2058992.565, E 348663.249  
ມາດຕາສ່ວນ: 1: 10 000 ເນື້ອທີ່ຂອງດິນ: 42 ເຮັກຕາ: 0000 ຕາແມັດ



ອອກໃຫ້ທີ່: ນະຄອນຫຼວງວຽງຈັນ ວັນທີ: 12 AUG 2015 ເດືອນ: ປີ:

351 ຫົວໜ້າກົມຄຸ້ມຄອງທີ່ດິນ



ຄຳເຫັນ ເພັດກິມມະລີ





ສາທາລະນະລັດ ປະຊາທິປະໄຕ ປະຊາຊົນລາວ  
ສັນຕິພາບ ເອກະລາດ ປະຊາທິປະໄຕ ເອກະພາບ ວັດທະນະຖາວອນ  
\*\*\*\*\*

ກະຊວງຊັບພະຍາກອນທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມ  
ກົມຄຸ້ມຄອງທີ່ດິນ

ເລກທີ...../ ກຊສ.ກທດ  
2106

**ໃບອະນຸຍາດໃຫ້ສິດໃຊ້ທີ່ດິນລັດ**

- ອີງຕາມ ດຳລັດຂອງນາຍົກລັດຖະມົນຕີ, ສະບັບເລກທີ 135/ນຍ, ລົງວັນທີ 25 ພຶດສະພາ 2009 ວ່າດ້ວຍການເອົາທີ່ດິນຂອງລັດໃຫ້ເຊົ່າ ຫຼື ສຳປະທານ.
- ອີງຕາມ ຂໍ້ຕົກລົງຂອງລັດຖະມົນຕີວ່າການ ກະຊວງຊັບພະຍາກອນທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມ ສະບັບເລກທີ 3059/ກຊສ, ລົງວັນທີ 16 ພຶດສະພາ 2012 ວ່າດ້ວຍການຈັດຕັ້ງ ແລະ ການເຄື່ອນໄຫວ ຂອງກົມຄຸ້ມຄອງທີ່ດິນ.

**ກົມຄຸ້ມຄອງທີ່ດິນ ກະຊວງຊັບພະຍາກອນທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມ ຕົກລົງ :**

- ❖ ອະນຸຍາດໃຫ້: ບໍລິສັດ ໄຟຟ້ານ້ຳງຽບ 1 ຈຳກັດ ..... ໄດ້ຮັບສິດໃຊ້ທີ່ດິນຂອງລັດ, ເຊິ່ງມີກຳນົດການນຳໃຊ້.....ປີ, ນັບແຕ່ວັນທີ.....ເຖິງວັນທີ.....ເພື່ອນຳໃຊ້ເຂົ້າໃນເປົ້າໝາຍ.....ໃນການຍົກຍ້າຍຈັດສັນ ແລະ ພື້ນຟູຊີວິດການເປັນຢູ່ຂອງປະຊາຊົນທີ່ໄດ້ຮັບຜົນກະທົບ.....
  - ❖ ທີ່ດິນຕັ້ງຢູ່ຖະໜົນ:.....ບ້ານ.....ຫາດຍື່ນ (ຄຸ້ມຫາດຊາຍຄຳ).....ເມືອງ.....ບໍລິຄັນ.....ແຂວງ.....ບໍລິຄຳໄຊ.....ແຜນທີ່ດາດິນເລກທີ..... A 348-058 ..... ຕອນດິນເລກທີ.....ແຜນທີ່ດິນລັດສະບັບເລກທີ..... 2105 ..... ລົງວັນທີ.....
  - ❖ ມີເນື້ອທີ່..... 42 ..... ເຮັກຕາ..... 0000 ..... ຕາແມັດ.
- ຜູ້ທີ່ໄດ້ຮັບອະນຸຍາດສິດໃຊ້ທີ່ດິນຂອງລັດ ຕ້ອງໄດ້ຄຸ້ມຄອງ ແລະ ປົກປັກຮັກສາທີ່ດິນຂອງລັດໃຫ້ດີ, ບໍ່ສ້າງຄວາມເສຍຫາຍໃຫ້ແກ່ຄຸນນະພາບຂອງດິນ, ບໍ່ທຳລາຍສິ່ງແວດລ້ອມ ແລະ ນຳໃຊ້ທີ່ດິນດັ່ງກ່າວໃຫ້ຖືກຕ້ອງຕາມລະບຽບກົດໝາຍທີ່ວາງອອກຢ່າງເຂັ້ມງວດ.
  - ທຸກການປ່ຽນແປງ ຫຼື ການເຄື່ອນໄຫວກ່ຽວກັບສິດໃຊ້ທີ່ດິນເຊັ່ນ: ການຄ້າປະກັນເງິນກູ້, ການໂອນ, ການເອົາໃຫ້ຜູ້ອື່ນເຊົ່າຕໍ່ ແລະ ການປ່ຽນແປງເປົ້າໝາຍການພັດທະນາ ຕ້ອງໄດ້ຮັບຄວາມເຫັນດີຈາກລັດຖະບານ.
  - ໃບອະນຸຍາດສະບັບນີ້ ມີຜົນສັກສິດນັບແຕ່ວັນລົງລາຍເຊັນເປັນຕົ້ນໄປ.

