Initial Environmental Examination

Project Number: 33356
Loan Number: 2780-LAO
February 2014

Lao People's Democratic Republic: Nam Ngum River Basin Development Sector Project

Prepared by the Ministry of Agriculture and Forestry for the Asian Development Bank.

Lao People's Democratic Republic
Peace Independence Democracy Unity Prosperity

Nam Ngum River Basin Development Sector Project Additional Financing

INITIAL ENVIRONMENTAL EXAMINATION (UPDATED)

NAM XAN SUB-WATERSHED

Longsan District

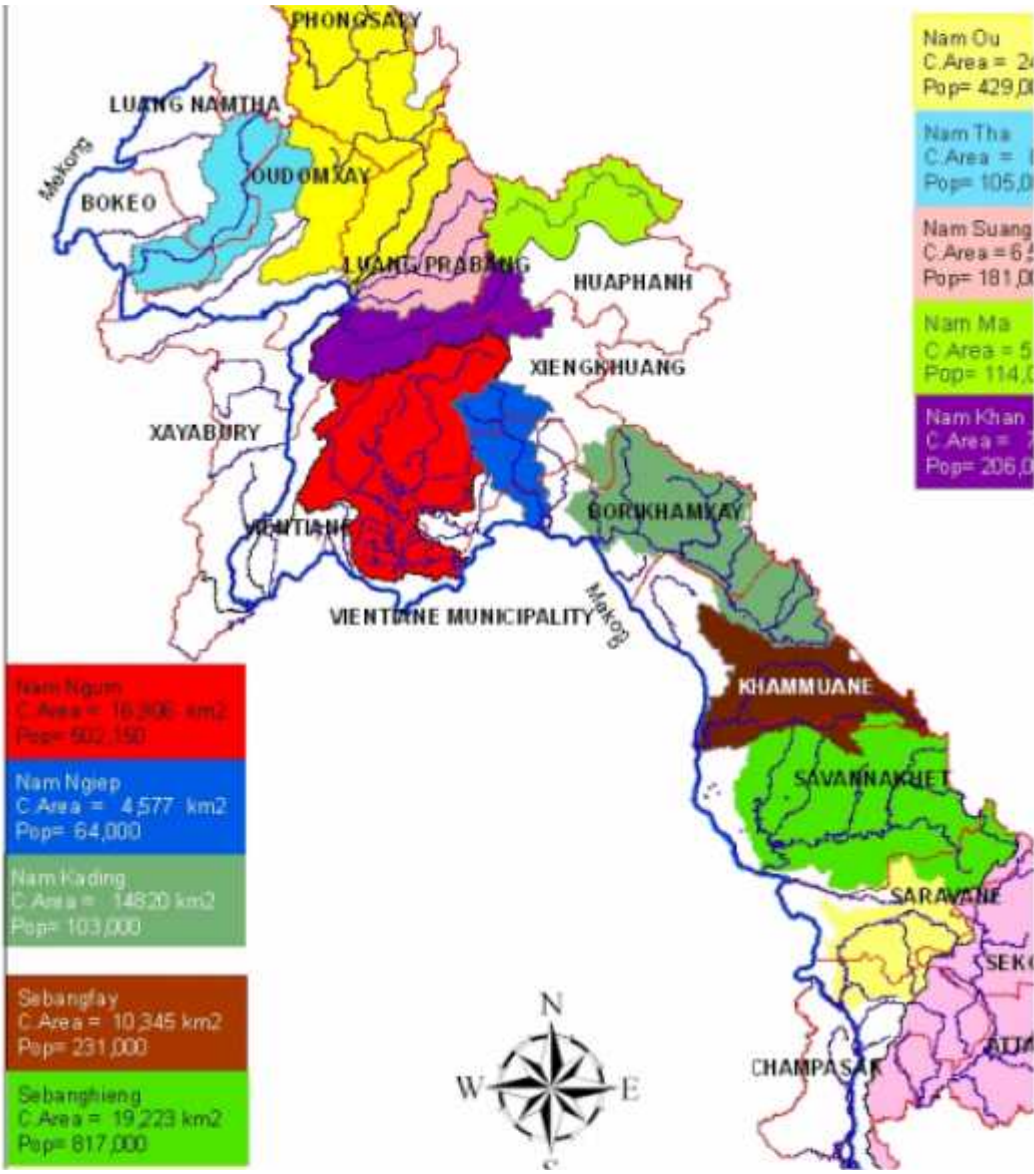
Xaysomboun Province

Updated by: Office of the National Project Management
Nam Ngum River Basin Development Sector Project-Additional Financing

