Initial Environmental Examination

August 2015

Lao PDR: Second Greater Mekong Subregion Corridor Towns Development Project

Prepared by Ministry of Public Works and Transport for the Asian Development Bank.

CURRENCY EQUIVALENTS

(as of 17 August 2015)

Currency unit	–	kip (K)
K1.00	=	$0.00012
$1.00	=	K8199.50

ABBREVIATIONS

DAF	-	Department of Agriculture, Forestry, And Fisheries
EA	-	Environmental Assessment
EIA	-	Environment Impact Assessment
ECC	-	Environmental Compliance Certificate
EMP	-	Environment Monitoring Plan
ESIA	-	Environment And Social Impact Assessment
EA	-	Executing Agency
GMS	-	Greater Mekong Subregion
IA	-	Implementing Agency
IEE	-	Initial Environmental Examination
IUCN	-	International Union For Conservation Of Nature
Lao PDR	-	Lao People's Democratic Republic
LWU	-	Lao Women's Union
MAF	-	Ministry of Agriculture, Forestry And Fisheries
MOF	-	Ministry of Finance
MONRE	-	Ministry of Natural Resources And Environment
MPWT	-	Ministry of Public Works And Transport
MRC	-	Mekong River Commission
NBSAP	-	National Biodiversity Strategy And Action Plan
NPA	-	National Protected Area
O&M	-	Operation And Maintenance
PIU	-	Project Implementation Unit
PPP	-	Public-Private Partnership
REA	-	Rapid Environment Assessment
TSS	-	Total Suspended Solids
UXO	-	Unexploded Ordnance
WREA	-	Water Resources And Environment Agency

WEIGHTS AND MEASURES

km:	kilometer
kg:	kilogram
ha:	hectare
mm:	millimeter

NOTES

(i) The fiscal year (FY) of the Government of the Lao People's Democratic Republic ends on 30 September. "FY" before a calendar year denotes the year in which the fiscal year ends, e.g., FY2015 ends on 30 September 2015.

(ii) In this report, "$" refers to US dollars

Initial Environmental Examination

June 2015

Second Greater Mekong Subregion Corridor Towns Development Project (CTDP): PPTA 8425

Houayxay and Luang Namtha Towns, Lao PDR

I. EXECUTIVE SUMMARY

Houayxay and Luang Namtha are the towns in Lao PDR that are participating in the Second Greater Mekong Subregion Corridor Towns Development Project.[1] Both town-subprojects consist of small infrastructure and environmental improvement investments that are being implemented with the immediate and ultimate goals of improving urban environments, and promoting socioeconomic development, respectively. Linked to the urban infrastructure investments of the subprojects is parallel development of Strategic Local Economic Development Plans (SLEDP) for each town and surrounding area. The selection of the urban infrastructure investments and the development of the SLEDPs are guided by the ADB Green City Agenda[2].

The initial environmental examination (IEE) presented herein addresses the two subprojects in Houayxay and Luang Namtha. The IEEs of the other five town-subprojects in Cambodia and Viet Nam have been prepared separately.

A. Project Summary

The components of the two subprojects in Lao PDR at the feasibility design stage and are summarized below[3]. To recognize related or similar subproject components in design or location the IEE combines some subproject components to avoid redundancy in the assessment.

Houayxay, Bokeo Province
IUD[4] - Riverbank Upgrading and Protection
IUD - Riverside Road and Walkway
IUD - River Port Rehabilitation
IUD - Ecological Park and Recreation Area
Solid Waste Management
Urban Roads and Drainage Upgrading
Luang Namtha, Luang Namtha Province
Solid Waste Management
Urban Village Upgrading – Village Upgrading
Urban Roads Drainage
Urban Recreation Facilities Upgrading
Nam Tha River Bridge

B. Potential Impacts

Both subprojects in Lao PDR are Category B for environment. The examination of the subprojects indicates that potential environmental impacts are largely restricted to the construction phase of the subproject components. Construction-related disturbances such as noise, dust, erosion, surface water sedimentation, tree removal, solid and liquid waste pollution, worker camp disturbances, increased traffic and risk of worker and public injury

[1] Cambodia and Viet Nam also participate in the Second Corridor Towns Development Project
[2] :http://www.adb.org/publications/enabling-green-cities-operational-framework-integrated-urban-development-southeast-asia
[3] Updated from Interim Project Report 3-15
[4] Integrated Urban Development

can be managed with standard construction practices and guidelines (e.g., IFC/World Bank 2007).

The civil construction works required for five the IUD subproject components situated on or near the Mekong riverbank in Houayxay require careful soil erosion mitigation to prevent or minimize sedimentation of the river. Standard mitigation measures such as temporary earthen berms, plastic sheet fencing, or in river silt curtains to contain eroded soil can manage that comprehensive construction impact. Potential pollution of the river from solid and liquid construction waste can be mitigated with planned and enforced construction waste management. Similarly, sedimentation and pollution of the Nam Tha river in Luang Namtha from construction of the new bridge can also be mitigated with standard construction design and management techniques.

Potential traffic disruption, noise, and dust caused by the upgrades to urban roads, and upgrades to stormwater and wastewater drains, and ponds in Houayxay and Luang Namtha can be minimized with enforced speed limits, dedicated construction vehicle roads or lanes, scheduled construction vehicle traffic at low urban traffic periods, regular use of wetting agents and coverings over excavated earth, and ensuring all construction vehicles are in good working condition. Public safety can be managed with speed limits, and use of sufficient signage warning of construction sites and activities for all subproject components in both towns. A tree replacement program must be implemented to offset the trees that must be removed for the subproject components with a ratio of 3 trees planted for every tree removed.

The streams and wetland areas that are located below the existing landfill sites in Houayxay and Luang Namtha can be protected during the landfill renovations with berms and plastic fencing to contain soil erosion to the immediate landfill areas. The same mitigation measures to manage air quality, traffic, and public safety should be applied to the renovation of the two landfills in the Houayxay and Luang Namtha. The depth of the water table, groundwater quality, and porosity and soil type at the two landfill sites will be determined with groundwater and soils study during the detailed design phase. This hydrogeological information is needed for the renovations of the landfills.

The influence of waste management practiced by the Thai Waste Recycling Company located on the existing dumpsite property on the design and sustainability of the renovation of the dumpsite to a controlled landfill needs to be investigated at detailed design phase. The influence of present and future waste streams from the production of oil from recycled plastics on the function of the future controlled landfill needs to be determined.

The lake that will form the centre piece of the ecological park in Houayxay must be protected from all development activities with the construction of a temporary, continuous berm and plastic or dense-link fence around the entire shoreline to prevent sedimentation from loose soil, and pollution from liquid and solid waste.

The only perceived induced or potential cumulative impacts of the two subprojects in Lao PDR will be increased natural resource consumption and pollution that could arise directly and indirectly from the subprojects goal of increased socioeconomic development in the towns and surrounding areas. However, overall the subprojects will yield positive impacts on the environmental quality of both towns.

The subprojects in Houayxay and Luang Namtha were screened to be *Low* in sensitivity to climate change due to the inland locations and relatively high elevations relative to the adjacent Mekong River and Nam Tha River. Nonetheless, the rehabilitated river port, and riverbank protection in Houayxay must consider future climate change-induced increases in rainy season levels of the Mekong River. Similarly, in Luang Namtha the foundations and elevations of the new bridge over the Nam Tha River, and the slope and walls rehabilitated and new wastewater ponds and canals must designed to be resilient to increased seasonal flood levels.

Lateral drainage of the renovated landfills in both subproject towns also must be designed to accommodate increases in the frequency and severity of rainfall events. Similarly, the new and upgraded open drains in both towns must be constructed to be able to contain and convey increased flood volumes as a result of climate change-induced increases in rainfall.

The component of both subprojects with the greatest potential for generating GHGs is the renovated landfills due to increased production of methane (CH_4) that will occur from the modernized anaerobic landfill cells. Moreover, the technology to capture and flare, or otherwise neutralize methane produced from the renovated landfills is not included in the feasibility designs which means methane generated as a result of the renovation of the existing dumpsites will dissipate to the environment.

C. Conclusions

The IEE concludes that the description of the feasibility designs of the two subprojects combined with available information on the affected environment is sufficient to identify the scope of potential environmental impacts of the project. Providing that significant changes do not occur to the design of one or more of the subproject components, and that new sensitive environmental or social receptor data are not discovered, that a detailed environmental impact assessment (EIA) of the project is not required.

The EMPs developed for each town subproject provide impact mitigation plans, environmental monitoring plans, and specify the institutional responsibilities and capacity needs for the environmental management of the subprojects. The EMPs will need to be reviewed and updated at the detailed design phase to ensure that they fully address the potential impacts of the final subproject designs.

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I. INTRODUCTION

A. Background to the IEE

1. The Second Greater Mekong Sub Region (GMS) Corridor Towns Development Project (PPTA 8425) is a multi-sector urban development project in Viet Nam, Cambodia, and the Lao PDR. The project is comprised of small urban infrastructure and environmental improvement investments in seven subproject towns in the three participating countries (Figure 1). The project consists of two primary outputs defined by:

1) Strategic Local Economic Development Plans (SLEDP) for the seven towns; and
2) Feasibility stage designs for urban infrastructure investments to improve the environmental quality of the towns, and ultimately, strengthen socioeconomic development.

2. The selection of the urban infrastructure and environmental improvement investments, and the development of the SLEDPs are guided by the ADB Green City Agenda[5]. The seven SLEDPs are presented elsewhere in the main body of the report.

3. The subprojects in the towns of Houayxay and Luang Namtha of Lao PDR are the focus of the IEE presented herein. The IEEs for the subproject towns in Viet Nam and Lao PDR were prepared separately. The country-level IEE reporting structure for PPTA 8425 is the same safeguard reporting structure that was used for the first ADB Corridor Towns Development Project (CTDP) in the same countries in 2012. Table 1 summarizes the subproject components of both corridor towns of PPTA 8425

Table 1. Town subproject components of Lao PDR

Houayxay, Bokeo Province
IUD[6] - Riverbank Upgrading and Protection
IUD - Riverside Road and Walkway
IUD - River Port Rehabilitation
IUD - Ecological Park and Recreation Area
Solid Waste Management
Urban Road and Drainage Upgrading
Luang Namtha, Luang Namtha Province
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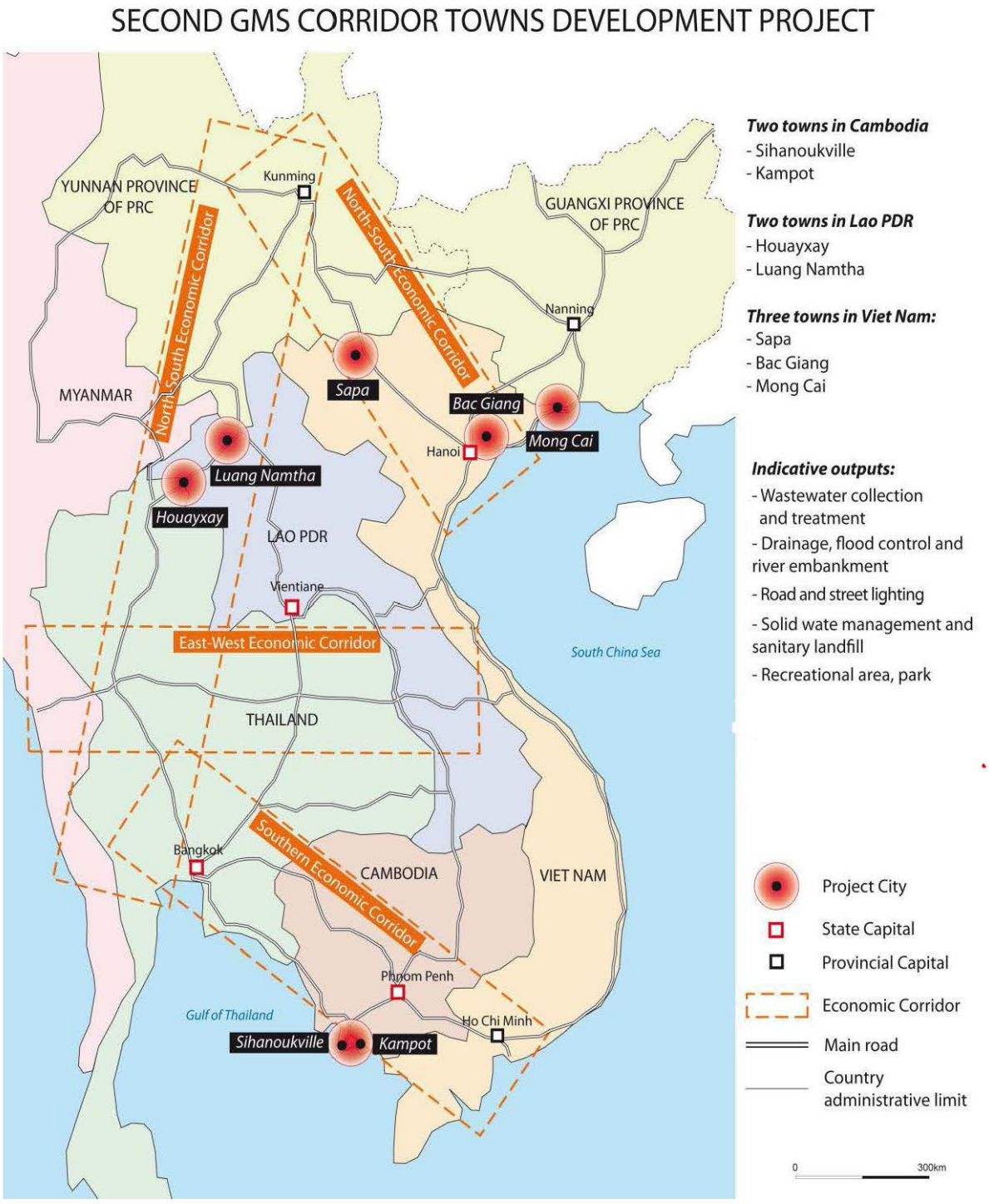
Urban Village Upgrading – Village Upgrading
Urban Roads Drainage
Urban Recreation Facilities Upgrading
Nam Tha River Bridge

[5] http://www.adb.org/publications/enabling-greeen-cities-operational-framework-integrated-urban-development-southeast-asia

[6] Integrated Urban Development

Figure 1. Seven subproject cities of Second Corridor Towns Development Project



B. Assessment Context

4. The project is category B pursuant to ADB's 2009 *Safeguard Policy Statement*[7] and recent good practice sourcebook[8] determined from the initial rapid environmental assessments (REA) of the subproject components which are reproduced in Appendix A. A category B project will have potential adverse impacts that are less adverse than those of a

[7] ADB. 2009. Safeguard Policy Statement. Manila.
[8] ADB. 2012. Environmental Safeguards, A Good Practice Sourcebook, Draft. Manila.

category A project, are site-specific, largely reversible, and can be mitigated with an environmental management plan (EMP).[9]

5. The IEE was prepared for the subprojects in the feasibility design stage using available data and information on sensitive ecological and cultural receptors at the different subproject sites obtained from provincial and national environment agencies and the grey literature. Detailed designs of the subprojects will follow project approval. The environmental management plans (EMP) that have been prepared for the subprojects will be updated where necessary to meet the final detailed designs of the subprojects.