ທີ່.....ນະຄອນຫຼວງວຽງຈັນ....., ວັນທີ..... 2 AUG 2015

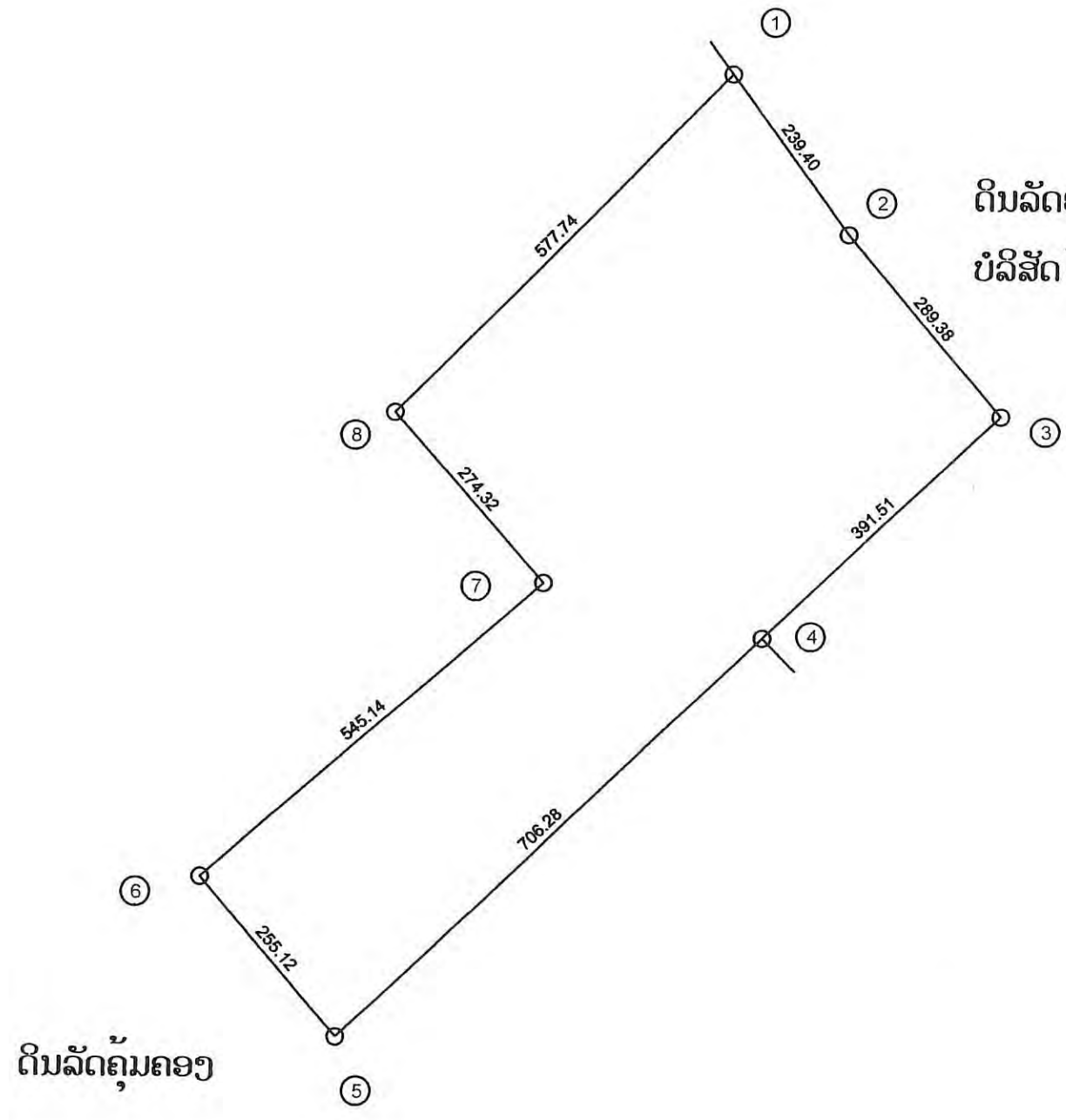
551 ຫົວໜ້າກົມຄຸ້ມຄອງທີ່ດິນ

ຄຳເຫຼັກ ເພັດກິມມະລີ



**ແຜນທີ່ດິນສະເພາະຕອນ**

ຕອນດິນເລກທີ.....ແຜນທີ່ຕາດິນໃບທີ **A 348-058**.....  
 ປະເພດທີ່ດິນ **ປູກສ້າງ (ອ່າງເກັບນ້ຳເພື່ອຊົມໃຊ້)**.....ເຂດ..... **ພູພຽງ ( ຊານເມືອງ )**.....  
 ຄຸ້ມຄອງນໍາໃຊ້ໂດຍ :..... **ບໍລິສັດ ໄຟຟ້ານ້ຳງຽບ 1 ຈຳກັດ**.....  
 ຖະໜົນ:.....ບ້ານ:..... **ຫາດຍື່ນ (ຄຸ້ມຫາດຊາຍຄຳ)**.....  
 ເມືອງ..... **ບໍລິຄັນ**.....ແຂວງ..... **ບໍລິຄຳໄຊ**.....  
 ມາດຕາສ່ວນ:..... **1 : 8000**.....ເນື້ອທີ່:..... **42**.....ເຮັກຕາ..... **0000**.....ຕາແມັດ




ດິນລັດຢູ່ໃນການຄຸ້ມຄອງຂອງ  
 ບໍລິສັດ ໄຟຟ້ານ້ຳງຽບ 1 ຈຳກັດ

ດິນລັດຄຸ້ມຄອງ