February, 2014

LIST OF ABBREVIATIONS

ADB	Asian Development Bank
BOL	Bank of Laos
CPI	Committee for Planning and Investment
CPC	Committee for Planning and Cooperation
CEI	Community Environmental Improvements
DOF	Department of Forestry
DAFO	District Agriculture and Forestry Office
DoT	Department of Transportation
DoU	Department of Urbanization
DoA	Department of Agriculture
DOI	Department of Irrigation
DOP	Department of Personnel
DAFO	District Agriculture and Forestry Office
DOAE	Department of Agricultural Extension
DoE	Department of Education
ERI	Environmental Research Institute
EPL	Environmental Protection Law
FAO	Food and Agricultural Organization, United Nations
GTZ	German Foundation for Internation Development or *GeschellshaftfuerTechnischeZuzammenArbeit*
IEE	Initial Environment Examination
IWMU	Integrated Water Management Unit
IWRM	Integrated Water Resources Management
LDC	Least-Developed Country
LUP/LA	Land Use Planning and Land Allocation
MAF	Ministry of Forestry
MIH	Ministry of Health
MPV	Marginal Productivity Values
MOF	Ministry of Finance
MOJ	Ministry of Justice
MOE	Ministry of Education
NA	National Assembly
NAWACOP	NamNgum Watershed and Conservation Project
NNRB	NamNgumRiver Basin
NTFP	Non-TimberForest Product
NNWS	NamNgum Watershed
NEQMP	National Environmental Quality Monitoring Program
NGPES	National Growth and Poverty Eradication Strategy
NAFRI	National Agriculture and Forestry Research Institute
NAFES	National Agriculture and Forestry Extension Service
NBCA	National Biodiversity and Conservation Area
OF	Office of Forestry
OA	Office of Agricultural
PLUMP/LA	Participatory Land Use Planning and Land Allocation
PM	Prime Minister
PNE	Potential Negative Effect
PAFO	Provincial Agriculture and Forestry Office
PSTEO	Provincial Science Technology and Environment Office
PPSC	Provincial Project Steering Committee
TA	Technical Assistance
WRCC	Water Resource Coordination Committee


PHONGSALY
LUANG NAMTHA
Mekong
BOKEO
OUDOMXAY
LUANG PRABANG
HUAPHANH
XIENGKHUANG
XAYABURY
BORIKHAMXAY
VIENTIANE
VIENTIANE MUNICIPALITY
Mekong
KHAMMUANE
SAVANNAKHET
SARAVANE
CHAMPASAK
N
W
E
S
Nam Ou
Nam Tha
Nam Suang
Nam Ma
Nam Khan
Nam Ngum
Nam Ngiep
C.Area = 4,577 km2
Pop= 64,000
Nam Kading
C.Area = 14820 km2
Pop= 103,000
Sebangfay
C.Area = 10,345 km2
Pop= 231,000
Sebanghieng
C.Area = 19,223 km2
Pop= 817,000

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I. Introduction

Nam Ngum River Basin Development Sector Additional Financing (Project) is financed by Asian Development Bank (ADB). It covers 10 districts of 3 provinces (Vientiane, LuangPrabang and Xiengkhuoang Provinces). Project activities are implemented through three components and one office of the national project management:

Component 1: Integrated Water Resources Management (IWRM) conducted by the Department of Water Resources (DWR), Ministry of Natural Resources and Environment (MoNRE). It is intended to build capacity in integrated water resource management, including river basin planning and management at the scale of both smaller sub-basin and larger river basins. Integrated river basin management includes developing a river basin plan which coordinates the activities and interests of the various water user sectors including the environment.

Component 2: Integrated Watershed Management Unit (IWMU) under Department of Planning and cooperation, Ministry of Agriculture and Forestry. Component's main activities assist in incorporating watershed landscape continuum plans developed under the previous project in district development programs. The activities are disseminate WLCPs to communities through the village development planning process, train district staff in preparing and revising district land use zoning in accordance with the WLCPs to promote environmentally sustainable land use, and update WLCPs based on the development process of district land use plans and sub-basin management plans.

Component 3: Agriculture Extension Component assigned under the Ministry of Agriculture and Forestry. Component's activities assist in enhance KESC operational capacity and sustainability, and increasing their beneficiaries intensive support will be provide to 23 KESCs in 10 district within the NNRB which are relatively poor and remote. The KESCs covers 230 villages, which had supported under previous project, and 50 additional villages.

This document provides an updated initial environment examination of the San sub-watershed under the NNRBDP-AF. The updated IEE is prepared according to ADB's Safeguard Policy Statement of June 2009 and the IEA decree of April 2010.

Potential impacts have been analyzed and mitigation measures identified following a visits and collection and examination of secondary information sources. The visit included inspection of project activities and discussions with district agriculture and forestry office, chief of villages and was undertaken jointly with infrastructure engineer from the agriculture and forestry extension component.

II. Description of the Project

The Nam Ngum River Basin Development Sector Additional Financing Project aims to for the optimal use of water resources, especially in the Nam Ngum River Basin (NNRB). The outcome will be integrated watershed management improved in the NNRB through four expected outputs: (i) Nam Ngum River Basin Committee Secretariat (NNRBCS) strengthened for sub-basin management, (ii) district land use planning enhanced, (iii) agricultural support services improved, and (iv) institutional and human resource capacity strengthened for project implementation.

The NNRBCS will initiate its operations for developing sub-basin plans to facilitate coordinated sub-basin management at the district level. Improved watershed planning is incorporated in district land use plans to align local development programs with sustainable sub-basin and watershed management. Enhanced agricultural support services will promote the adoption of environmentally sustainable and profitable farming and forestry practices.

The project activities will assist the newly established NNRBCS in initiating sub-basin management. These activities will include (i) selecting five priority sub-basins; (ii) undertaking multi-stakeholder consultations for sub-basin planning and monitoring in the selected sub-basins; (iii) establishing a working group for each of the priority sub-basins; (iv) training on sub-basin management; (v) developing and disseminating sub-basin management plans; and (vi) developing guidelines for the implementation and monitoring of the plans. The sub-basin plans will identify specific sub-basin issues to be addressed through a decentralized consultation process with beneficiaries. The key elements of these plans will be incorporated into district development plans.