Impact Footprints

6. The subproject components in Houayxay and Luang Namtha are located in established urban and peri-urban areas. Moreover, some subproject component sites already exist such as urban roads and landfills. Thus, the potential environmental impacts of the subprojects will be mostly marginal to the existing impact footprints.

C. Structure of the Report

7. The IEE was conducted and reported by individual town in order to minimize redundancy of background information. The report structure is consistent with and supports the individual subproject EMPs that have been prepared which are based on the results of the IEE.

II. POLICY, LEGAL, AND REGULATORY FRAMEWORK

A. National Environmental Laws, Strategies, and Policies

8. The national framework for the governance of environmental matters of Lao PDR includes a comprehensive set of environmental and natural resources related laws and regulations. Several government agencies are involved in environmental management.

9. In 2011 the Ministry for Natural Resources and the Environment (MONRE) was created by merging the Water Resource and Environment Administration (WREA) with departments of the National Land Management Authority (NLMA) and portfolios of other ministries including the Geology Department, and the Forest Conservation and Divisions within the Ministry of Agriculture and Forestry (MAF). The policies, laws relevant to environmental protection are listed below.

1. Laws

- Law on Environmental Protection No. 02/99/NA (1999)
- Law on Industry No. 01/99/NA (1999)
- Law on Hygiene, Prevention and Health Promotion No.01/NA (2001)
- Law on Water and Water Resources (1996)
- Law on Land (2003)
- Law on Roads (1999)
- Law on Forestry (2007)
- Law on Cultural, Historical and Natural Heritage (2005)
- Law on Fisheries (2010)
- Law on Wildlife and Aquatic Ecology (2007)

2. Strategies, Plans, Policy

- The 7th National Social and Economic Development Plan (NSEDP) (2011-2015)

[9] Footnote 6.

- National Forestry Strategy to 2020 (FS2020)
- National Biodiversity Strategy to 2020 & Action Plan to 2010 (NBSAP*)*
- Urban Master Plan (2001) No. 58/PM
- National Water Resources Strategy and Action Plan [draft]
- Strategic plan on disaster risk management in Lao PDR (2020, 2010) and Action Plan (2003-2005)

3. Climate Change Policy and Programming

- National Strategy on Climate Change (2010)
- National Climate Change Action Plan (2013-2020)
- National Adaptation Programme of Action to Climate Change (NAPA) (2009)
- National Development Socioeconomic Development Plan: Streamlining Climate Change
- National Disaster Management and Climate Change (DDMCC) of the MONRE

4. International Agreements

10. The Lao Government is party to international multilateral environmental agreements. Agreements pertaining to the project are listed below.

- Framework Convention on Climate Change (FCCC), 4 January 4, 1995
- Agreement on The Cooperation for The Sustainable Development of The Mekong River Basin (Mekong Agreement), April 5, 1995
- Convention on Biological Diversity (CBD), September 20, 1996
- Montreal Protocol on Substances that Deplete the Ozone Layer, August 21, 1998
- Persistent Organic Pollutants (POPs), March 5, 2002
- ASEAN Agreement on Transboundary Haze Pollution, June 10, 2002
- Plant Protection Agreement for the Asian and Pacific Region, March 17, 1960

5. Environmental Standards & Criteria

11. National standards and criteria exist for drinking water quality, surface and groundwater quality, soil quality for agriculture, air quality and noise level standards, and wastewater discharge standards for BOD, NH_3-N, TSS, and pH. Specific standards are also available for certain chemical use by factories. The existing standards are found in the National Environmental Standard Order No. 2734/PMU-WREA (2009)

B. National Forest Management Types

12. Some components of the subprojects are located adjacent to forested areas. The three primary forest types or categories with respect to forest preservation and development are defined below[10].

1. Protection Forests

13. Protection forests are forests classified for the function of environmental protection defined by water resources, river banks, road sides, preventing soil erosion, protecting soil quality, strategic areas for national defense, and protection from natural disasters.

a. Activity Restrictions

14. Protected forests are further stratified into *total protected zones* and *controlled use zones.* The *total protected zone* is usually steep sloped, contains water resources

[10] From Law of Forests (2007)

including forests along rivers, roads and other areas with high risk of environmental degradation. These areas must be protected from activities such as crop rotation, cutting, or burning, tree removal, housing construction, extraction of soil, stones, or mining

15. The *controlled use zone* is the forest area without a perceived high risk of environment impacts. These areas must be protected similar to the total protection zone, but people are allowed to use wood and forest products according to the management plan. For example Article 5 of the Forestry Law would apply which indirectly encourages the utilization of forests for research, tourism and recreational purposes.

2. Conservation or Reserved Forests[11]

16. Conservation forests are forests classified for the purposes of conserving nature, preserving plant and animal species, forest ecosystems and other valuable sites of natural, historical, cultural, tourism, environmental, educational and scientific research experiments. Conservation forests exist at the national, provincial, district and village levels.

a. Activity Restrictions

17. Similar to protected forests, conservation forests are divided into zones defined by *total protection zones, controlled use zones, corridor zones and buffer zones.* The *total protection zone* is the forest area that is main habitat, feeding and breeding place for various wild animals and it is the place of diverse and dense vegetation. In this zone, it is strictly prohibited to conduct any forestry activity, to harvest any forest products, including unauthorized entry in this zone. Examples are core zones of national parks or nature reserves.

18. The c*ontrolled use zone* is the forest area adjacent or close to the total protection zone. These areas must be protected similar to the *total protection zone,* but people are allowed to use wood and forest products according to local management plan.

19. The *corridor zones* are managed areas for preserving tracts of forest to provide passage for animals between two conservation forests or between a conservation forest and another category of forest to preserve existing biodiversity and to increase the general wildlife population. In this zone, it is prohibited to cut trees, conduct forestry activities or any other activity that may obstruct or destroy the passage for the animals. The *buffer zones* are managed areas for preventing any encroachment and destruction in the conservation forest.

3. Production Forests

20. Production forests are natural forests and planted forests that are actively utilized for wood production, and for wood and forestry product-related livelihoods to satisfy the requirements of national socio-economic development and people's living.

21. Two other managed forest categories which reflect the overall goal of the Government of forest restoration through community based forest management are *Regeneration Forests* and *Degraded Forests*[12].

4. Regeneration Forest

[11] Conservation forests commonly referred as reserved forests during discussions with agencies and village heads

[12] From NAFRI, 2007

22. Regeneration forest is young fallow forest classified for the purpose of regeneration and maintenance so that it increases in maturity toward a stage of natural equilibrium.

5. Degraded Forests

23. Degraded forest has been heavily damaged to the extent that land is barren without trees. The forest is classified for tree planting and/or allocation to individuals and organizations for tree planting, permanent agriculture and livestock production, or for other purposes.

C. Urban Environment Management

1. Houayxay and Luang Namtha

24. The Urban Development Authority Administration (UDAA) of towns in Laos issues the following regulations for urban planning and management:

- Agreement of keeping good urban environment with the provincial territory no. 295/PG, dated 06/10/2006;
- Agreement of building and construction with municipality No. 296/PG dated 06/10/2006; and
- Agreement on road management and activities subject to urban road No. 297/PG, dated 06/10/2006.
- Agreement on revenue and expenditure of UDA No. 372/PG, dated 05/12/2006;

D. National Environmental Assessment Procedure & Directives

25. Pursuant to the Environmental Protection Law (1999) development projects and operations that have the potential to affect the environment shall require environmental assessment in accordance with the regulations of WREA.[13] WREA is responsible for environmental management and monitoring, and the issuance of an Environmental Compliance Certificate (ECC) as per the Regulation on Environment Assessment No: 1770/WREA (3/10/2000).

26. A Development Project Responsible Agency (DPRA), [which is the Ministry of Public Works and Transport or Executing Agency of the CTDP], conducts the initial environmental assessment in accordance with the Regulation. The DPRA screens the project to determine whether the initial environmental assessment must be expanded into an IEE as specified in Article 9 of the Regulation. A more in depth Environmental Impact Assessment (EIA) may be required if shown to be needed following a review of the IEE as specified in Articles 11, 12, 13, and 14 of the Regulation. A detailed description of the national environmental assessment procedure for Lao PDR is found in Appendix 2. Key directives and regulations for environmental assessment in Lao PDR are as follows:

- Decree of Environmental Impact Assessment (no. 112/PM, February 2010, see below)
- Regulation on Environment Assessment No: 1770/WREA (3/10/2000)
- Manual of Environmental Impact Assessment Procedures for Road Projects in the Lao PDR (1997).
- Regulation and Guidelines for the Environmental Assessment of Road Projects (1999), MPWT.
- Environmental Impact Assessment for Industry and Processing Handicraft Order No. 1222/MIH (2005)
- Regulation on EIA for Road Projects (2004)

[13] WREA now incorporated in the new MONRE

- Decree on Compensation and Resettlement of People Affected by Development Projects (2006) and
- Technical Guideline on Compensation and Resettlement of People Affected by Development Projects (2013)

27. The technical and procedural aspects of above regulations and directives were recently combined into the UNDP-UNEP supported and MONRE-sponsored Environmental Impact Assessment Guidelines for Lao PDR (2012), which has been followed by the *draft* IEE guidelines (2013).[14] The 2012 EIA and 2013 draft IEE guidelines support the recently promulgated Decree of Environmental Impact Assessment (2010).

28. The IEE requirements of the ADB SPS (2009) more than satisfy the current draft IEE guidelines for Lao PDR. Briefly, similar to SPS process, a project is assigned the requirement for either an IEE or EIA depending on project size or complexity. The Lao PDR EIA and IEE process by design is essentially the same but differs by the required level of investigation, and that an EIA requires a formal Scoping and TOR for the EIA be prepared similar to World Bank EIA process. The Lao and ADB IEE follow the same major steps and consist of the same major components. However, the scope of the follow-up environmental and social management plan differs. The EMP of the ADB IEE equals the scope of the ESMMP[15] required of the Lao PDR EIA. Thus, while similar in process the ADB IEE provides more comprehensive assessment and follow-up management.

29. The Lao PDR's environmental assessment process does not dictate a formal timeline for the approval process for a project IEE/EIA, only the series of process steps. MONRE confirmed that there is not a formal timeline for the preparation and approval of an IEE or EIA, but that the normal timeline for the approval of an IEE or EIA as well as a RP and IPP after documents submission to MONRE is approximately 45 days.

E. ADB Safeguard Policy

30. The ADB Safeguard Policy Statement and Sourcebook (ADB 2009, 2012) clarifies the rationale, scope and content of an EA and is supported by technical guidelines (e.g., Environmental Assessment Guidelines 2003). Projects are initially screened (Appendix A) to determine the level of assessment that is required according to the following three environmental categories: Category A for projects that normally cause significant or major environmental impacts that are irreversible, diverse or unprecedented such as hydroelectric dams (an Environmental Impact Assessment is required); Category B projects which have potential adverse impacts that are less adverse than those of category A, which are site-specific, largely reversible, and for which mitigation measures can be designed more readily than for category A projects (an Initial Environmental Examination is required); and Category C projects that are likely to have minimal or no negative environmental impacts. An environmental assessment for Category C projects is not required but environmental implications need to be reviewed.

F. Parallel Environmental Due Diligence of Subprojects

31. The procedures and timing of environmental due diligence (DD) of infrastructure development projects required by Lao government (MONRE) is similar to the environmental safeguard process of the ADB SPS (2009) including IEEs (or EIAs) of both jurisdictions being initiated for the feasibility design stage[16]. However, the preparation of the ADB IEE normally leads due to the imperatives of loan approval, and also because the separate and partially parallel Lao environmental DD benefits from technical elements of the ADB environmental safeguard process.

[14] MONRE 2012, 2013
[15] Environmental & Social Management and Monitoring Plan
[16] Lao PDR, 2012. Environmental Impact Assessment Guidelines, 94 pgs + 11 Appendices

32. The Lao PDR does not require the ADB IEE/EMPs prepared for a project to comply with any specific environmental regulations or guidelines, however, the draft IEE/EMPs must be reviewed by the government for complete approval after the initial review and approval by the ADB. The approval is by formal letter. Throughout the detailed design and implementation phases of the project the ADB and Lao DD occurs cooperatively with specific reference to stakeholder disclosure and consultation. Table 2 summarizes the major DD processes and timelines of both jurisdictions.

Table 2. Summary of environmental due diligence during project implementation

Design and Implementation	Environmental DD and Approvals			Milestones & Notes
	ADB / PPTA	Lao PDR	PMIS[17] / Contractor	
Feasibility design				
Initial stakeholder disclosure & consultation	PPTA	EA[18] assists		
Draft IEEs and EMPs	PPTA			Draft IEEs & EMPs completed
Finalize IEEs and EMPs	ADB review & approves IEE/EMPs			ADB approved IEE/ EMPs as per SPS (2009).
		EA reviews and approves IEE/EMPs		EA approved IEE/ EMPs with formal letter only. ***Compliance with specific GOV / EA regulations not required***
Loan documents (PAM/RRP)	Document preparation, approval by ADB	Review & approval of PAM		Loan approval
Initiation of Lao PDR environmental DD[19]		EA leads with oversight from DONRE		MONRE approved Lao IEE or EIA follows independently after Lao DD begins
Detailed engineering design				
Continued stakeholder disclosure & consultation		IA/PIU[20] lead	ES[21] support to PMIS	As per PCP (2012)[22] stakeholder disclosure and consultations continue throughout construction phase coincident with initiation of GRM[23]. ***Also satisfies consultation requirement of Lao[24].***
Update EMPs		Support to ES	Lead by ES	Approval of updated EMP by EA and ADB
Tendering / contract award				

[17] International Project Implementation Management Support Consultant (see Environmental Management Plan EMP)
[18] Government assigned Executing Agency of project (see EMP)
[19] Footnote 16
[20] Project Implementation Agency assigned by EA (see EMP) with supporting Implementation Unit
[21] International and national environment specialists of PMIS (see EMP)
[22] ADB Public Communication Policy (2012)
[23] Grievance Redress Mechanism (see EMP)
[24] Footnote 16

Design and Implementation	Environmental DD and Approvals			Milestones & Notes
	ADB / PPTA	Lao PDR	PMIS[17] / Contractor	
EMPs included in tender documents		Lead by EA/IU	Support by ES	
Tenders let and bids prepared		Lead by EA	Contractor drafts CEMP[25]	CEMPs prepared and included in contractor bids
Construction packages	Input from ADB		CEMPs reviewed by ES/PMIS	Construction package awards
Construction & supervision				
Implementation of mitigation and monitoring plans		Support from IU/PIU	By contractor with support from ES	CEMP implemented by contractor, other aspects of EMP overseen by ES
Continued stakeholder disclosure and consultation		IA/PIU lead	Support from ES	As part of GRM
Monitoring reporting	To ADB	IA/PIU lead preparation of regular reports to ADB	Support from ES	Reports provide input for review missions

III. SUBPROJECT DESCRIPTIONS

33. The selection of the subproject components for Houayxay and Luang Namtha are based on the Strategic Local Economic Development Plans (SLEDP) for both towns from the main PPTA report, which embodies the theme of the greening of affected urban environments, vis-à-vis, ADB's Green City Agenda. Coupled to the objective socioeconomic-based urban infrastructure developments is the opportunity to improve and rehabilitate the natural urban environments.