ສຳຫຼວດວັດແທກຄັ້ງວັນທີ **2-15/06/2015**.....ດ້ວຍກ້ອງ:GPS.....  
 ຈຸດທີ່ຕັ້ງຝັກຂອງຕອນດິນ: **N. 2058992.565, E 348663.249**

- ສຳຫຼວດວັດແທກໂດຍ:
1. ທ່ານ **ສຸທິກອນ, ທ່ານ ໂອລຳ**
  2. ທ່ານ **ສຸນາເຄນ**

ກວກາໂດຍ:  
  
**ຄຳໄຊ ກອກມິລາ**

ໄວ້ຫນ້າກົມຄຸ້ມຄອງທີ່ດິນ



ຄຳເຫຼັກ ເພັດກິມມະສີ



ສາທາລະນະລັດ ປະຊາທິປະໄຕ ປະຊາຊົນລາວ  
 ສັນຕິພາບ ເອກະລາດ ປະຊາທິປະໄຕ ເອກະລາດ ວັດທະນາຖາວອນ  
 Lao PeoPle's Democratic Repulic

**ເອກະສານຊ້ອນທ້າຍ II ຄຳນວນຄ່າພິກັດ**

**Result of coordinates computations**

ການສຳຫຼວດເນື້ອທີ່ດິນສຳປະທານເຂດບ້ານ: ຫາດຍື່ນ (ຄຸ້ມຫາດຊາຍຄຳ), ເມືອງ: ບໍລິຄັນ, ແຂວງ: ບໍລິຄຳໄຊ  
 ເຈົ້າຂອງສຳປະທານ: ບໍລິສັດ ໄຟຟ້ານ້ຳງຽບ 1 ຈຳກັດ  
 ເນື້ອທີ່: 42 ເຮັກຕາ: 0000 ຕາແມັດ.