The project will assist in incorporating watershed landscape continuum plans (WLCPs)[1] developed under the previous project in district development programs. The planned activities will (i) disseminate WLCPs to communities through the village development planning process, (ii) train district staff in preparing and/or revising district land use zoning in accordance with the WLCPs to promote environmentally sustainable land use, and (iii) update WLCPs based on the development process of district land use plans and sub-basin management plans.

The project assistsin enhancing KESC operational capacity and sustainability, and increasing their beneficiaries. Intensive supports are provided to 23 KESCs in 10 districts[2] within the NNRB which are relatively poor and remote. The KESCs will cover 230 villages, which have been supported under the previous project, and 50 additional villages. The project will transform existing VDRFs in 16 districts into sustainable financing institutions. The activities will (i) strengthen KESC capacity for the effective management of the centers by improving technical skills of staff, (ii) train farmer leaders and foster their networks, (iii) implement extension services with income-generating activities such as seed and seedling production and cattle fattening, and (iv) institutionalize the VDRFs as district savings and credit unions or other appropriate credit institutions by registering under the Bank of Lao PDR.

III. Policy, Legal and Administrative Framework

The law governing the protection of the environment, including the assessment and management of projects, is the Environmental Protection Law (EPL), 1999. An update was prepared and released in 2013, reflecting rapid economic growth and socioeconomic development and the need to address increasing conflict and social impacts as well as pollution issues with some larger projects, increasing foreign investment, and climate change. Responsibilities and procedures for Environmental Assessment, together with requirements for environmental monitoring of projects, have been revised and are set out in a new Decree on Environmental Impact Assessment (EIA decree), dated April 2010.

[1]WLCPs were developed for improved and coordinated watershed management. While sub-basin management under output 1 will focus on water-based natural resources such as quantity and quality of river flows and riverine ecosystems, WLCPs provide guidance for land use planning at the district and village levels with site-specific environmental information and coordinated zoning.
[2]Hinheup, Hom, Kasy, Pek, Phaxay, Phonhong, Phoukhoune, Phoukout, VangVieng, and Xaysomboum districts. The project will monitor and provide minimal support to six KESCs (86 villages) within the other six districts.

The EIA decree states that all investment projects that may create adverse environmental and social impacts, are to be designed with the correct and appropriate environmental and social impact prevention and mitigation measures or environmental management and monitoring plans (EMMP) and social management and monitoring plans (SMMP) (Article 1). According to the decree, primary responsibility for undertaking environmental assessment of projects is with the Office of the National Project Management (ONPM), which for this project is the Ministry of Agriculture and Forestry (MAF). The Ministry of Environment and Natural Resources (MoNRE), acting through the provincial Department of Environment and Natural Resources (DoNRE) is responsible for review and approval of environmental assessment reports, co-ordination of monitoring and evaluation, and issuance of compliance certificates. Public participation and discussion with local administrations is required throughout the environmental assessment process.

Investment projects are categorized according to a schedule to the EIA decree into category 1–small scale, requiring an initial environmental examination (IEE) or category 2–large scale, requiring an environmental impact assessment (EIA). The schedule lists irrigation scheme, access road improvement, and water supply (item 2.3, 4.14, 3.52, respectively) as category 1.

IV. Description of the Project Environment

4.1 Physical Resources

4.1.1 Topography

Nam Ngum River Basin (NNRB) in north-central Lao PDR, covers an area of approximately 16,906 square kilometers (km²). The upper basin, that covers about 8, 297 km², is the catchment area for Nam Ngum 1 reservoir. NNRB extends northeast from the Vientiane waterfront about 400 km to XiengKhouang and is equivalent to about 2.73% of the entire Lower Mekong Basin. The catchment outlet is 157 meters (m) above sea level, and the highest point is 2,682 m above sea level. Less than one third lies below 300 m above sea level.

The average annual rainfall of 1,300- 2000 millimeters, the annual water usage is about 2.12% of the Nam Ngum annual discharge. Land ranges from large and small flat valley floors to rolling uplands 1,100- 1,500 m or more above sea level. Most flat valley floors have been developed into paddy fills with traditional and modern irrigation about 81% of the sub-project area has a forest cover and shifting cultivation is practices on about 1,300 (ha).

Studies in 1991- 1995 confirmed low nutrient status and Phosphate deficiency in most are of basin. The upper basin has fertility and highly acid soils area common in XiengKhouang. Whether soil acidity affects the aquatic environment is not known the other areas in the upon basin are karstic with basin soils. Continuing loss of forest cover and soil degradation is threatening productivity and increasing stream flow variability, since water storage in the forest litter soil and subsoil zones are reduced.