34. The descriptions of the subprojects in Houayxay and Luang Namtha from Table 1 are presented below[26] which are updated from the ADB fact finding mission. Subproject components that share similar activities or are located in the same area are combined in order to minimize redundancy in the IEE.

A. Houayxay

The major components of the subproject in Houayxay are shown in Figure 2.

1. Integrated Urban Development

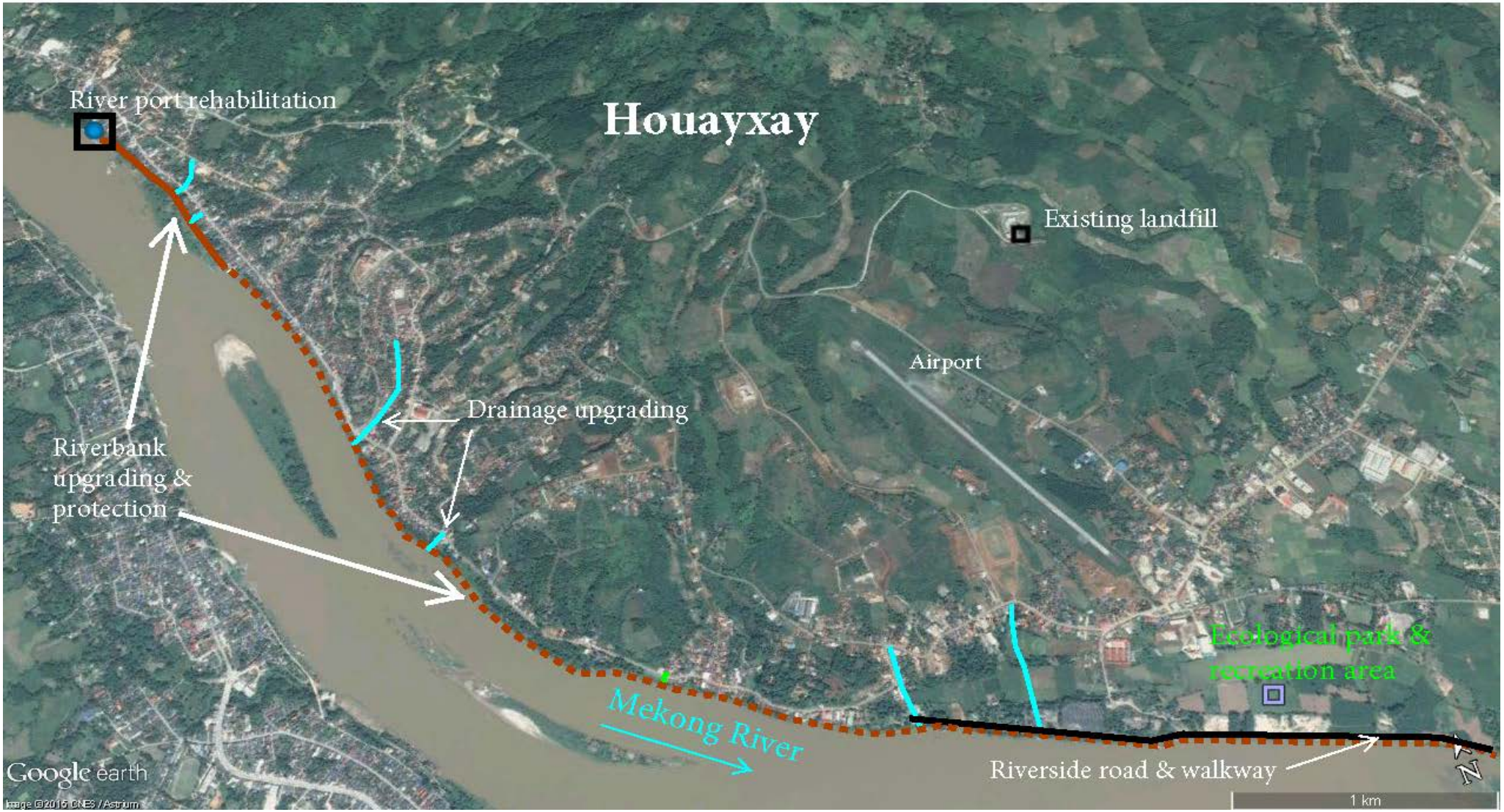
a. Riverbank Upgrading and Protection

35. There is currently no riverbank protection in Houayxay. Erosion during the wet season is removing parts of the embankment and undercutting foundations of some houses in the town centre area. Some individual areas to the south of town towards the border bridge are also under erosion and require protection.

36. The riverbank will be protected in two areas delimited by a continuous section in the town centre (Figure 2), and a second longer section from the town centre down river to the international border bridge. Several options have been considered for both sections as follows:

[25] Construction Environmental Management Plan based on EMP in tender documents (see EMP)
[26] Updated from fact finding mission 4/15

Figure 2. Locations of major subproject components in Houayxay



Town centre section:

- a protection embankment along existing riverbank at town centre downstream to end of main town area at local Houayxay-Chiang Khong ferry terminal that is graded above current seasonal flood levels using imported fill from the main port area.

- a similar protection embankment as above but using the river island next to the town centre as fill material.

- A protection embankment along an alignment behind the river island with land reclamation that connects island to the town and provides an accessible recreational area.

Downstream section:

- a continuous section of protection embankment along existing riverbank alignment continuing downstream from end of the proposed *town centre section* to international bridge that would be graded above seasonal flood levels using imported fill.

As above but with discontinuous short sections of bank protection for specific areas identified as vulnerable to erosion.

37. For the town centre section the selected option is to construct an embankment from the main river port downstream towards the edge of the main built up area, ending at the local Houayxay-Chiang Khong ferry terminal. The style of embankment proposed is similar to the embankment constructed just north of Houayxay at the Kings Roman casino in Tonpheung district, but finished with the type of interlocking paving with a central hole in each unit that can be planted, to provide a green appearance. A 2m wide footpath will run along the top of the embankment.

38. For downstream section between the international border bridge and the town centre the proposal is to use a more flexible “green” approach with short sections of riverbank protection provided where needed, but not along the full length of riverbank. Particular protected sections needed are at the southern end of town next to buildings that are close to the river. The exact locations of the short sections will be confirmed during detailed design stage.

39. The total length of embankment protection proposed is a maximum of 1.5 km with a 1km section through the town centre and an allowance of 500m for shorter sections south of the town centre area. Materials for forming the riverbank protection must be imported and not sourced from the river for environmental reasons.

a. Riverside Road and Walkway

40. There is no riverside road to the proposed ecological park and recreational area. There is an existing sealed two lane road from the border bridge to the town centre running parallel to the river about 1km inland which joins the existing riverbank road about half way between the bridge and the northernmost end of town.

41. Now that the border bridge is open, and the land between the bridge and the Houayxay town is slowly being developed, a second riverside road with walkway is proposed to link Houayxay to the bridge. The second riverside road has been divided into two phases with Phase 1 being considered for the subproject component. Phase 1 will link Ban Thinthad on the edge of the town to the proposed ecological park. Phase 2 would continue the road south to the border bridge. The proposed road and footpath will be 9m wide with drainage, footpaths, street lighting, and paved with a bitumen surface (Figure 4).

Figure 3. Continuous town centre riverbank protection options

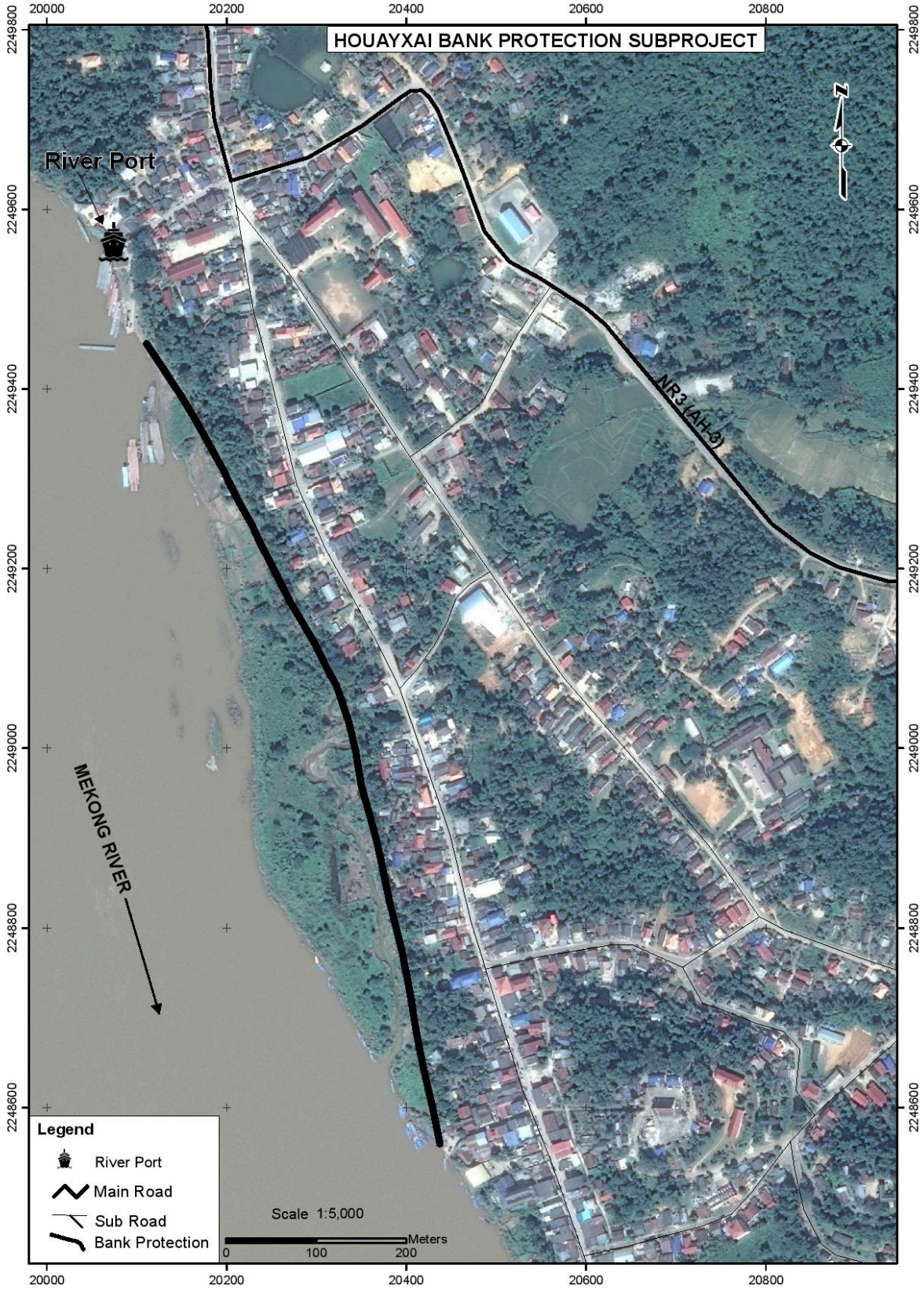
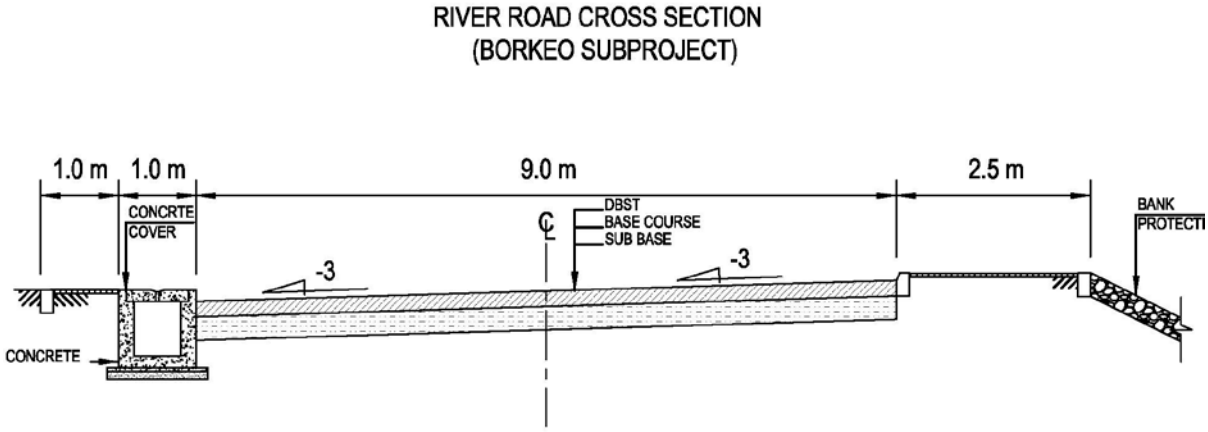


Figure 4. Cross section of river road in Houayxay



b. River Port Rehabilitation

42. The port is used for tourist boat travel to Pakbeng and Luang Prabang, and local trade boats crossing to Chiang Khong, Thailand including some larger commercial trade boats. Currently more than 30 big boats and 25 small speed boats per day use the port in addition to cross border trade boats (Figure 5).

43. The current facility consists of a concrete ramp from the main street down to low water level, with limited parking at the top of the ramp. Vehicles often park at the side of the ramp which limits access. Boats dock at either side of the ramp and are accessed only by wooden planks across natural riverbank on the downstream side and a concrete bank on the upstream side. There is no turning space on the ramp. Access to ticket offices and port management office is by makeshift steps up the riverbank.