Point	Northing	Easting	Ell. Height	Point	Northing	Easting	Ell. Height
1	2059491.464	348709.676		31			
2	2059297.411	348849.871		32			
3	2059074.93	349034.915		33			
4	2058805.609	348750.759		34			
5	2058318.321	348239.506		35			
6	2058513.465	348075.175		36			
7	2058871.798	348486.003		37			
8	2059078.496	348305.65		38			
9				39			
10				40			
11				41			
12				42			
13				43			
14				44			
15				45			
16				46			
17				47			
18				48			
19				49			
20				50			
21				51			
22				52			
23				53			
24				54			
25				55			
26				56			
27				57			
28				58			
29				59			
30				60			

ຄິດໄລ່ວັດແທກຄັ້ງວັນທີ: 2-5/06/2015

ຄິດໄລ່ໂດຍ

ຈຸດທີ່ຕັ້ງພິກັດຂອງຕອນດິນ: N 2058992.565, E 348663.249

ເຄົ້າມູນອ້າງອິງ: WGS 84, ສຳຫຼວດວັດແທກໂດຍ: ທ່ານ ສຸທິກອນ, ທ່ານ ໂອລຳ, ທ່ານ ສຸນາເຄນ



Unofficial Translation

Ministry of Natural Resource and Environment  
Department of Land Administration

No. 20101/MONRE.DOLA

**MAP OF STATE LAND**

Administration and utilisation by: [Nam Ngiem 1 Power Company Ltd](#)  
Based on the: [Decision from MONRE Minister, No. 4466/MONRE, dated 31 July 2015](#)  
For the purpose of utilisation: [Building/Construction \(residence\)](#)

Land location

Road: ..... Village: [Hat Ngeun \(Hatxaykham Sub Village\)](#)  
District: [Bolikhan](#) Province: [Bolikhamxay](#)  
On the Map No.: [A 346-060, A 348-060](#) Land Plot No.: .....  
Location-coordinates of land: [N 2059488.816, E 349172.640](#)  
Scale: [1: 30 000](#) Total Area: [276 Hectare 0000 Square Meter.](#)



Issued at [Vientiane Capital](#) dated [12 August 2015](#)

Acting Director General  
Khamleck PHETKOMMALEE

**STATE LAND USE RIGHTS**

- Pursuant to Prime Minister's Decree, No. 135/PM, dated 25 May 2009, Land Lease or Concession of State Land;
- Pursuant to Minister of Natural Resources and Environment's Agreement, No. 3059/MONRE, dated 16 May 2012, the Organization and Management of Land Administration Department.

**Department of Land Administration Ministry of Natural Resources and Environment Agreed:**

- ❖ Grant the permission to: [Nam Ngiem 1 Power Company Ltd](#) Grants the rights to use State Land, Utilisation period for: ..... Year, From: ..... To: ..... Purpose of utilisation: [Resettlement and Livelihood for PAPs](#)
  - ❖ Land located on the road: ..... Village: [Hat Ngeun \(Hatxaykham Sub Village\)](#) District: [Borlikhan](#) Province: [Bolikhamxay](#)
  - ❖ On the Map No.: [A 348-058, A 350-058, A 346-060, A 348-060](#) Land Plot No.: ..... State Land Map No.: [2101](#) Dated: [12 Aug 2015](#)
  - ❖ Total Area: [276](#) Hectare [0000](#) Square Meter.
- The person who granted the permit to use State Land must manage and protect State Land in good manner, not to create damage to the quality of the land, not to destroy to the environment and use this land in the right manner strictly accordance to the regulation and law.
  - Any changes or proceeds for the permit to use this land for example: bank loan guarantee, land transfer, lease to other and change the purpose of development, must be agreed from the Government.
  - This permission is effective from the date it is signed.