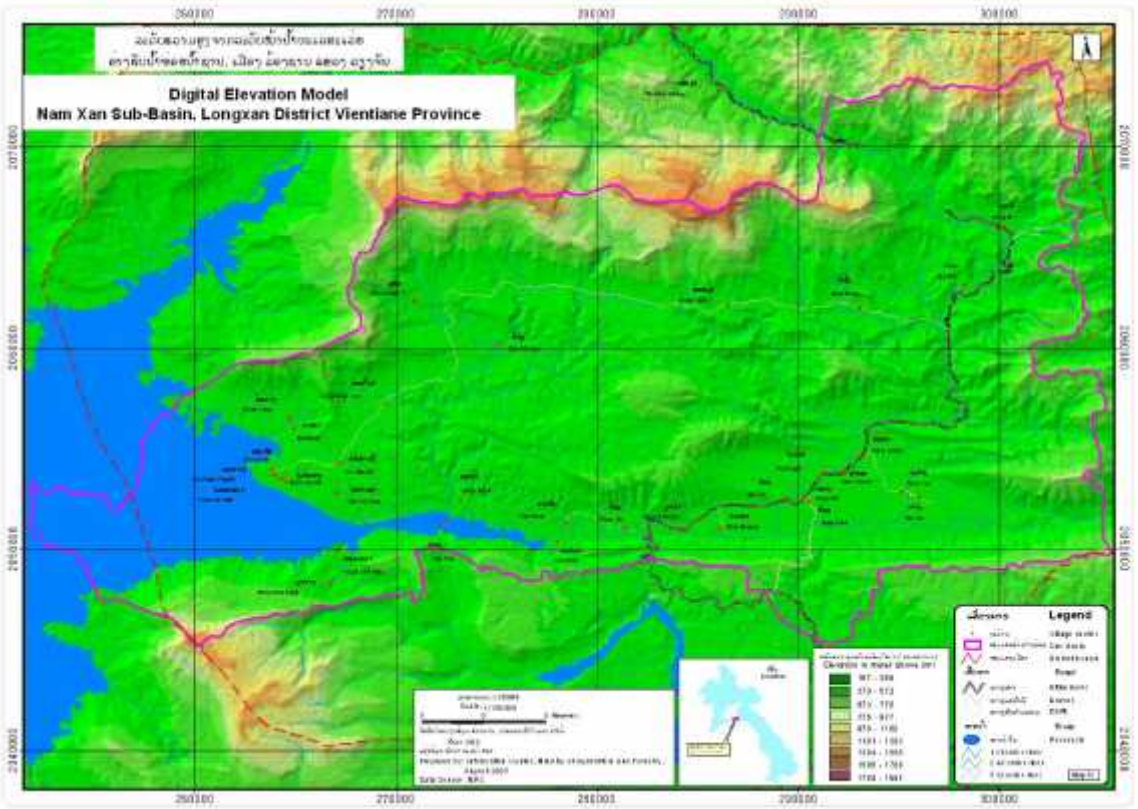

Figure 1Map of Xan sub-watershed

4.1.2 Climate

The climate of the Nam Ngum River Basin is largely tropical with distinct wet season from June to October and a mostly dry season for the rest of the year. In the hottest months of March and April, average temperatures range from 30°C to 38°C, depending on location and altitude. Coolest temperatures occur between November and February and at higher elevations, where they may average 15°C. Average rainfall in the river basin is 2,000 mm and ranges from more than 3,500 m near Vanvieng in the Nam Lik Basin, to below 1,400 mm in Phonsavan in Xiengkhouang Province.

Nam Xan Sub-watershed is located at Hom district where is influenced by seasonal monsoon climate. Mean monthly rainfall collected from the meteorology and hydrology station at Phonemouang Village as referred data for average rainfall within district (2,224 mm). The average annual temperature is about 17° Celsius. The coldest month is December with the lowest temperature of about 6° Celsius. The hottest month is May with the highest temperature of about 27° Celsius (Department of Meteorology and Hydrology, 2003).

4.1.3 Geology and Soil

Referred to the data of soil classification by the National Agriculture and Forestry Institute (NAFI), soil types classified into 9 groups. Details show in table 1 below

Table 1 Soil Classification

No	Soil types	Area (Ha)	Areas (Percent)
1	Dystric FLUVISOLS (FLd)	589.75	0.21
2	Dystric REGOSOLS (RGd)	11,112..50	3.92
3	Ferric ALISOLS (Alf)	20,499.25	7.23
4	Haplic ALISOLS (ALh)	19,374.75	6.83
5	Gleyic ACRISOLI (ACg)	113.00	0.04
6	Ferric ACRISOLI (AFC)	98,371.25	34.67
7	Haplic ACRISOLI (ACh)	97,671.50	34.43
8	Ferric LIXISOLS (LXf)	5,847.75	2.06
9	Reservoir (Rsv)	30,132.75	10.62
		283,717.50	**100**

4.1.4 Land Use

Most of land use systems within Nam Xan sub-watershed are related to shifting cultivation which is considered as in transition. Shifting cultivation is considered as a major land use practice in upland and high land areas where the minority ethnic groups scattering settle. Shifting cultivation systems vary enormously but little is known about them. The Department of Forestry estimates that close to 280,000 families engage I shifting cultivation and clear about 300,000 ha annually (PMO, 1993). So that this land use system is considered a major cause for forest cover changes and has resulted in many negative impacts.

Land resources as other natural resources, plays a significant role in the livelihood and welfare of Lao people. Meanwhile, the country's topographic pattern is subject to a fragile environment and susceptibility to soil erosion due to its shallow infertile soil condition and the steep slopes. Land use patterns within project area are being classified according to minority groups who practice different farming types and on top of mountains where sources of water originate.

Almost villages have well-established access and use the rights to forest and agricultural land within areas under their traditional control. Villages enjoy traditional and customary rights to land, heritable by the family and transferable to third parties, and access to a large variety of non-timber forest products for domestic consumption and sale, and wood consumption.