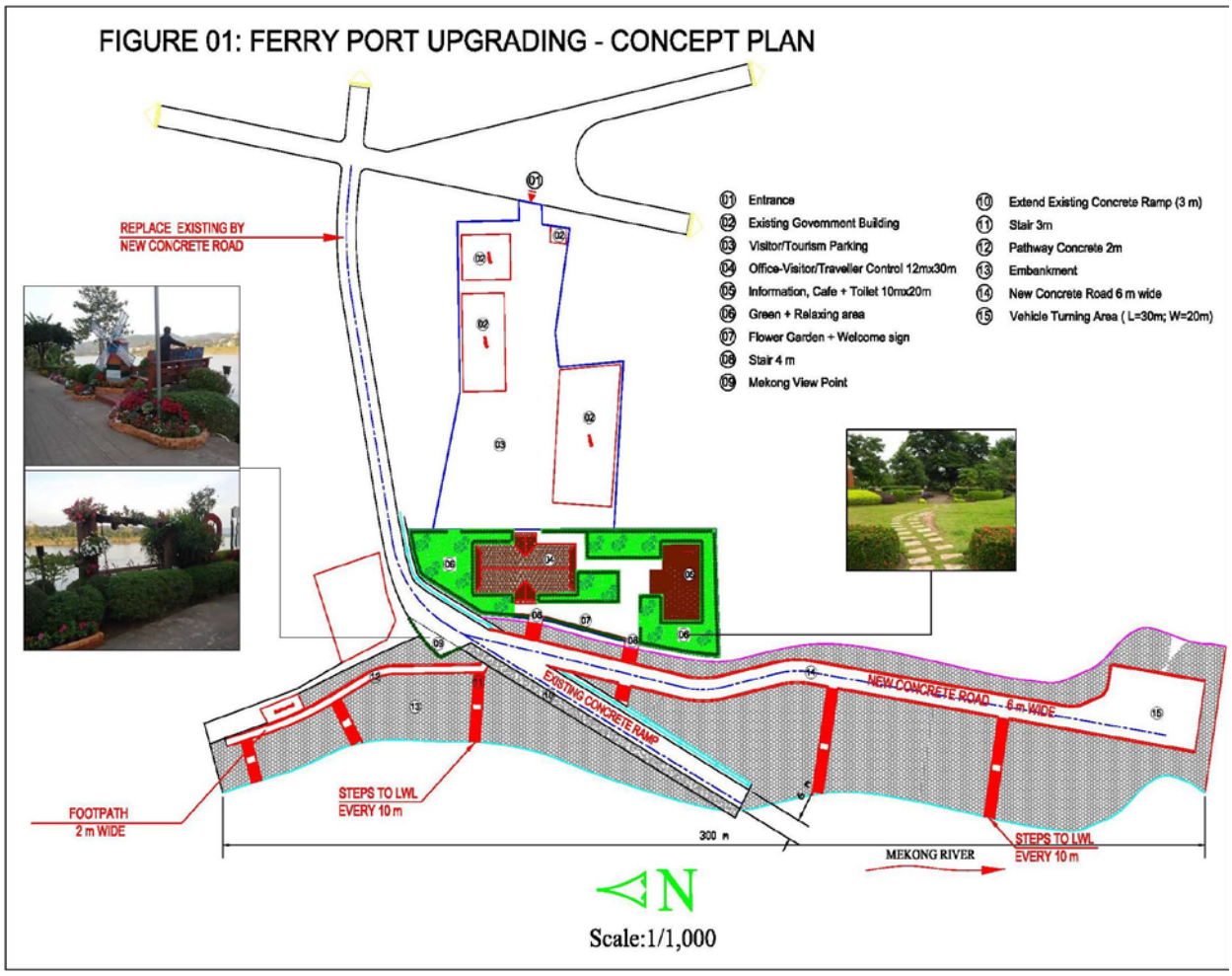
The current port which was established when boat traffic was much less now requires formal planning, and designated areas for local and provincial boat traffic. The provincial government examined the option of relocating the port outside of town, but decided to retain the current location and rehabilitate the existing port. This decision was due to logistical problems with relocating the port 5 km down river. The new location would be inconvenient for tourists who already have to pay for transport into town across the new border bridge, and would cause problems with Thailand from significantly increasing the distance between the two opposing international ports. Further, the town has developed around the current

Figure 5. Existing river port in Houayxay

port, with guesthouses, restaurants, and shops serving the daily movement of tourists through the port. Relocating the port would also relocate the business on which the port tourist facilities depend.

44. For rehabilitation the tourist boats Luang Prabang will be separated from the commercial boats. Concrete embankments will be constructed on both sides of the existing main access road down to the boat area with the concrete access road widened, and extended south beyond port area with parking and turning area added (Figure 6).

Figure 6. Plan of rehabilitated river port in Houayxay



45. The extended access road and surrounding public area will be linked to the northern end of the riverbank protection subcomponent (Table 1). From the access road down to the low level mark of the river a concrete embankment with wide steps will be provided down to the boats, and extending up to the main road inland of the port. The existing customs and ticketing buildings will be removed and replaced with a new single building developed as a “one-stop-shop” area.

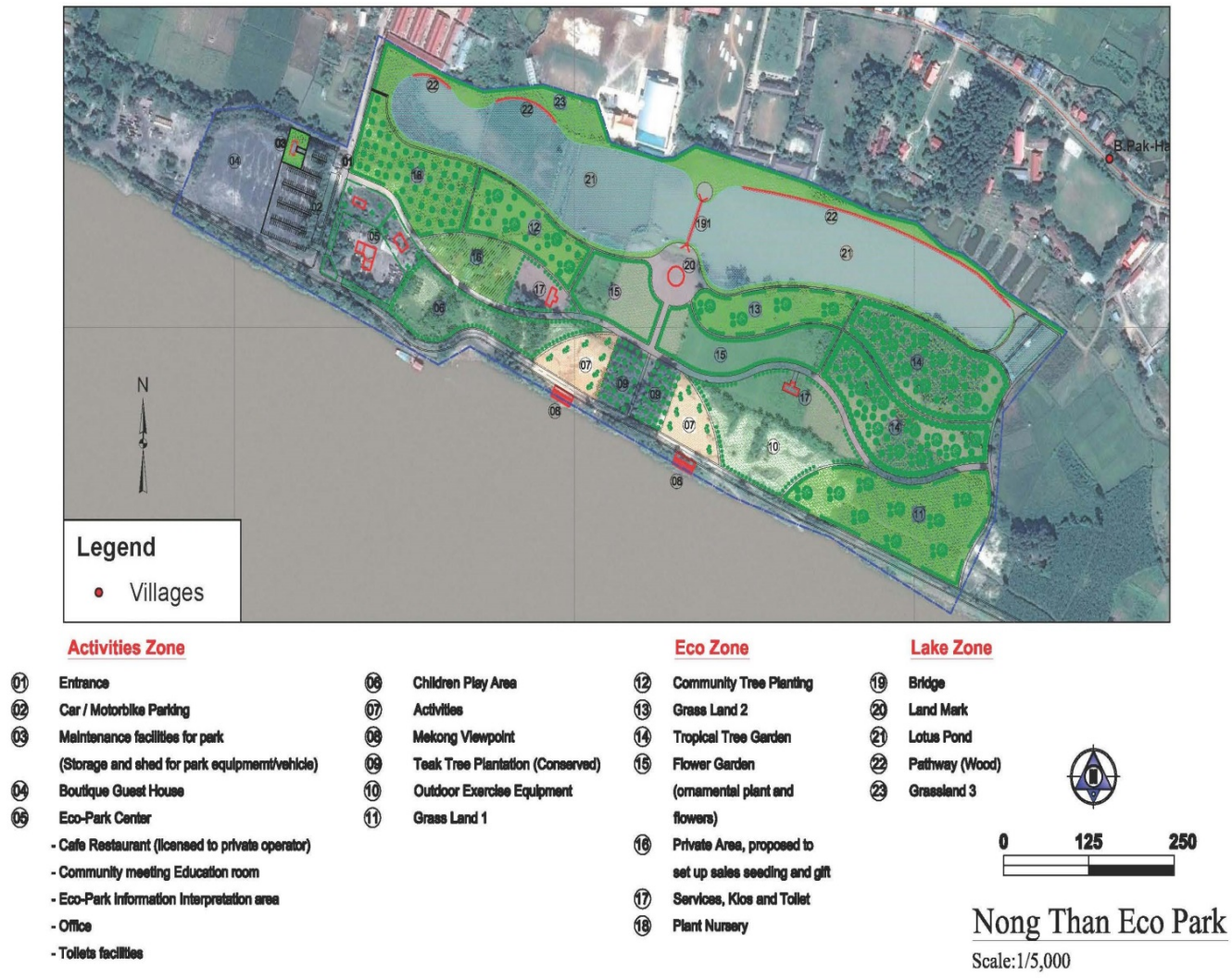
c. Ecological Park and Recreational Area

46. The area for the park presently consists of a pond surrounded by pasture on south and west sides, buildings, restaurants, and a school on the east side, and paddy to the north.

47. Provincial authorities have reserved 4.5ha of land to develop the area (Figure 7). The park will be designed as an informal recreational facility including footpaths, tree planting, landscaping, boardwalk, fishing, and seating areas. A car park will be located on the north side of park. Land along the riverfront will be set aside for a future guest house or boutique

hotel development. A sprinkler system with buried pipework will be included for dry season irrigation.

Figure 7. Plan of ecological park and recreation area



2. Solid Waste Management

48. The Urban Development Administration Authority (UDAA) is responsible for collection and dumpsite management. In 2009 a Thai company developed a facility on the site to produce biodiesel from recycled plastic and tyres. Currently there is no sanitary landfill, no treatment of waste, and no leachate storage, and thus, the landfill today is operating as an “uncontrolled dump site”.

49. However, the 8 ha dump site was originally designed and commissioned in 2008 with a series of cell layers, access road, leachate ponds, and site drainage. The Thai company took over and built around half of the original dumpsite. Today the lower levels of the original dumpsite are no longer accessible in the wet season, and the original site drains, leachate ponds, embankments and septage treatment facilities were either removed or damaged. Only 2.4 ha remains of the original site with the remainder being used by the Thai company.

50. About 43% of households in town are reported to have waste collected. Many households in town currently throw solid waste into streams or onto vacant land. There is inadequate equipment to manage solid waste, and no full time responsible person is present on site to coordinate placement of waste, collect fees, and manage waste pickers.

The UDAA does not receive any income from tipping fees, or from the Thai company, and reportedly, are in a deficit every year.

51. Restoration of the existing dump site is proposed followed by upgrades to a functioning "controlled landfill". Design of the landfill will include clay lining of cells, groundwater monitoring, planned cell development, protective embankment, leachate collection and storage, surface water management, regular covering of waste and controlled waste picking. Leachate storage will occur in a lined pond sized to accommodate rainfall, which will include a small submersible pump and pipe to re-distribute upper settled layers of leachate back over the cells in the event of the pond approaches capacity. Existing waste which is currently scattered all over the site will be consolidated into a single cell, compacted in layers and covered with earth.

52. The target catchment for collection will be all 17 urban villages in Houayxay. An operator office is proposed close to the entrance. An incinerator house for infectious waste (from hospital), and special fenced pit for toxic and hospital waste are also proposed.

53. The 1.47 km access road to the dumpsite will be improvement, widening to 6m, and sealed including provision of a 100m detour to avoid a proposed new storage depot. Four vehicles (compactor truck (5-8 m^3), waste dump truck (8m^3), detachable container truck + 10 containers (5m^3), and soil dump truck (6m^3) with excavator bucket 0.6m^3 bucket) will be provided. An integrated public awareness campaign and capacity building for both waste collection and management are crucial for the success of any further investment into solid waste management and will need to be ongoing for the initial years of operation.

3. Urban Road and Drainage Upgrading

a. Road drains

54. Most existing urban roads outside of the town centre are compacted gravel and sand without roadside drains. Some roads have drains but are inadequate for collecting and transporting water. The two elements of this subproject component are a) improved urban roads with side drains and street lighting; and b) new drains for existing urban roads. From the DPWT preliminary assessment 19 urban villages require road upgrades totaling 15.25 km. For the subproject 8 alignments are proposed totaling 7.22 km. A total of 7 new or upgraded drains are proposed for existing urban roads. The 8 proposed roads to be upgraded are listed in Table 3, and Figure 8 shows a cross section of a road. Table 4 lists the 7 urban roads for which new or upgraded drainage will be provided by the subproject, and Figure 9 shows an example upgraded road drain.

Table 3. Proposed road alignments to be upgraded by the subproject.

Road ID	Length (km)	Cost estimate ($)
UR1	0.54	375,302
UR2	1.27	882,802
UR3	0.27	187,682
UR4	0.2	139,024
UR5	0.61	423,883
UR6	2.09	1,452,320
UR7	0.61	423,883
UR8	1.63	1,293,723
Total	**7.22**	**5,178,630**

Table 4. New or existing drains to be upgraded by subproject.

Drain ID	Length (km)	Cost estimate ($)
D1	0.63	352,919
D2	3.24	1,816,661

Drain ID	Length (km)	Cost estimate ($)
D3	3.52	1,972,253
D4	0.73	408,525
D5	0.6	336,332
D6	0.19	106,133
D7	0.92	514,396
Total	**9.83**	**5,507,220**

Figure 8. Example cross section of an upgraded road in Houayxay

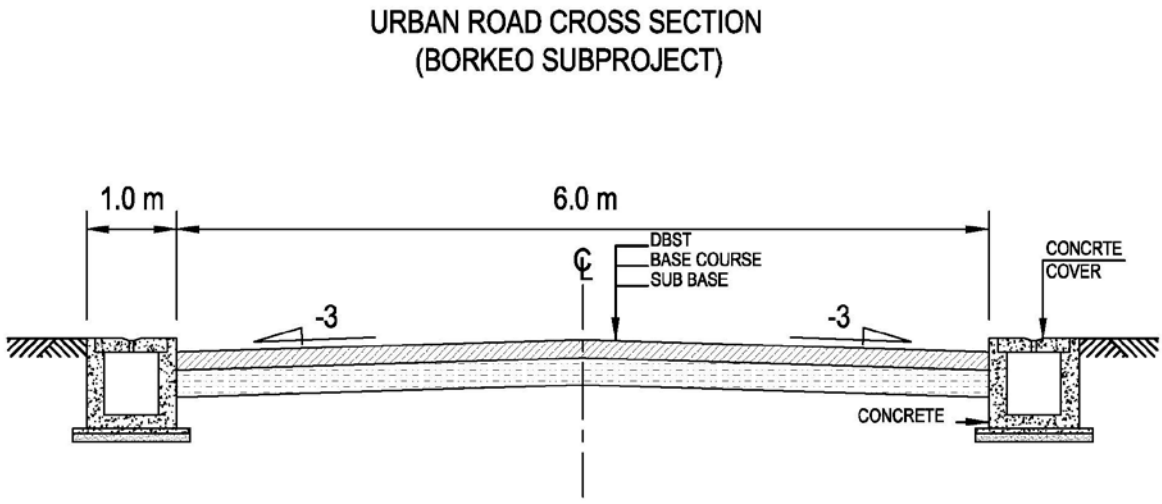
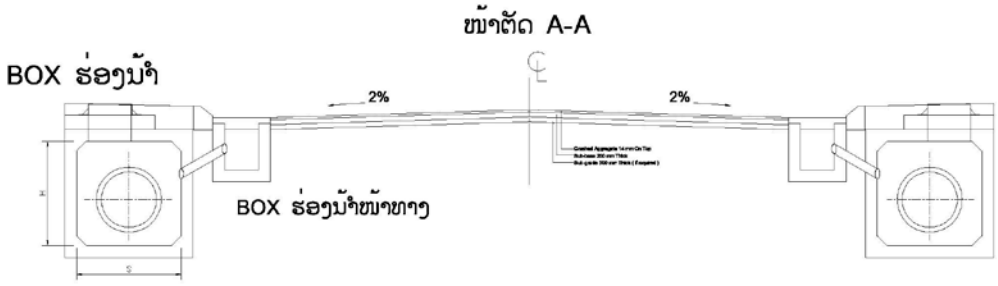


Figure 9. Example upgraded road drain for Houayxay.



b. Wastewater/Stormwater drains

55. No information is available on the number of septic tanks being used in Houayxay. Most households have some kind of primary treatment, either a septic tank or wet pit latrine (soakaway). Effluent from these septic tanks or latrines flows to 10 small watercourses through town either directly or indirectly which deliver the wastewater to the Mekong river.