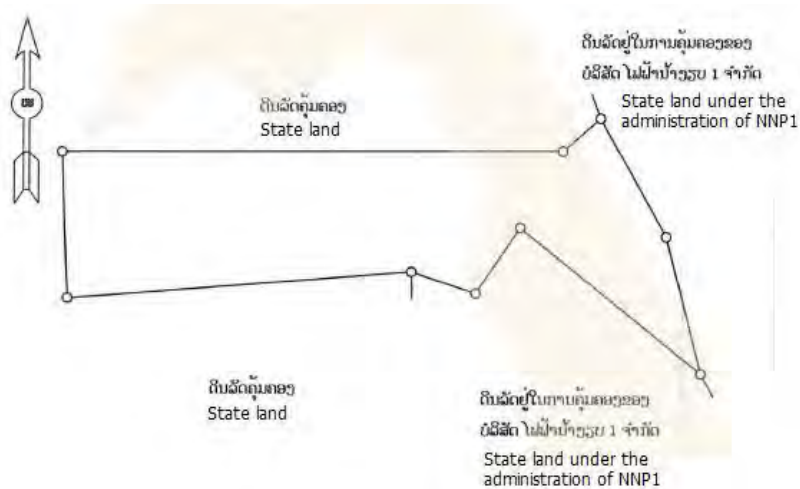
Vientiane Capital, dated 12 August 2015  
Acting Director General  
Khamleck PHETKOMMALEE

**MAP OF STATE LAND**

Administration and utilisation by: [Nam Ngiem 1 Power Company Ltd](#)  
Based on the: [Decision from MONRE Minister, No. 4466/MONRE, dated 31 July 2015](#)  
For the purpose of utilisation: [Agriculture \(tree plantation\)](#)

Land location

Road: ..... Village: [Hat Ngeun \(Hatxaykham Sub Village\)](#)  
District: [Bolikhan](#) Province: [Bolikhamsay](#)  
On the Map No.: [A 344-060, A 346-060](#) Land Plot No.: .....  
Location-coordinates of land: [N 2061025.550, E 347043.829](#)  
Scale: [1: 30 000](#) Total Area: [330](#) Hectare [0000](#) Square Meter.



Issued at [Vientiane Capital](#) dated [12 August 2015](#)

Acting Director General  
Khamleck PHETKOMMALEE

**STATE LAND USE RIGHTS**

- Pursuant to Prime Minister's Decree, No. 135/PM, dated 25 May 2009, Land Lease or Concession of State Land;
- Pursuant to Minister of Natural Resources and Environment's Agreement, No. 3059/MONRE, dated 16 May 2012, the Organization and Management of Land Administration Department.

**Department of Land Administration Ministry of Natural Resources and Environment Agreed:**

- ❖ Grant the permission to: [Nam Ngiem 1 Power Company Ltd](#) Grants the rights to use State Land, Utilisation period for: ..... Year, From: ..... To: ..... Purpose of utilisation: [Resettlement and Livelihood for PAPs](#)
- ❖ Land located on the road: ..... Village: [Hat Ngeun \(Hatxaykham Sub Village\)](#) District: [Borlikhan](#) Province: [Bolikhamxay](#)
- ❖ On the Map No.: [A 344-060, A 346-060, A 348-060](#) Land Plot No.: ..... State Land Map No.: [2103](#) Dated: [12 Aug 2015](#)
- ❖ Total Area: [330](#) Hectare [0000](#) Square Meter.

- The person who granted the permit to use State Land must manage and protect State Land in good manner, not to create damage to the quality of the land, not to destroy to the environment and use this land in the right manner strictly accordance to the regulation and law.
- Any changes or proceeds for the permit to use this land for example: bank loan guarantee, land transfer, lease to other and change the purpose of development, must be agreed from the Government.
- This permission is effective from the date it is signed.

Vientiane Capital, dated 12 August 2015  
Acting Director General  
Khamleck PHETKOMMALEE