In many part of the Nam Xan sub-watershed, forest encroachment follows logging are burned and forest or scrub bush land is converted to agricultural use, generally planting of unimproved varieties of upland rice, cassava, corn, banana, etc. Crop yields are satisfactory during the first few years, due to nutrients by burning or decomposition of forest cover, the crop sharply

4.1.5 Water resource

About 90% of the area of Lao PDR forms parts of the Mekong river basin, some 25% of the total extent of the basin, contributing to around 35% of its total flow. Nam Ngum River has total length of just over 330 km and its 19 major tributaries are Nam Lik, Nam Son, Nam Xan and others. The mean annual discharge of Nam Ngum River is 668m^3/s to the Mekong River Baisn. Nam Xan sub-watershed is originated at Xiengmi Village in Hom district, Xaysomboun Province. Its tributaries include Nam Ngiew, Houay Pho, Nam Phan, Houay San, HouaySala, Nam Korn, HouayLan, and

HouayKhui. Nam Xan flows throughout 11 villages of Xiengmi, Napho, Vangluang, Phonlao, Xamkhone, Khonvat, Hinsor, Phonmouang, Phoupamanh, Thamdin, and Thahuea village.

4.2 Ecological Resources

4.2.1 Forests

Lao PDR has endowed with considerable forest resources, occurring in a range of forest types that vary according to altitude, rainfall, soil types, and represent habitats of considerable international conservation values. The forests have an important role to play both in the national economy and the sustenance of traditional lifestyles. The balance between exploitation to realize the financial value of resources and conservation to preserve species diversity, protect the environment and sustain lifestyles is difficult to strike. In recent decades, the decline of forest resources has been marked, even alarming. Estimates suggest a drop in forest cover from 70% of the total land area in 1940 to 41.5% in 2002.

Non Timber forest products are important as a food and tradable commodity source for wide range of forest dependent communities around the country. These products include spices, oils, rattan, meat and resin, valued as foods, medicines, for handicraft and for other uses. Trade in Non timber forest products is a very important part of income of average rural families.

Attempts have been made to establish plantations and thereby produce timber and other forest products while buffering remaining natural forest reserves, however, success has been variable, due mainly to the standards of planning and management of forest plantation.

4.2.2 Protected Area

The range of habitats, including forest in Lao PDR is wide, and of international conservation value, including lowland and upland forest, plateau and riparian habitats. The diversity of the plant animal and fish species is high and there are a number of species with high endemism (not found or very rare outside Lao PDR). Besides encroachment on these habitats, wildlife is threatened by trade in wildlife products. In recognition of the high conservation value of the habitats, a national protected area system has been established, comprising 19 areas which collectively account for 13% of the land area of the country. These protected areas are managed by the department of Forestry under the Ministry of Agriculture and Forestry, via provincial and district level offices, with villager participation and co-ordinated by the Division of Forest Resources Conservation. Management focuses on conservation, integrating traditional land uses (such as long rotation Sweden agriculture) in most cases.

4.2.3 Aquatic Ecosystem

With high levels of rainfall and an extensive mountainous terrain, freshwater reserves are diverse, from small, high altitude mountain streams to Nam Ngum River. This gives rise to diversity in aquatic habitats, also reflected in a diversity of fish species, which show a high degree of endemism. Besides stream and rivers, wetlands are significant aquatic habitats in Lao PDR, occurring mainly in the south of the country near the Mekong River. Fish are an important economic resource and fisheries

management also needs to strike a balance between commercial exploitation and conservation. Fisheries make up approximately 13% of the GDP.

Fisheries are one an important livelihood activity, particularly in the lowland areas where wetlands, oxbow lake remnants and rice fields are all sources of fish. There are seasonal migrations of fish between the Mekong and its tributaries, with the first major fish migration of the year commencing at the start of the wet season.

4.3 Human and Economic Development

4.3.1 Local Economy

Agriculture production and livestock farming is the main source of livelihood in sub-watershed. It has high potential for agriculture production such rice cultivation, industrial tree plantation, cassava, maize. The significant income source for the poor families is come from collecting NTFPs and trading.Currently, rubber production is a main income for people within Xan sub-watershed that help to reduce poverty among ethnic group.

4.3.2 Quality of Life

Hom district comprise of 39 villages, there are 4,572 households, and total population of 32,166 habitants. Most people were settled near or along shore of Nam Ngum Reservoir and its tributaries. Ethnic minorities live within Nam Xan Sub-Watershed divided into five groups, Hmong, Lao Lum, Khummou, Oiewmien, and Tai group. The detail of ethnic group and percentage shows in table 2 below.

Table 2population

No	Ethnic group	Population		Percentage (%)
		Total	Female	
1	Lao lum	4,672	2,293	14.52
2	Hmong	23,267	11,113	72.33
3	Khmou	2,508	1,200	7.80
4	Oiewmien	1,669	795	5.19
5	Tai	50	22	0.16
Total		32,166	15,423	100

Source: District Planning Office, 2012

4.3.3 Education

There are 47 schools in Hom district which are about 2 kindergartens, 40 primary schools, 2 secondary schools, and 3 high schools.All most schools are located away from district center and located in remote areas that find difficulties to access during the rainy season.