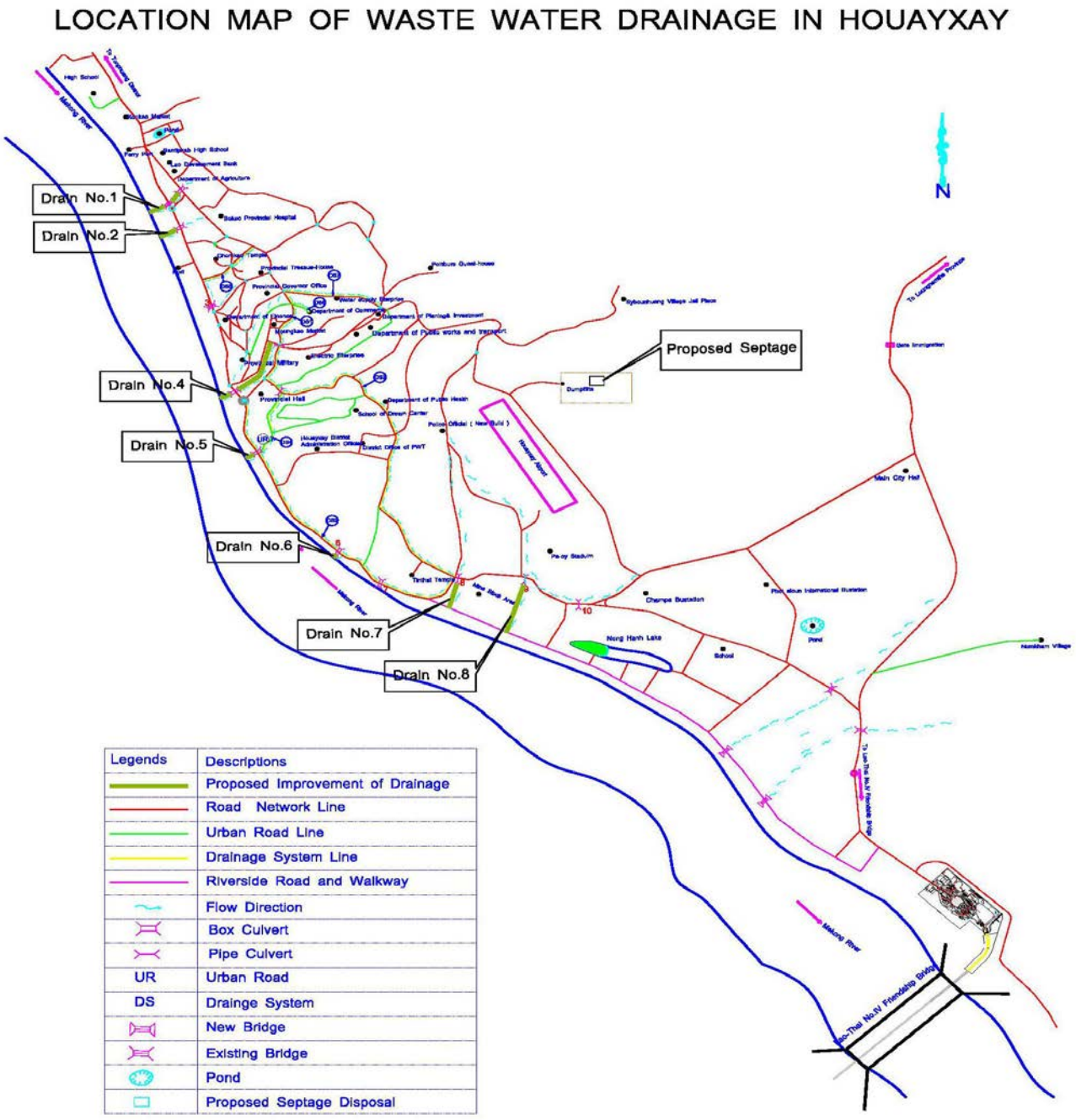
56. Rehabilitation of 7 of the 10 open, combined wastewater/stormwater drains to the Mekong river will consist of installation of culverts and wingwalls for passing under main road (Figure 10). The remaining 3 drains have already been rehabilitated by the province.

57. A centralized wastewater treatment plant would require extensive pumping and is both technically inappropriate and expensive to operate. There is little to no space for aeration ponds where the wastewater enters the Mekong river which would also produce odour in the middle of town and close to houses. While disposal of wastewater (with primary treatment) directly to the river is far from ideal this is common practice for all other towns on the Mekong river. There no viable alternative for Houayxay with its topography and lack of

open space. Emphasis will be placed on improving primary treatment through a public awareness campaign and provision of new septic tanks to poor households. The subproject includes:

- Dredging and formation of open drain boundaries with stone masonry.
- Repair of culverts and wingwall structures under the main road as identified.
- Initial survey of septic tank coverage
- Septic tank promotion/subsidy scheme as required
- Provision of free septic tanks to poor households
- Public awareness on septic tank use and maintenance
- Design & construction of septage treatment facility for Houayxay at solid waste site
- Provision of 1 vacuum truck for UDAA

Figure 10. Wastewater drains to be upgraded, and road network in Houayxay



B. Luang Namtha

58. The locations of the major components of the subproject in Luang Namtha are shown in Figures 11 and 12.

Figure 11. Subproject area of Luang Namtha delimited by landfill, and park

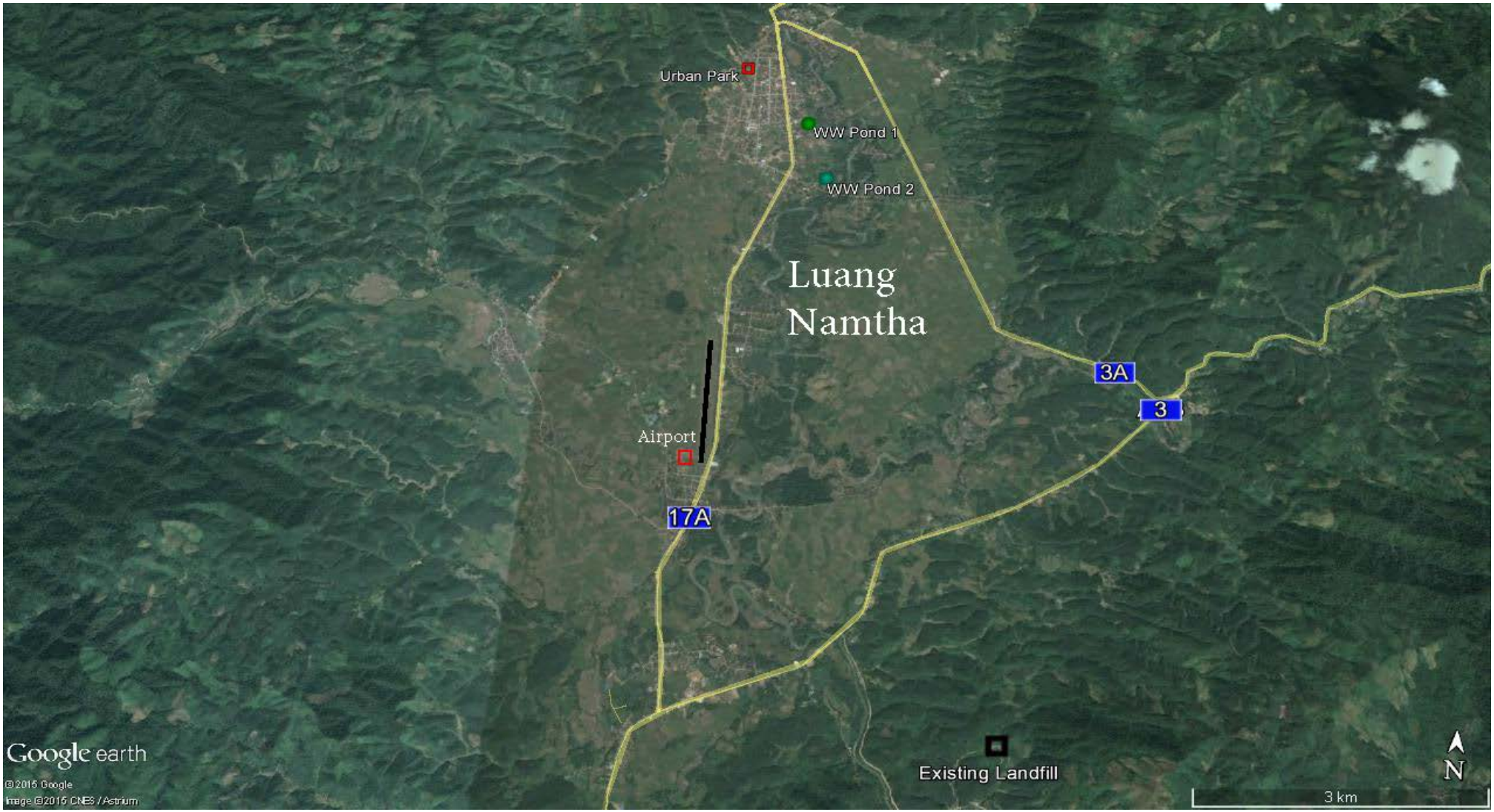
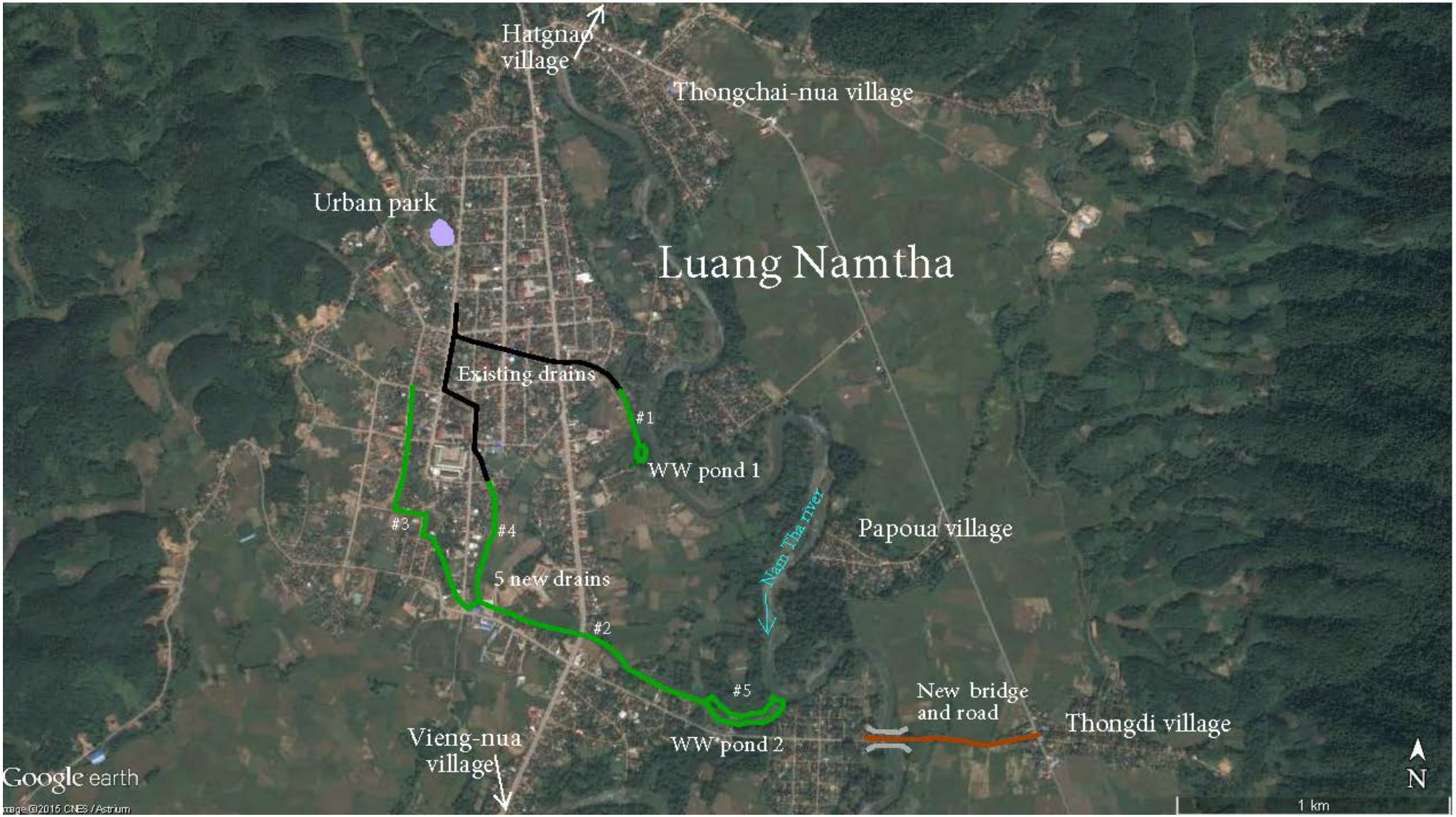


Figure 12. Demonstration villages, WW ponds & drains, and new road & bridge



1. Solid Waste Management

59. The municipal dump site is located at southern edge of town in Ban Mai, about 6.5 km from old Namtha The terrain is hilly, and the access road is muddy in the wet season with no maintenance conducted on site. The landfill was developed under a previous ADB project and included landfill cells, leachate ponds, septage disposal, and vehicles. The site covers 15.7 ha of which 3 ha was developed as the landfill site.

60. Only 22% of villages in Luang Namtha district have solid waste collected which is from 17 of the total of 78 urban villages in the District. Of these 17 villages only 55-60% of households use the collection service. The Urban Development Administration Authority (UDAA) is responsible for solid waste management. Current waste production is about 36 tonnes per day based on 0.65 kg/person/day, of which approximately 18-20 tonnes/day is collected and transferred to the dump site. The fee is 15,000 kip/month collected by the truck drivers in return for a commission. Two new and two old trucks belonging to UDAA are used to collect solid waste. The tractor that was provided by the ADB project built the current dumpsite. A septage disposal facility will be included on the site as part of the Wastewater Treatment and Drainage Improvement component.