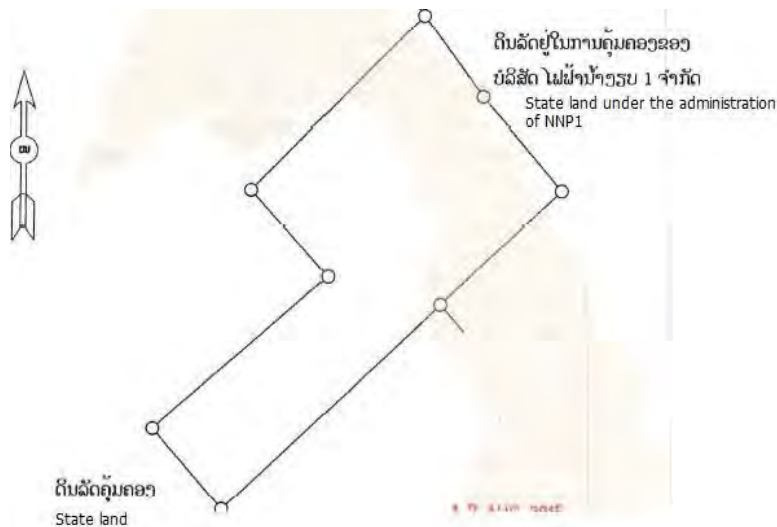


**MAP OF STATE LAND**

Administration and utilisation by: [Nam Ngiem 1 Power Company Ltd](#)  
Based on the: [Decision from MONRE Minister, No. 4466/MONRE, dated 31 July 2015](#)  
For the purpose of utilisation: [Building/Construction \(reservoir for consumable water\)](#)

Land location

Road: ..... Village: [Hat Ngeun \(Hatxaykham Sub Village\)](#)  
District: [Bolikhan](#) Province: [Bolikhamsay](#)  
On the Map No.: [A 348-058](#) Land Plot No.: .....  
Location-coordinates of land: [N 2058992.565, E 348663.219](#)  
Scale: [1: 10 000](#) Total Area: [42 Hectare 0000 Square Meter.](#)



Issued at [Vientiane Capital](#) dated [12 August 2015](#)

Acting Director General  
Khamleck PHETKOMMALEE

**STATE LAND USE RIGHTS**

- Pursuant to Prime Minister's Decree, No. 135/PM, dated 25 May 2009, Land Lease or Concession of State Land;
- Pursuant to Minister of Natural Resources and Environment's Agreement, No. 3059/MONRE, dated 16 May 2012, the Organization and Management of Land Administration Department.

**Department of Land Administration Ministry of Natural Resources and Environment Agreed:**

- ❖ Grant the permission to: [Nam Ngiem 1 Power Company Ltd](#) Grants the rights to use State Land, Utilisation period for: ..... Year, From: ..... To: ..... Purpose of utilisation: [Resettlement and Livelihood for PAPs](#)
  - ❖ Land located on the road: ..... Village: [Hat Ngeun \(Hatxaykham Sub Village\)](#) District: [Borlikhan](#) Province: [Bolikhamxay](#)
  - ❖ On the Map No.: [A 348-058](#) Land Plot No.: ..... State Land Map No.: [2105](#) Dated: [12 Aug 2015](#)
  - ❖ Total Area: [42](#) Hectare [0000](#) Square Meter.
- The person who granted the permit to use State Land must manage and protect State Land in good manner, not to create damage to the quality of the land, not to destroy to the environment and use this land in the right manner strictly accordance to the regulation and law.
  - Any changes or proceeds for the permit to use this land for example: bank loan guarantee, land transfer, lease to other and change the purpose of development, must be agreed from the Government.
  - This permission is effective from the date it is signed.

Vientiane Capital, dated 12 August 2015  
Acting Director General  
Khamleck PHETKOMMALEE



ສາທາລະນະລັດ ປະຊາທິປະໄຕ ປະຊາຊົນລາວ  
ສັນຕິພາບ ເອກະລາດ ປະຊາທິປະໄຕ ເອກະພາບ ວັດທະນາຖາວອນ

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ກະຊວງຊັບພະຍາກອນທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມ  
ກົມຄຸ້ມຄອງທີ່ດິນ

ບົດບັນທຶກກອງປະຊຸມ

— ອີງຕາມ ບັດເຊີນເຂົ້າຮ່ວມກອງປະຊຸມ ສະບັບເລກທີ 2527/ກຊສ.ກທດ, ລົງວັນທີ 23 ກັນຍາ 2015.