Table 3 Education and Sport

No	School types	No	Number of Student		Number of teachers	
1	Kindergarten	2	132	58	15	15
2	Primary (1-3)	16	978	451	55	14
3	Primary (1-5)	24	5,075	2,304	283	73
4	Secondary school	2	666	285	38	3

5	High school	3	3,914	1,568	159	24
		47	10,765	4,666	586	136

Source: District Education and Sport Office, 2012-2013

4.3.4 Health, water supply, and Sanitation

Although there is a hospital within the sub-watershed but its staff abilities has a limit for carrying out treatment when patients come to treat. The main diseases seen in this area are worms (tape, hook etc.), diarrhea, gastric infection, stomach related diseases, fever, cough, typhoid. Although local people have drinking water facilities, there are 29 villages have been used the gravity fed systems, and 5 villages used boreholes, the rest used natural water sources such as rivers, stream. People drink water without treatment and water borne diseases have been also reported. Most of the households in rural area still lack of toilet facilities.

4.3.5 Energy consumption

There is an electricity facility with the transmission line and electricity grid within sub-watershed area which facilitated 28 villages of 39 villages in total have used and connected to electricity network permanently. Solar cell is an alternative source of energy which 3 villages has been benefit.

4.3.6 Transportation

Road networks access to all most of villages within Hom district and can transport both rainy season and dry son. According to a report from district of public work and transport office that only some parts of district, eastern part of the district, conjunction to Nam Mangfacing difficulties due to be new access road, no bridges, along the stretch of road.

V. Anticipated Environmental Impacts and Mitigation Measures

5.1 Method of Assessment

Potential impacts have been assessed by mean site investigation, discussions with local authorities, KESCs and members of the public. Table 4 below present impacts project activities and related to various sectors (agriculture and forestry, mining, hydropower, and water resources and environment)

Mitigation measures have been identified to, what possible, avoid potential negative impacts, or otherwise to ameliorate impacts.

5.2 Overview

The most significant impacts expected to arise from the project are major improvements to livelihood and quality of life people in the sub-watershed from provision of safe water and the improvement household and community access road, irrigation rehabilitation, and agricultural and extension services. These activities were run by the agricultural extension component

5.3 Anticipated Environmental impacts within Sub-watershed

5.3.1 Impact on soil erosion

Its predominant soil types and heavy rainfall combine to make a significant part susceptible to erosion, particularly if cultivation on a permanent basis occurs under inadequate cultivation systems. Where vegetative cover is removed, the soil surface becomes exposed to the impact of rain drops which causes a sealing of the soil surface. Less rain then infiltrates the soil. Runoff increases, stream flows fluctuate more than before, flooding becomes more frequent and extensive, and streams and springs becomeephemeral. Land degradation takes several forms, such as nutrient depletion, structural decline and compaction, biological decline, chemical deterioration (e.g. salinization), and soil erosion.

Mitigation measure:

these include all the problems of transforming shifting cultivation farming systems away from low input/low output systems in order to stabilize communities, enhance resources productivity, improve the socio-economic environmental and minimize the degradation of the natural resource base. The strategic vision for the agricultural sector, 1999 suggest that's the specific development initiatives for the areas (sloping land strategic initiative) respectively are summarized below:

- Land use zoning based on bio-physical (e.g slope and land capability) and socio-economic parameters)
- Participatory land allocation and land use occupancy entitlement
- Community management of natural resources
- Farming systems diversifications on farmer' s field
- Expansion of small-scale community managed irrigation systems
- Farmer demand-driving extension
- Sustainable land use management with soil erosion control, afforestation, plantation forestry and conservation management
- Rural saving mobilization and micro credit extension
- Competitive rural finance system development with market determined interest rates in most areas to promote technology adoption among the poorest socio-economic strata.
- Strengthening of capacity and legal framework for state owner commercial banks in community market access through feeder road upgrading and expansion and market information delivery.

Expansive land uses for agricultural activity are a major concern in San Sub-watershed, particularly, slash and burn in upland areas extensively among the poor families. Industrial plantations are common found in the areas of sub-watershed, excessive pesticide and chemical fertilizer making unsafe food consumption and water quality, aquatic life.

Encroachment of protective forest and conservation forest are often cited as the main cause of deforestation. However, several studies have pointed that commercial logging and conversion of forests for plantations (rubber) are the main causes of destruction of Lao primary forest. Deforestation for commercial use often destroys the NTFP resources that local communities rely on.

5.3.2 Impact on surface water sources

Surface water abstractions particularly from public water supplies, irrigation, and industrial process and hydropower plants exert a major pressure on water resources with significant implications for issues of quantity and quality of water resources. Main concerns relate to the inefficient use of water and to its environmental and socio-economic consequences; Low River flows, water shortage, salinization of fresh water bodies, human health problems.

5.3.3 Impact on Forest

Deforestation includes shifting cultivation, inappropriate farming system, exploitation timber, absence of a sustainable forest management planning system leading to destroy forest in the watershed area. High price of log and timber in the market making illegal logging and uncontrolled illegal trade are still going on.