61. Similar to Houayxay subproject a rehabilitated, controlled landfill at the existing dumpsite is proposed that will not be as advanced as a sanitary landfill, but will be managed more than the current uncontrolled dump. Design of the landfill will include clay lining, groundwater monitoring, planned cell development, leachate collection and storage, surface water management, regular covering of waste and controlled waste picking.

62. An on-site operator office is proposed along with an incinerator house for infectious waste (from hospital), and special fenced pit for toxic and hospital waste are proposed. Improvement of the access road to the dump site will occur along with provision of 4 landfill vehicles (compactor truck (5-8m^3), waste dump truck medium size (8m^3), detachable container truck + 10 containers (5m^3) , and soil dump truck (6m^3) with excavator bucket 0.6m^3). An integrated public awareness campaign and capacity building for both waste collection and management are crucial for the success of any further investment into solid waste management and will need to be ongoing for the initial years of operation.

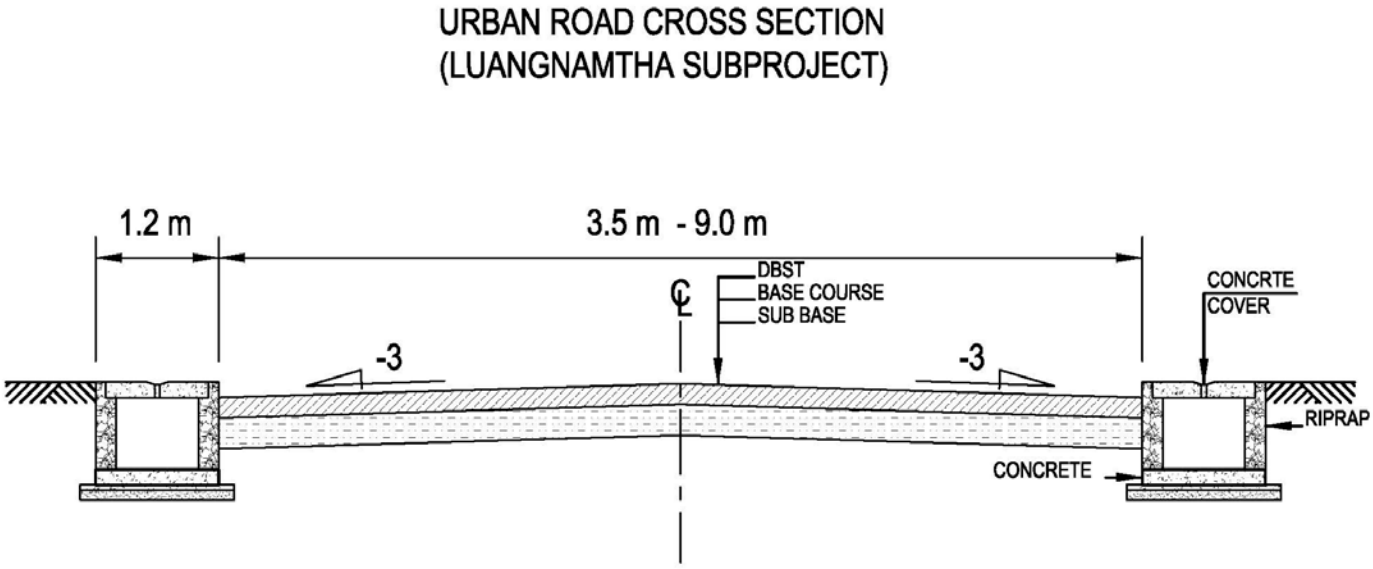
2. Urban Village Upgrading Demonstration

63. The villages making up Luang Namtha typically have dirt roads with no formal drainage which causes problem flooding in some areas every wet season. Newer houses generally have septic tanks but older houses still use pit and soakaway latrines. The urban villages are characterized by poor infrastructure and constraints to social development or employment opportunities. There is a potential capacity for engagement in small scale employment opportunity centred on ethnic‘ related products which require support and credit facilities to access markets.

64. There were initially 12 villages selected by the province for the subproject component. The five priority “ demonstration” villages of Vieng Neua, Hat Gnao, Thonchay Neua, Papua and Thondee (Figure 12) will form the subproject component. The scope of the component will be infrastructure upgrading to include road improvements, new drainage, provision of septic tanks and landscaping. Under the SLEDP a further proposal is livelihood support for community based

enterprise development, acknowledging the potential of women in employment, including improved credit facilities. An example cross section of upgraded road is shown in Figure 14.

Figure 13. Cross section of upgrade road in Luang Namtha

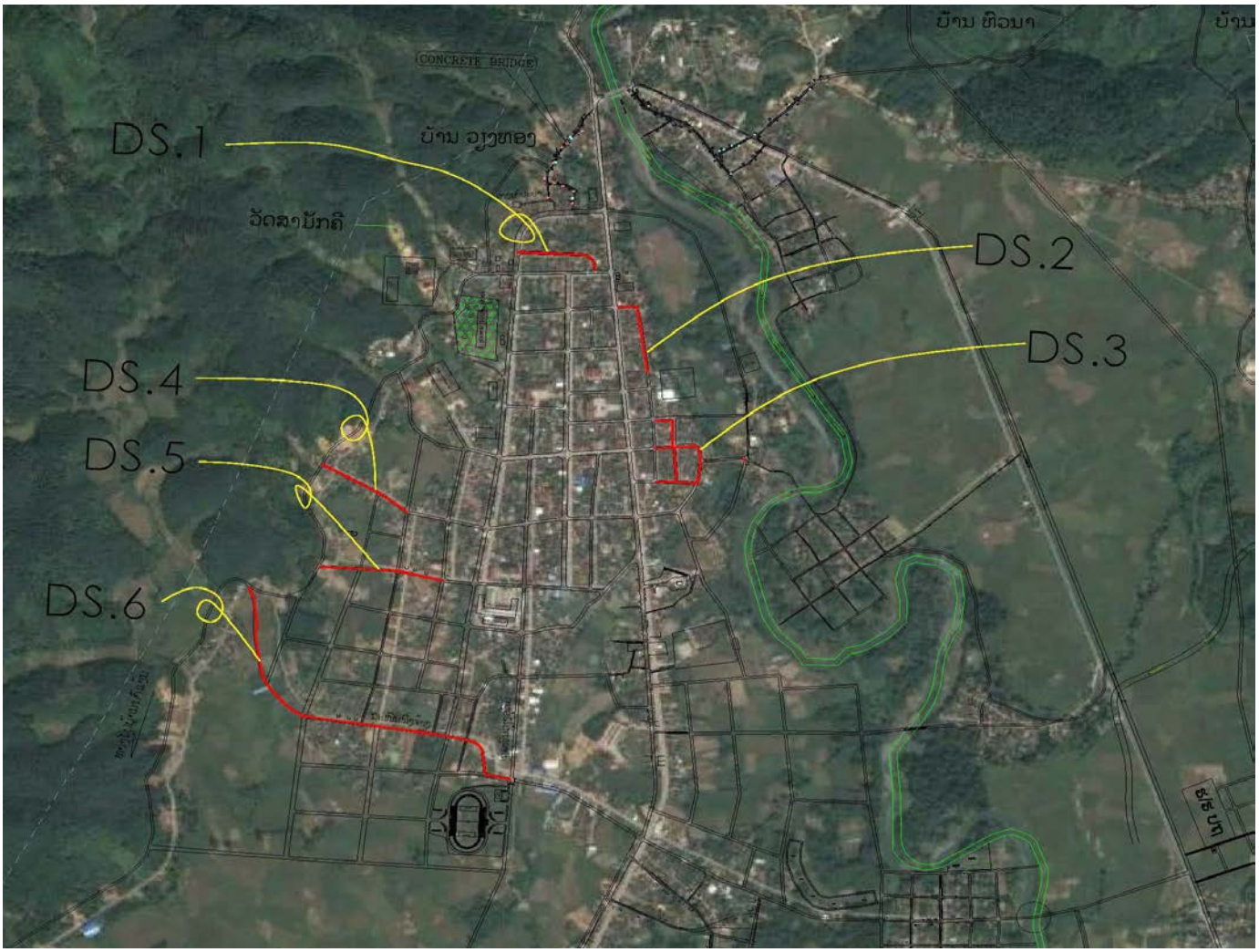


3. Drainage

a. Road drains

65. Currently there is currently little or no road drainage especially in old Namtha. Stagnant water carries waterborne disease and ponding causes road damage. The subproject will construct 2.6 km of double sided urban road drains for a total of 6.53 km of road drainage in areas selected by the province (Figure 15). A total drain length of 11.9 km was initially requested by the province, but this request included 5.37 km of village drain improvements which is included in subproject component 3. The drain type selected is box culvert.

Figure 14. Road drains to be upgraded in Luang Namtha



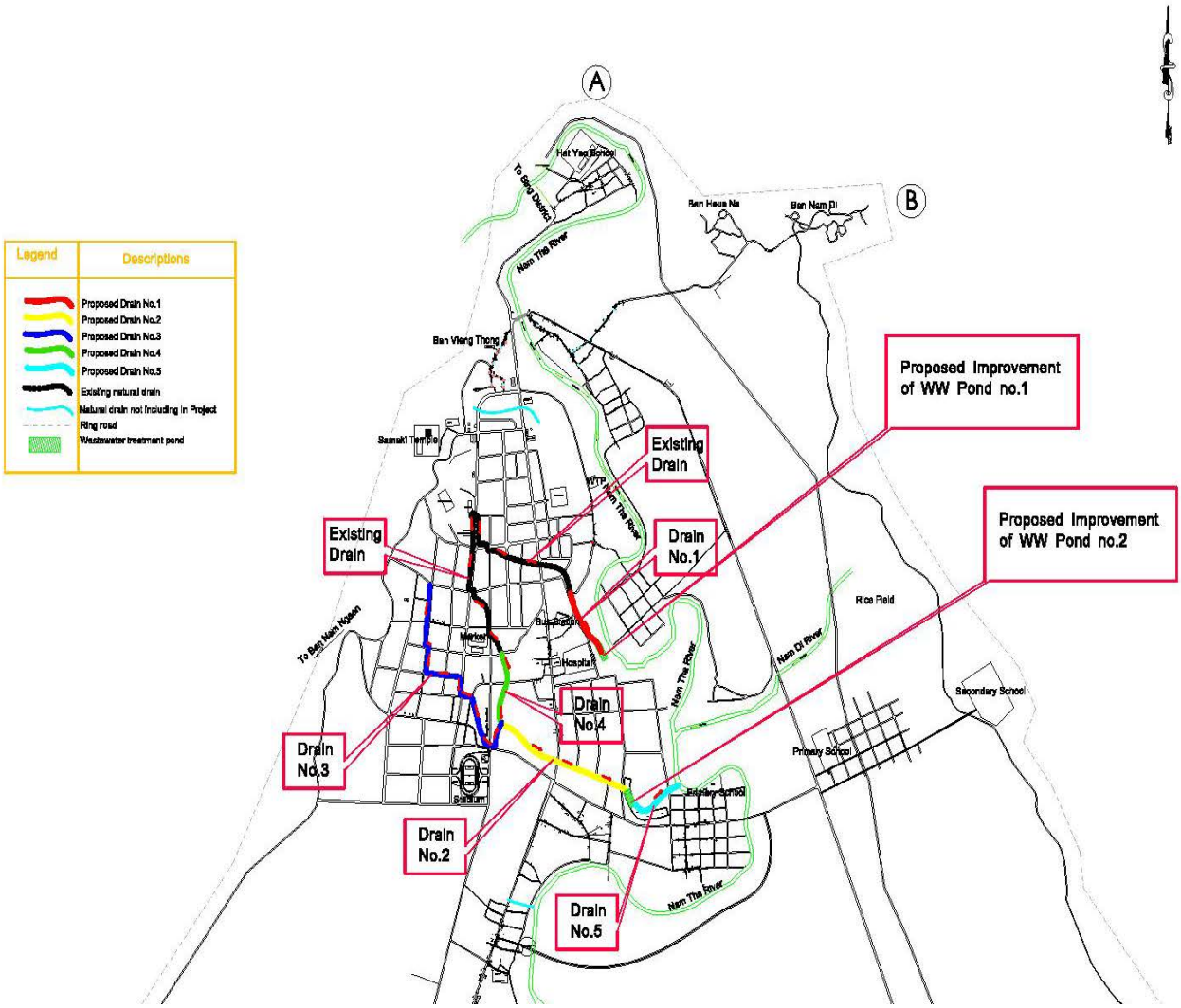
b. Wastewater collection improvements

66. Currently there is no wastewater treatment in Luang Namtha other than some septic tanks and soakway latrines. Government and private vacuum trucks offer septage removal from the tanks which is disposed directly to the environment either on rice paddy or rubber plantation land. There was a septage disposal area at the existing solid waste dumpsite which is now inaccessible due to dumped garbage, and not been used for over a year.

67. Storm and grey water currently flows to the low lying areas and generally makes its way to the Nam Tha river via some drains, ponds and rice field areas. There are two main pond and low lying areas that receive combined wastewater and stormwater in the town. Area #1 is actually a rice field area behind the hospital (Figures 12 and 13) which receives drainage from the bus station and surrounding villages. The main inlet is along the hospital access road.

68. Pond #2 an actual pond formed from an oxbow of the Nam Tha river that was cut off causing the river to follow a more direct route south. This length of isolated waterway –"pond" -

Figure 15. Wastewater ponds and drains in Luang Namtha



has been divided into approximately 12 sections with earthen banks with one used as buffer storage for combined wastewater from surrounding villages. The inlet is a stream that flows from the southern end of the town centre area with the outlet to the river via a channel with flow controlled by sandbags.

69. Both drainage areas have had samples taken in November 2014 and tested in the National Environmental laboratory in Vientiane, and show levels of coliforms under the accepted limit for surface water quality. A lined septage storage facility is proposed at the solid waste dump site, for septic tank sludge. The existing facility may be upgraded (see below).

4. Urban Recreation Facilities Upgrading

70. Currently a landscaped urban park in the town does not exist. The area of land used during festivals lacks the required features for the area to be used as a public recreational facility. The current market has open uncovered seating in a square outside, with a basic covered area behind to house handicraft stalls.

71. Local authorities have reserved land for a recreation area for local residents and tourists. The proposed location will link the inner stadium, Wat Samakhi and Thad Luangnamtha. The proposed preliminary design (Figure 16) retains a predominantly grassed area with paved footpaths, tree planting for shade, seating areas and planted feature gardens. Toilets, a kiosk, and a restaurant are proposed with landscaped features such as a water fountain, petanque courts, outdoor gym equipment and a childrens play area. The existing bandstand will be demolished and future festival events held at the stadium. Also proposed is to renovate or replace the existing sports hall next to the park area.