ໃນຕອນເຊົ້າ ຂອງວັນທີ 6 ຕຸລາ 2015 ເວລາ 9:00 ໂມງ, ທີ່ຫ້ອງປະຊຸມກົມຄຸ້ມຄອງທີ່ດິນ, ກະຊວງຊັບພະຍາກອນທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມ, ໄດ້ຈັດກອງປະຊຸມປຶກສາຫາລື ກ່ຽວກັບ ການຂໍອະນຸມັດເນື້ອທີ່ດິນ ຈຳນວນ 3,715 ເຮັກຕາ ຢູ່ທີ່ເມືອງ ບໍລິຄັນ, ແຂວງ ບໍລິຄຳໄຊ ຂອງບໍລິສັດ ເຂື່ອນໄຟຟ້ານ້ຳງຽບ 1 ຈຳກັດ, ເພື່ອເປັນເຂດປົກປັກຮັກສາດິນລັດ ແລະ ເຂດຍົກຍ້າຍຈັດສັນປະຊາຊົນທີ່ຖືກຜົນກະທົບຈາກໂຄງການສ້າງເຂື່ອນໄຟຟ້ານ້ຳງຽບ 1, ພາຍໃຕ້ການເປັນປະທານຂອງ ທ່ານ ອານິງສອນ ພິມມະຈັນ ຮອງຫົວໜ້າກົມຄຸ້ມຄອງທີ່ດິນ, ຊຶ່ງມີຜູ້ເຂົ້າຮ່ວມຈາກຫ້ອງວ່າການປົກຄອງແຂວງ ບໍລິຄຳໄຊ, ພະແນກຊັບພະຍາກອນທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມ ແຂວງ ບໍລິຄຳໄຊ, ພະແນກຊັບພະຍາກອນທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມ ແຂວງໄຊສົມບູນ, ຫ້ອງການຊັບພະຍາກອນທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມ ເມືອງບໍລິຄັນ ແລະ ພະນັກງານວິຊາການເຂົ້າຮ່ວມຈຳນວນໜຶ່ງ ( ດັ່ງມີລາຍຊື່ຄັດຕິດມາພ້ອມ )

ຜ່ານການປຶກສາຫາລື ແລະ ຄົ້ນຄວ້າທາງດ້ານວິຊາການ ໄດ້ມີຄວາມເຫັນດີເປັນເອກະພາບກັນດັ່ງລຸ່ມນີ້:

1. ບົນພື້ນຖານແມ່ນເຫັນດີສະເໜີຂຶ້ນເທິງພິຈາລະນາ ອະນຸຍາດສິດໃຊ້ເນື້ອທີ່ດິນດັ່ງກ່າວ ໃຫ້ບໍລິສັດ ໄຟຟ້ານ້ຳງຽບ1 ນຳໃຊ້ເນື້ອທີ່ດິນ ຈຳນວນ 3,715 ເຮັກຕາ, ເພື່ອເປັນເຂດປົກປັກຮັກສາທີ່ດິນລັດ ແລະ ເຂດທຳມາຫາກິມຂອງປະຊາຊົນ ທີ່ຖືກຜົນກະທົບຈາກໂຄງການໄຟຟ້ານ້ຳງຽບ1;
2. ກ່ອນການອະນຸຍາດສະເໜີໃຫ້ກົມຄຸ້ມຄອງທີ່ດິນ ປະສານສົມທົບກັບກົມຄຸ້ມຄອງຊັບພະຍາກອນປ່າໄມ້

Nam Ngiep 1 Office		ລະ
Date:	Post	IN
Distribution	Action	Copy
MD	3.	ກອນ
DMD Technical		
DMD Finance		ກ່ຽວຂ້ອງຂຶ້ນແຂວງ
DMD Adm		
DMD ESD		
KS head off.		
EGAT head off.		
LHSE head off.		

ກົມປ່າໄມ້ ກະຊວງກະສິກຳ ແລະ ປ່າໄມ້ ກ່ຽວກັບຂອບເຂດ, ແຜນທີ່ດິນ ວ່າທີ່ດິນດັ່ງກ່າວແມ່ນພື້ນຖານປ້ອງກັນ ຫຼື ປ່າຜະລິດ; ແລະ ຫຼັງການຈັດຕັ້ງປະຕິບັດ ໃຫ້ບໍລິສັດ ຫຼື ກອງເລຂາປະສານສົມທົບ ກັບ ພະແນກການທີ່ກ່ຽວຂ້ອງຂຶ້ນແຂວງ ( ໂດຍສະເພາະພະແນກຊັບພະຍາກອນທຳມະຊາດ ແລະ ສິ່ງແວດລ້ອມ ແລະ ພະ