Mitigation Measure

- Improve villager's living standards in pilot areas through village forestry and village development projects.
- Consult and develop land use and development plans to guide forest concessionaires in logging operations
- Improve villager's ability to manage forest through extensive training
- Involve local participation in ongoing reforestation programs
- Conduct applied, adaptive research on species (including seed and nursery requirements and the use of indigenous species), species/site matching harvesting, thinning and coppicing method, site and soil preparation, fertilization programs and post-plantation management
- Conduct research result available to PAFO and DAFO and thence to potential growers. This would entail assisting DAFO in developing adequate capacity for the task
- Provide tree plantation owners, especially those owning teak plantation in the north, with skills to select seed, plant at the correct density, thin and prune stands for quality improvement and increased sale price
- Carry out market research to determine the effect of market trends and access on specie selection, conditions under which plantation products are sold, how qualities are defined and checked and how prices, premiums and discounts are set

5.3.4 Impact on Aquatic

Aquatic resources situated in Nam Xan sub-watershed are not polluted. There are many of gears are habitats specific and their use can be highly seasonal. Some gears ate unspecialized (e.g barrage fences) and catch a wide variety of species, while others are species specific. Some fishers specialize in the use of one gear type, particularly in the professional/commercial sector, but normally a range of gears will be used.

Mitigation measure:

Fish conservation zone (FCZ) was set up in 59 villages during 1993 and 1997. The effectiveness of the FCZ is currently being evaluated under auspoces of the living aquatic resources research center (LARReC).

- Increasing co-management as well community based fisheries management.
- Set up fish conservation zones
- Fish capture control
- Prohibit zone for fishing during fish breeds
- Local authorities should enforce government regulations on the use of poisons
- Public awareness programs are also needed to help local people understand the impacts of excessive poisoning of wild life, and agricultural pests such as insects and rats.

5.3.5 Impact on Wildlife

Wildlife trade in Lao PDR involves a large internal trade for food and medicine and a substantial international trade for a diverse range of uses including traditional medicine, food, and trophies, in markets and restaurants, it is not uncommon to see displaying of squirrels, monitor lizards, birds, soft shell turtles, snake and sometimes pangolins, as well as fresh and dried deer meat.

The impact on the biodiversity relate to the loss of relatively rich and diverse wildlife. Continued loss of biodiversity correlates to a reduction in species of wildlife and plants of national and local significance, economic development opportunities, food security, national heritage values, and recreational and ecotourism opportunities.

Mitigation measure:

- Establish village conservation forest areas and demarcated
- Prohibit hunting during wildlife breeds
- Establish community base wildlife monitoring

5.3.6 Impact on Land use

Population growth pressure due to the limitation of arable land for permanent agriculture is considered as a major cause of forest encroachment. Upland farmers, who are mostly engaged in traditional slash and burn cultivation, have been claimed to be a cause of forest destruction and land degradation. Population growth and concomitant growth in demand for land use products. In the given situation of proportion growth and the extent of land conservation leads to annual forest depletion.

Mitigation Measure:

- Land allocation
- Proper land management
- Farming planning
- Community-based on land use planning and management

5.3.7 Agriculture, animal husbandry and aquaculture agriculture

Shifting cultivation is widely practiced on highly elevated sloping land. The major product is upland rice. Farm input for production is considerably low. Production is mainly for home consumption. Living condition are poor. Wet season rice production is dominant, and irrigation farming is not commonly practiced. Many farmers use animal draft power for crop cultivation, mainly for paddy. Products are mostly for

household consumption. Use of chemical fungicides, herbicides, insecticides, molluscicides and rodenticides is currently very low within the project areas. With the increase in cropping intensity, it is expected that there will be a gradual increase in the problems encountered with weeds, insect pests, rats and snails as seen elsewhere in the region. Commonly these problems appear within a few years of intensification of production. It is likely that one of the responses by farmers will be to increase their use of chemical agents to combat these pests. This could have several undesirable effects, both direct and indirect. Direct effects include unsafe application with subsequent ingestion by farmers, incorrect application resulting in unsafe levels of toxic chemical residues in farm produce and buildup of chemical resistance among pests. Indirect effects include toxic residues entering the soil, surface water and ground water with subsequent problems for aquatic flora and fauna as well as the danger of human consumption. These dangers are compounded by the large amount of banned substances that are available because of the lack of regulation and knowledge within Laos of their dangers. This is balanced by the high degree of awareness of farmers about Integrated Pest Management (IPM) including leaf-eating insects and their natural enemies. In addition, the Lao PDR Government has been discouraging the use of chemical pesticides.

Mitigation Measure:

- Appropriate technology
- The project will have paid and fruit tree to develop method of farming system, in agriculture animal husbandry and fruit tree plantation, using of green manure, compost and animal manure is encouraged under a close follow up by the project.
- Irrigation development and management
- Farmers training in pesticide use and protection
- Support the farmer to use local knowledge and utilize insects itself
- Farmers training on integrated pest management (IPM)
- Animal husbandry

5.3.8 Livestock production

Livestock production, which includes buffaloes, cattle, pigs, poultry, and goats, also contributes appreciably to the economy. A considerable amount of agricultural activities are at the subsistence level. Three types of livestock production is envisioned in the sub-watershed areas, with increases in each type in the next few years: (i) upland or mountainous area grazing involving cow, buffalo and goat; (ii) lowland foraging among dry deciduous forest that has been partially converted to improved pasture, again for cow, buffalo and goat; and (iii) animal propagation near village that aim at small livestock (pigs, chickens, ducks and goats).

Mitigation Measure:

- Develop baseline assessment and monitoring protocols of the natural and cultural resources affected by livestock use. This assessment serves as a baseline against which all grazing-induced changes should be measured and the overall effectiveness of a grazing management plan assessed. Data should be complied at a central location.
- Determine the health of rangelands currently under management that have been affected by grazing management practice. This be an interdisciplinary approach, which should include range science and related disciplines such soil and watershed science.