Figure 16. New recreational park in Luang Namtha

72. The existing night market on the main street of the town will be upgraded with a better toilet block, washing areas for stallholders, floor surfacing and improvement of the handicraft area behind the food stalls.

5. Nam Tha River Bridge

73. There is a dry season ford in the Nam Tha river near Donsamphan village that is used by pedestrians and motorbikes as a short cut to Road 3A 400 m east at Thongdi village on the east side of the river. There is an existing bridge near Viengthong village a few km to the north of Donsamphan but this bridge was built in 1972 and not considered able to carry heavy loads such as trucks.

74. The proposed new bridge will span the Nam Tha river near Donsamphan village (Figure 6) with approximately 400m of new road connecting the bridge to Road 3A at Thongdi village (Figures 12 and 17). The bridge will provide a safer crossing point for heavy goods vehicles and local traffic.

Figure 17. New road and bridge over Nam Tha river

6. Associated facilities

75. There are no existing or future facilities that are or will be associated (ADB SPS 2009) with any of the subproject components in both towns.

IV. DESCRIPTION OF AFFECT ENVIRONMENTS

76. The description of the affected environments focuses on site-specific environmental features that could be affected by the subprojects in Houayxay and Luang Namtha, and the environmental features that could possibly influence the successful implementation and

operation of the completed subprojects. Supplemental provincial information is provided as for required for context only.

77. The environmental baseline information provided herein was obtained from existing reports and grey literature provided by the provincial environment agencies including the DONREs, and Fisheries sections of the Departments of Agriculture and Fisheries (DAFF). Discussions with their national agency counterparts in Vientiane also provided additional information where relevant. The description of affected environments focuses on natural features and land use. The potentially affected social, economic, and demographic features of the subprojects is provided in detail in the social impact reporting for the DFR.

A. Northern Laos

78. Lao PDR is 236,800 km^2 and situated in the centre of the South East Asian peninsula between 13°54' and 22°30'N and between 100°05' and 106°38'E. The landlocked country which extends approximately 1,000 km at its longest length in a northwest to southeast direction is bordered by Cambodia in the south, Thailand and Myanmar in the west, the Peoples Republic of China (PRC) in the north, and Vietnam to the east.

79. Northern Laos is broader than southern Laos with a northern width approaching 470 km. Bokeo province in which Houayxay is located and Luang Namtha province in which Luang Namtha is located form the northwest country boundaries with Thailand, Myanmar, and China. Two primary physiographic regions exist[27] in northern Laos which are defined by:

80. Northern Highlands. Consist of severe mountainous terrain between 500-2000m with only 6% of the area with a slope of under 20% with half of the terrain exceeding 50% slope. Soils are characterized with low pH with low water retention, and low fertility; and

81. Annamite Range. The Annamite range is mountainous topography between 500-2000m. The soil type is similar to the Northern Highlands.

82. The Mekong Plain is the third country region located mostly in the south of the country which is characterized by the alluvial plain of Mekong river and the major tributaries, and thus being relatively flat with fertile alluvial deposits. The newer alluvial soils of the floodplain are more fertile.

83. Topography in the north is predominantly mountainous with numerous settlements such as the towns of Houayxay and Luang Namtha which are located on the relatively narrow cultivated floodplains of the upper Mekong River and tributaries such as the Nam Tha river (Figure 18). A notable feature of Luang Namtha is the Nam Tha National Protected Area (NPA) which partially borders the floodplain area (Figure 18). Similarly, is the Nam Kan National Protected Area (NPA) which both provinces share.

[27] Modified from ICEM, 2003

Figure 18. Houayxay and Luang Namtha including two NPAs

From Lao 2003, modified with 2014 REF

B. Houayxay

84. Bokeo province is mountainous province of 6,169 km^2 located in the extreme northwest of Lao PDR with the Mekong river forming the western provincial boundary, Houayxay is located in the southwest of province on the Mekong river facing Thailand and Myanmar across the river. The Laos provinces of Luang Namtha, Oudomxay, and Xaignabouli form the north, east, and south boundaries with Bokeo province, respectively.

85. There are eight valleys in the province that support agricultural production, farming and livestock livelihoods. Bokeo province provides the transit corridor in northwest Laos with

national road R3 and the Mekong river to form the regional road and waterway link to China, Myanmar, Laos and Thailand. The special Golden Triangle Special Economic Zone of the area offers border trade among the three countries.

1. Climate

86. The climate of Houayxay and Bokeo is tropical monsoon with air temperatures ranging between 8.7°C in high altitude area to 39.2°C in the lowlands. Average annual daily temperature in January is 19.80^0C and 28.3^0C in April. Average wind speed is 11 m/s. The dry season occurs between November and February while the rainy season occurs between May and October. The dry season is generally cooler, though temperatures rise significantly in March and April prior to the onset of the rains. Relative humidity varies from 43% in March to 98% in December, January and February.

87. The annual monsoon from the Gulf of Thailand and Indian Ocean governs precipitation of the province. Total monthly rainfall generally exceeds 210 mm between May and September with average peak rainfall in July at 369 mm (Table 5). The dry season is particularly pronounced with average December and January rainfall below 18 mm. Rainfall varies significantly from year to year. Table 2 shows total rainfall for 2003-2012 The years 2003 and 2093 were particularly dry.

Table 5. Total Rainfall (mm) registered in Bokeo from 2003-2013

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Total
2003	40.9	72.2	4.1	137.8	50.3	207.9	427.2	243.0	194.8	54.8	1.8	0.0	1,434.8
2004	1.0	7.2	6.4	184.0	268.0	287.3	294.2	392.2	224.9	54.7	29.7	0.0	1,7509.6
2005	1.4	0.0	67.6	136.0	205.9	180.5	300.9	381.9	199.8	117.4	16.7	19.9	1,628.0
2006	0.0	29.5	187.7	134.9	254.6	187.7	417.8	447.0	217.4	252.9	0.0	0.0	2,129.5
2007	6.3	2.6	4.3	120.0	247.8	334.5	173.8	287.7	373.1	180.5	38.9	0.0	1,769.5
2008	43.6	46.1	64.9	127.0	268.5	280.4	652.9	608.1	223.3	54.7	60.4	7.0	2,436.9
2009	0.0	0.0	54.0	174.0	205.6	170.2	326.0	161.6	235.4	56.0	19.9	0.7	1,403.4
2010	9.6	0.0	53.8	114.1	146.3	235.0	344.4	518.5	313.9	46.4	0.0	7.9	1,789.9
2011	19.7	0.0	94.5	83.5	236.2	245.6	278.5	368.7	236.9	37.8	15.4	16.0	1,632.8
2012	52.3	0.0	42.4	128.0	252.6	87.5	477.4	456.1	174.6	118.1	53.9	18.9	1,861.8
Mean	**17.5**	**15.8**	**58.0**	**133.9**	**213.6**	**221.7**	**369.3**	**386.5**	**239.4**	**97.3**	**23.7**	**7.0**	**1,783.6**

Source Station: Bokeo Meteorology and Hydrology Office

2. Topography, Geology, and Soils

88. The average elevation of the subproject area in Houayxay ranges from 340m - 365m masl with gently undulating terrain. The upper catchment area is steep terrain with a peak of approximately 1200 masl.

89. The soil types of northwest Laos including Houayxay remain largely unmapped. Detailed data are not available. In general lowland soils are hydromorphic ranging from medium clay to

lighter, loamy soils. The rich alluvial clays of the wide river valleys are ideal for wetland rice paddy. The loamy more porous soils tend to be found in the smaller watersheds. Upland soils are of two main kinds defined by reddish brown laterite, which is deeply weathered and slightly acidic. Though not very fertile the laterite soils are stable and capable of retaining water and permitting swidden agriculture. The second soil type is medium to heavy textured red dish yellow podsols that are derived from acidic rock. This soil has poor water retention, low fertility, and little organic content. The podsols are easily eroded so cultivation on sloped podsols yields little success. Soil depths vary depending on location, slope, and the extent to which they have been subjected to forces of erosion.

90. The soils under dense forest cover recycle nutrients relatively quickly such that the nutrient base of the forest is stored in the vegetation. As a result, it takes up to 15 or 20 years for soils to recover their fertility when upland forested areas are cleared. Moreover, upland soils that have been deforested erode easily.

3. Water resources

91. The Mekong river plays an important role in people's lives in Houayxay because the river is used for local and international transportation, livelihoods, tourism, and food. The major tributaries of the Mekong resource are the Nam Tha river from Luang Namtha, Num Fa, Num Kerng, Num Yon, Num Ngao, Num Tin, and Num Tah. The mountainous tributaries are equally for irrigation, and transportation of materials to the Mekong main stem and for hydropower.

92. The Num Ngoi flows to the southeast in the vicinity of Route 3 joining the Mekong just north of Houayxay. Bokeo villagers report problems of excessively low water in the Nam Ngao during the dry season and flooding in the rainy season. The Ngao's hydrological imbalance is considered to be the result of logging activities in the upper just south of the Nam Ha National Protected Area (NPA). Recent water quality data of the Mekong river at Houayxay are presented in Table 6.

93. Recent exceptionally dry years resulted in extreme low flow conditions in these surface water resources [with lowered water tables] which affected transportation, agricultural yield, and river-based livelihoods including tourism. Conversely, above average water years resulted in local severe flooding in villages leading to local pollution events wastewater discharged from households, factories and agricultural production sites. The apparent recent volatility with rainfall is likely a useful window into future [or present] climate change.

4. Aquatic ecosystems

94. The comparatively low population in northern Laos has maintained relatively diverse aquatic ecosystems defined by rivers, streams, ponds, small lakes, and reservoirs. The aquatic ecosystems are subject to a variety of human activities such aquaculture, fishing, the creation of rice paddy, and the construction of dams and irrigation weirs. In the upland rural areas aquatic resources are important sources of protein in the local diet, dominated by fin fish, and shellfish including molluscs, and crustaceans. Aquatic insects, amphibians, and reptiles that inhabit the water bodies add to the overall biodiversity. Threats to aquatic ecosystems include over fishing, the use of damaging fishing techniques such as blasting and poisoning, upstream use of pesticides, release of pollutants and the introduction of exotic fish species for aquaculture.

Table 6. Water quality of the Mekong river at Houayxay

Lao People's Democratic Republic
Peace Independence Democracy Unity Prosperity

Water Analysis report

312 --

Vientiane Capital City NamPaPa Nakhonluang
Chinaimo Water Treatment Plant Laboratory
Tel.:312564 or 2204693

Sampling Place: Water Source
Location: : Mekong river, Houaysai, Houaysai district
Bokeo Province

Testing Date:4 ~ 28/11/ 2014

N.	Description of analysis	units	N.1	N.2	N.3	Lao water Supply Standards
	Sampling name		Mekong	NamHouaysai	Filtered	
	Sampling day		-	-	-	
1.	Turbidity	NTU	53.0	7.0	6.0	<5
2.	Color	CU	48.0	15.0	4.0	<5
3.	Odor	-	soil	Fish	Normal	Normal
4.	pH	-	9.0	8.3	7.5	6.5~8.6
5.	M. Alkalinity ($CaCO_3$) or TAC	mg/l	82.0	52.0	50.0	-
6.	Ammonia ion (NH_4^+)	mg/l	N.D<0.07	N.D<0.07	N.D<0.07	0.5
7.	Nitrate ion (NO_3^-)	mg/l	1.00	0.30	0.50	<50
8.	$KMnO_4$ consumed	mg/l	12.8	9.7	4.6	<10
9.	Total Hardness ($CaCO_3$)	mg/l	136.0	62.0	94.0	<500
10.	Chloride ion (Cl^-)	mg/l	9.2	4.3	5.0	<250
11.	Total Dissolved Solids(TDS)	mg/l	127.0	44.0	49.0	-
12.	Manganese (Mn)	mg/l	0.47	0.07	0.04	<0.1
13.	Residue Chlorine (Cl_2)	mg/l	x	x	0.10	0.1~1.0

Remarks: D.N= Non Detection.
Nam mean river

Laboratory:
Mrs Khonesavanh.K

Chief Chinaimo WTP :

General Manager NPNL:

5. Community Fisheries

95. Community-managed fisheries have been established throughout Lao PDR[28] with the Mekong river supporting the largest community gillnet fishery in the region. There are two sections of the Mekong river adjacent to Houayxay that are managed by the villages of Thinthat and Pa Oy in Houayxay district (Figure 19) which invoke limits to the size and numbers of certain fishes that can be caught. The local fishery is also used tourist revenue. Common fish species of the upper Mekong are listed in Table 7.

[28] Fisheries Section of MAF, Vientiane, 2013

Figure 19. Community fishing zones in Mekong river in Houayxay district

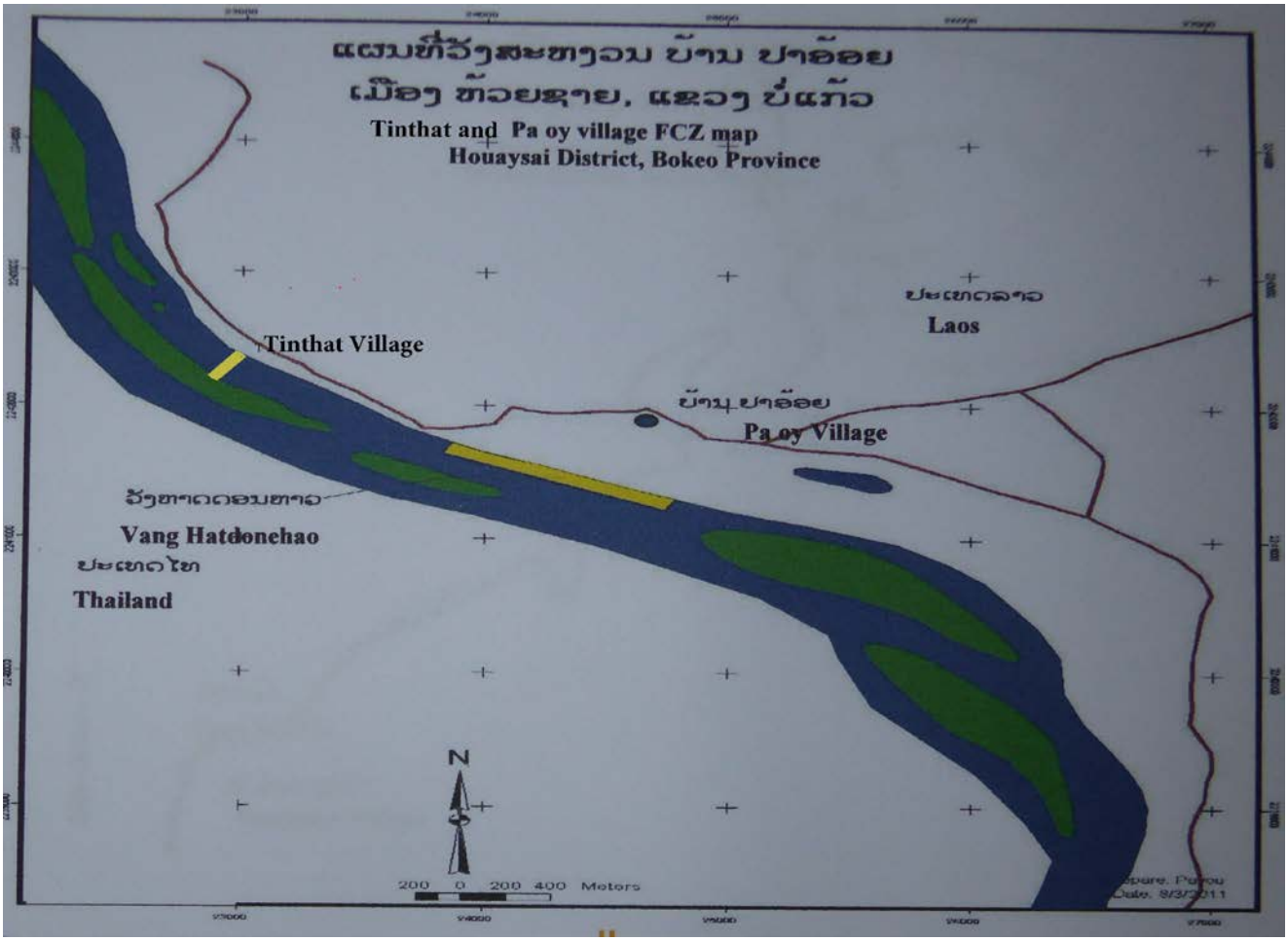


Table 7: Common Fishes of Mekong River Fisheries[29]