ແນກກະສິກໍາ ແລະ ປ່າໄມ້ ແຂວງບໍລິຄໍາໄຊ ) ເພື່ອໃຫ້ສອດຄ່ອງກັບພາລະບົດບາດຂອງແຕ່ລະພາກສ່ວນ  
ທີ່ກ່ຽວຂ້ອງ;

4. ສະເໜີໃຫ້ບໍລິສັດ ແລະ ກອງເລຂາ ຕ້ອງໄດ້ເຮັດບົດລາຍງານຄວາມຄືບໜ້າຂອງໂຄງການຕາມພາລະ  
ບົດບາດ;

ກອງປະຊຸມໄດ້ປິດລົງໃນເວລາ 12:00 ໂມງ ຂອງວັນດຽວກັນ.

ດັ່ງນັ້ນ, ຈຶ່ງໄດ້ເຮັດບົດບັນທຶກສະບັບນີ້ໄວ້ ເພື່ອເປັນບ່ອນອີງໃນການຈັດຕັ້ງປະຕິບັດໃນຂັ້ນຕໍ່ໄປ.

ນະຄອນຫຼວງວຽງຈັນ, ວັນທີ 6 ຕຸລາ 2015

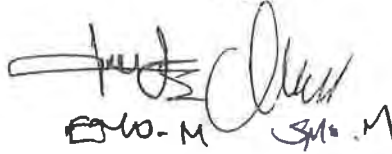
ປະທານກອງປະຊຸມ

ບໍລິສັດ ໄຟຟ້ານ້ຳງຽບ 1 ຈຳກັດ

ຜູ້ບັນທຶກກອງປະຊຸມ



ອານົງສອນ ພິມມະຈັນ



ຄວ. ມ ສາ. ມ



**The Lao People's Democratic Republic**  
**Peace Independence Democracy Unity Prosperity**

Ministry of Natural Resources and Environment  
Land Management Department

**Meeting Minutes**

- Based on the invitation to the meeting, No; 2527/MoNRE.DoLA, dated: September 23, 2015.

On the morning of October 6, 2015 at 9am, at the Land Management Department office, Ministry of Natural Resources and Environment, a discussion meeting was held on the title of the proposal for land with a total area of 3,175 hectares at Bolikhan district, Bolikhamxay province of NNP1 to be used as the government's protection area and resettlement area for villagers who are impacted by the construction of the NNP1 project. The meeting was chaired by Anongson Phommachanh, Deputy Director of the Land Management Department with the participants coming from the Bolikhamxay Administration Office, Bolikhamxay Natural Resources and Environment Division, Xaysomboun Natural Resources and Environment Division, Natural Resources and Environment office of Bolikhan district and related technical staff (attached name list).

Through the discussion and technical study, it is agreed as follows:

1. Basically, it is agreed to propose to the upper levels of government to ask for the utilization rights of the mentioned area. It is agreed to allow NNP1 to utilize the land area of 3.175 hectares to be the state protection area and the means for earning a living by the NNP1 Project affected people;
2. Before permission is granted, it is proposed that the Land Management Department shall coordinate with the Forestry Management Department and Department of Forestry under the Ministry of Agriculture and



ນ ແກ້ວຂຶມພູ ສັກດາວິງ  
Khampho SAKDADONG



- Forestry related to the boundary and land map to define if the area is a protection area or production area;
3. Before and after the implementation, it is advised that the company or RMU should coordinate with the provincial related sectors (especially Borikhamxay Natural Resources and Environment Division and the Agriculture and Forestry Division) to be in compliance with the roles and responsibilities of the related sectors.
  4. It is proposed that the company and RMU shall make a report on the project's progress based on their roles;

The meeting was closed at 12:00pm on the same day.

Therefore, this record is made as evidence for further implementation.

Vientiane Capital, October 6, 2015

The meeting's chairman

Anongsone PHOMMACHANH  
Deputy Director General-DoLA

Nam Ngiep I Power Company

Chakrit DUANGJAI-SMO  
Viengkeo PHETNAVONGXAY-EMO

The meeting's record respondent

Bungon KEONAKHONE



ນ. ພົມວິຫານ ສັກດາວົງ  
Keekomphon SAKDAVONG