- Develop restoration/vegetation techniques that will return lands removed from grazing or no longer subject to trespass grazing to a desired plant community of native vegetation where natural processes will dominate. Restoration techniques should also be developed for lands damaged by grazing activities but are still subject to grazing
- Develop a methodology for monitoring grazing activities for the preservation of cultural and natural resources. Provide recommendations for the protection of resources to be incorporated into allotment management plans. This methodology should consider soils, hydrology, water quality, as well as the desired plant community.

5.4 Anticipated Environmental Impacts by project activities and Mitigation

The table shows the assessment of impacts to be brought about by the project and the significance of the change to human populations. In each case, changes may be positive or negative.

Table 4 Indicative Mitigation Measures

Activities potentially impact environment	Anticipated Environmental Impacts	Proposed mitigation measures
1. Agricultural support services (Crop, livestock and fishery production improvement)		
Physical expansion of crop area.	Loss of precious ecological resources, and historical or cultural sites.	Careful site-selection of project activities the sensitivities.
	Animal defecation causes water course pollution.	Village level planning for livestock includes measures to keep livestock out of riparian areas and streams through appropriate fencing and off-stream watering points where practical.
Improved productivity	Misuse of chemical fertilizers and pesticides negatively affect soil and water quality, causing health and pollution problems.	Train farmers on environmentally appropriate farming practices.
	Removed pressure to forest increases biodiversity.	Promote organic fertilizers and integrated pest management techniques.
Introduction of new crops and fodder or imported breeds.	Alien species invades conventional species. Imported varieties and breeds cause disease problems.	Promote tested species/breeds or hybrid seeds that produce infertile offspring.
2. Forest management		
Disturbance or exclusion of conventional practices and historical or cultural sites.	Loss of productive areas, precious ecological resources, and historical or cultural sites.	Careful site-selection of project activities the sensitivities.
Introduction of new species.	Alien species invades conventional species.	Promote tested species. Where possible, high value native forestry species be considered rather than exotic species.
	Predominance of deciduous species may exacerbate soil erosion.	Limit deciduous species less than 50% of the mixture. No planting on slopes greater than 20% degrees without contour planting.

Promotion of Non Timber Forest Products (NTFPs).	Overexploitation of NTFPs.	Training for sustainable NTFP use.
Nursery construction	Soil erosion.	Establish on flat land with gravel base.
	Water pollution.	Use of slow release fertilizers. Proper drainage.
	Workers health and safety.	Enforce personal protective equipment and medical facilities.
Seed collection	Existing forest depletion.	Local protocols for sustainable seed collection be established, with specific protection for any rare or threatened species.
Herbicide use (e.g., Glyphosate)	Damages on non-target species	Use proper equipment on days with no wind and rain.
Fertilizer application	Leaching to water courses.	Use small quantities next to individual trees.
3. Improved village infrastructure		
Physical construction works (e.g., small-scale irrigation systems, rural road, and water supply systems)	Soil erosion and Water pollution.	Promote plant cover, where applicable. Careful treatment of soil, especially works in riparian areas.
	Workers health and safety.	Enforce personal protective equipment.
4. Land use planning		
Land use planning	Exclusion from conventional use of land and water resources. Improved capacity and management facilitate sustainable use and conservation of natural resources.	Involve concerned provinces, districts and communities into planning process.

VI. Environmental Management Plan (EMP)

6.1 Institutional Arrangements

The project implementation will be in the hand of the office of the national project management (ONPM) located within the department of Planning and Cooperation with links to provinces where implementation take place. Both provincial and district offices of MAF (PAFO and DAFO) are intimately involved in project execution, and some of the environmental functions needed to effectively execute the project are located within these offices.

The ONPM and the consultant engaged to implement activities will be required to oversee the environmental monitoring and compliance activities, and to coordinate among the various subsidiary agencies involves in the project. Further engagement ofconsultants in environmental monitoring is needed alongside the ONPM during the implementation of the componentto assure that environmentally-friendly practices are in corporate into the farmer field demonstration and training work, and to assist in implementing various mitigation measured related to control of fertilizer applications, pesticide use, and IPM.

6.2 Environmental Monitoring Program

District Project Office (DPO) is responsible for carry out environmental planning and monitoring in collaboration with villagers. A monitoring plan for each target village may be prepared at the activity planning stage. Office of National Project Management (ONPM) is responsible to support and supervise the DPO and also ensure that environmental safeguard requirements are complied. The DPO provides ONPM with reports on the implementation of the EMP on quarterly basis. ONPM regularly prepare quarter progress reports on project progress on environmental aspects, in collaboration with provincial, district and village level stakeholders, to report to the Project Steering Committee (PSC), Ministry of Natural Resources and Environment (MONRE) and Asian Development Bank (ADB).

VII. Conclusions and Recommendation

The initial Environmental examination process has found that the project will cause significant negative environmental impacts. The project is therefore be classified as Category B according to ADB's classification system. This refers to projects that are joded to have some adverse environmental impacts, but of lesser degree or significance than those for Category B projects.

It is recommended that the environmental management plan for each component will be monitored by Project staff from ONPM, PPOs and DPOs is responsible to monitoring and reporting approaches.

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