Lao PDR Name	Scientific Name	Common Name
ปาเค็ง	*Mystus wyckioides*	Redtail catfish
ปาเซ้	*Bagarlus bagarius*	Groonch
ปาจอก	*Cyclochellichthys furoatus*	Mekong Giant barb
ปาสะงิ้ว	*Micronema apagon*	Silver sheatfish
ปา ຂົບ	*Belodontich trysdinema*	Twisted-Jaw sheatfish
ปาไน	*Cyprinus carpio*	Common-carp
ปาเพ้ย	*Morulus chrysophekadion*	Sailfin shark
ปาปาก	*Hypsibabusvernayi*	Silver barb carp
ปาผาไล	*Amphotistius Lao PDR sensis*	Laotian stingray
ปาซั้งบ/ปาสา	*Tonsinensis*	unavailable
ปา ค้า	*Wallago attu*	Great wilke sheatfish

[29] From MAF, Vientiane 2013

Lao PDR Name	Scientific Name	Common Name
ปายอน	*Pangasius macronema*	Long barbells Pangasiud catfish
ปาสะกาๆ	*Pu ntioplites faicifer*	Sickle fin barb
ปา(ຂົ່ມ)สูด	*Hampala dispar*	Spotted hampala barb
ปาด้างแดง	*Hemisilurus mekonggensis*	Not found
ปาก็ด	*Mystus nemurus*	Long whiskers catfish
ปาตอๆ	*Chitala ornate*	Clown featheback
ปาหลาด	*Mastacembeius armatus*	Tiretrack spiny eel
ปาบู่	*Oxyeieotris mamorata*	Marble goby
ปาแข้อไก้	*Botia lecontei*	Orangefin
ปาโจก	*Cosmochilus narmandi*	Grun Giant barb
ปามาๆ	*Poropuntius deauratus*	Snail eating barb
ปาม้กเขีา	*Osteochilus*	Giant biny-lip carp
ปาสะอิ	*Mekonggina erytrospila*	Not found
ปาแดง	*Irrhinus molitorelle*	Mud carp

6. Forest & Land Resources

Forest Resources

96. Bokeo province is rich with 510,529 ha of forested land or approximately 82% of the total area of the province. Forest management apportions the forest resource into 156,000 ha of conservation forest, 122,000 ha of production forests, and forests for water production and forest renewal at approximately 232,362 ha. The most notable national conservation area in Bokeo is the Nam Kan NPA of 136,000 ha. Formal forest protection occurs but which could be more effective with stronger enforcement of existing regulations and laws.

97. Timber harvesting that contributes to the local economy is from harvesting tree varieties such as Mai Yang, Mai Si, Mai Daengnum, and Mai Yom. However, over the last 5-10 years the forested area assigned to conservation and protection has been decreasing due the practices of swidden agriculture, development of rubber tree plantations, and ongoing regional development of such as irrigation networks, roads, and electric power transmission. A large-scale example of cultivation is the banana plantation that forms the northeastern boundary of the existing landfill. Below the landfill is rice and vegetable cultivation. The sloped areas are also used for agriculture use, have been subject to traditional shifting cultivation.

Land Resources

98. The total land use in Bokeo is estimated to be 72,000 hectares which is divided among cultivation cropping, mixed farmland, plantation lands including rubber, and fruit trees. Timber production areas also exist. Land utilization also includes livestock production and land for construction, and service industries.

99. Soil quality is deteriorating due to the continuing use of chemical fertilizers, along with poor cultivation practices. Cleared and forested land is increasing being given up to land concessions to foreign companies for industrial activities and plantation development with high

inorganic fertilizer use. These pressures on land quality and productivity are slowly being reversed through public education and awareness lead by local government (e.g, DONRE, DAF). Land at and near the subproject sites in Houayxay is extensively cultivated along with thickets of shade trees surrounding most homes and along waterways. Many non-shade trees areas have been largely exploited for fuels woods leaving scrub vegetation.

100. Increasingly land that is not used for irrigated agriculture is being developed for tree plantations which are dominated by teak and rubber. Additionally, soybean and fruit trees such as longgan, mango and citrus species are cultivated. In peripheral areas of cleared land that has been left dense secondary forest is developing which is supporting common wildlife such as deer.

Biodiversity

101. Despite urban and regional development, and resource extraction the biodiversity of Bokeo province is relatively high with the focal area being the Nam Kan NPA. The province supports many species of plants and animals commonly grouped is deer, wild pig, bear, monkey. Though, species such as tigers, bulls, apes, and elephants are now rare and endangered. Commonly known valued plant species include Make Tao, Mark Naeng, Waiy, bamboo varieties, Paeuk pong, Ki Si, Sa Pa, Por Sar, Peauk Mueak, Sa Kan, MakKueam, Dork Kaem, and medicinal plants. Houayxay town does not support any known rare or endangered terrestrial wildlife, or critical habitat (sensu SPS 2009).

102. Aquatic species in the Mekong include varieties of crab, fish, and other shellfish. Larger valued species include the Pa Buek, and the famous migratory giant catfish which is endangered. Over the last 10 years species have been decreasing in abundance due to deforestation, pollution and from other development stressors.

7. Provincial Heritage

103. Bokeo province is rich with cultural and historical heritage such as the ancient Stupa of Suvanakhom Kham district, the Pa Kham Stupa-Pa Pa Luk Sow Chow Anuvong, Pa Paban Peng, the caves of “Num Yu”, “Pha Bard” and “Huay Kood”, the “Num Kerng” Huay Pounglor” hotsprings and the “Chomkow Manilat”, “ Ban” and “ Numpouk” temples, and the notable “Lan-Tan” ethnic group. All of these sites are developing tourism. There are no heritage sites near the subproject areas.

8. Demographics

104. Bokeo province with a population 158,638 is comprised of 5 districts, 291 villages, and 51 established Khum Ban, 4 big villages with 13 ethnic groups. From 2005 the population has increased 1.7% annually with a present density of 26 /km^2. The 3 poor districts of Mueang Merng, Mueang Parktha and Mueang Phaoudom comprise 32.3% of the population which comprises approximately 6,480 families. The number of villages that have clean water is 222, percentage of households with toilets is 63.3%, and the number of villages receiving electricity is 185. The province has 236 primary school and 31 high schools. The rate of economic development has averaged 7.5% / year with 2009-2010 showing a provincial income of 1,370,410 billion kip. Forestry accounts for 45,9% of the GDP with the service industry 33,5%.

9. Features of the Houayxay Subproject

105. Example sections of riverbank are shown in Figure 20 which distinguish the riverbank at the town centre between island and mainland, from eroded section of riverbank downstream near the Ecological Park. For the town centre section the options exist to either separate or join the island to the mainland with or without mining the island for fill. The downstream section shows example erosion that would be corrected with protection works.

Figure 20. Riverbank sections at town centre and near Ecological Park

	**Fig 20a:** At town centre showing island on right and mainland on left
	Fig 20b: Eroded area near Ecological Park

106. Figure 21 shows the river port as tourists embark a boat bound downstream for Luang Prabang. The upgraded port would extend downsteam to connect to the riverbank protection component in background of Figure 21.

Figure 21. Houayxay river port showing tourists traveling to Luang Prabang.

107. The lake and area for the Ecological Park is shown in Figure 22. The western pasture would be developed into parkland surrounding the lake which would be connected to the Mekong riverside road and walkway component on west side. Note restaurant and school on east side of lake.

Figure 22. Lake and pasture area for Ecological Park

Fig 22a: Lake viewed from east shore with western pasture in background.

Fig 22b: Lake viewed from western pasture.

108. Figure 23 shows the existing dumpsite, and two example wastewater and storm-water road drains that need to be upgraded. The Thai recycling facility is located on left of photo on Figure 23. Note banana plantation and agriculture area below dumpsite. The small roadside drains and large collector drain-outfalls at Mekong river are depicted in Figure 23.

Figure 23. Existing dumpsite and combined road drains in Houayxay

B. Luang Namtha

109. Luang Namtha is located northeast of Bokeo province and borders China to the north, Myanmar to the west, and the Laos province of Oudomxay to the east and south. Similar to Bokeo, Luang Namtha is a mountainous province with a total area of approximately 9,325 km^2 comprised of 85% of mountains and 15% flat land.

1. Climate

110. The tropical monsoon climate of Luang Namtha is similar to Bokeo province but with slightly cooler or warmer average monthly temperatures. Monthly rainfall from 2003-2012 is summarized in Table 8 which show slightly drier conditions as a result of being located away from the Mekong river influence.

Table 8. Total Rainfall in Luang Namtha, 2003-2012 (mm)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Total
2003	39.8	45.3	23.0	87.6	43.9	114.7	151.9	309.5	92.4	42.8	0.0	3.5	954.4
2004	4.1	21.0	27.5	90.3	43.9	96.3	195.9	323.8	283.1	124.2	50.1	0.0	1,611.0
2005	5.4	2.4	221.7	155.5	194.9	298.6	303.8	204.9	98.5	83.3	26.6	41.0	1,636.7
2006	0.0	43.6	45.4	199.3	203.2	124.5	325.2	586.2	202.1	189.4	28.8	3.2	1,950.9
2007	1.4	3.7	1.3	201.2	192.9	117.4	232.8	219.8	149.0	75.5	61.4	0.0	1,256.4
2008	49.3	62.5	51.9	95.0	97.2	169.7	330.0	346.0	165.8	108.3	67.9	6.3	1,549.9
2009	0.0	2.1	18.4	211.6	287.3	309.7	206.7	133.6	143.9	76.6	7.4	17.7	1,415.0
2010	5.2	0.1	28.4	134.2	188.8	180.9	208.8	348.2	175.8	73.1	0.0	8.5	1,352.0
2011	13.8	0.0	124.2	100.4	196.8	243.4	233.9	328.3	260.7	34.9	31.6	6.3	1,574.3

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Total
2012	38.9	2.2	13.7	55.8	195.2	158.5	373.2	286.8	121.7	50.6	146.1	16.4	1,459.1
Mean	15.8	18.3	55.6	133.1	199.5	181.4	256.2	308.7	169.3	85.9	42.0	10.3	1,476.0

Station: Luang Namtha PAFO and Department of Meteorology and Hydrology

2. Topography

111. The subproject areas in Luang Namtha lie between 640 to 900 masl on flat or mildly undulating terrain. The upper catchment area is in steep terrain at elevations of up to 900 m ASL. The highest peak in the district is in the Nam Ha NPA at 1,719 m masl.

3. Water resources

112. The important water resources of the province flow through the Nam Ha National Protected Area (NHNPA) (see below), and are tributaries of the Mekong river. The major Mekong river tributaries of the province include the Nam Tha from the northeast which flows through Luang Namtha town southeast to the Mekong river at Pak Tha in Oudomxay province, the Nam Pha flowing northeast to the Mekong near Xieng Kok, and the Nam Mo which flows to intersect the Mekong north of Xieng Kok. The Nam Ha flows northeasterly through the center of the NHNPA joining the Nam Tha near Hattat.

113. The rivers systems provide a wide range of aquatic resources for subsistence and trade, as well as water for drinking, bathing, and crop irrigation. These river systems are of relatively good quality providing good potential for the provincial socio-economic development, particularly hydro-power development, irrigation, and tourism. Existing local water pollution is caused by industrial discharges, domestic waste, and use of agro-chemicals in the basins. Recent water quality data of the Nam Tha river at Luang Namtha are presented in Table 9.

Table 9. Water quality of the Nam Tha river in Luang Namtha

Lao People's Democratic Republic
Peace Independence Democracy Unity Prosperity

Water Analysis report

B 1 1 - -

Vientiane Capital City NamPaPa Nakhoniuang
Chinaimo Water Treatment Plant Laboratory
Tel.:312564 or 2204693

Sampling Place:. Water Source
Location: Namtha, NamJouk and NamLong
LuangNamtha Province
Testing Date:3 ~ 28/11/ 2014

N.	Description of analysis	units	N.1	N.2	N.3	Lao water Supply Standards
	Sampling name		Namtha	NamJouk	NamLong	
	Sampling day		23/10/14	20/10/14	21/11/14	
1.	Turbidity	NTU	4.0	3.0	10.0	<5.0
2.	Color	CU	6.0	10.0	13.0	<5.0
3.	Odor	-	soil	plant	soil	Normal
4.	pH	-	8.5	8.5	8.6	6.5~8.5
5.	M. Alkalinity ($CaCO_3$) or TAC	mg/l	62.0	80.0	42.0	-
6.	Ammonia ion (NH_4^+)	mg/l	N.D<0.07	N.D<0.07	N.D<0.07	<0.5
7.	Nitrate ion (NO_3^-)	mg/l	N.D<0.25	N.D<0.25	N.D<0.25	<50
8.	$KMnO_4$ consumed	mg/l	7.9	6.1	11.9	<10
9.	Total Hardness ($CaCO_3$)	mg/l	92.0	122.0	128.0	<500
10.	Chloride ion (Cl^-)	mg/l	6.4	2.8	4.3	<250
11.	Total Dissolved Solids(TDS)	mg/l	73.0	95.0	41.0	-
12.	Manganese (Mn)	mg/l	0.07	0.11	0.06	<0.1

Remarks: D.N= Non Dection.
Nam mean river

Laboratory: Mrs Khoucsavanh.K

Chief Chinaimo WTP :

General Manager NPNL:

4. Agriculture

114. Luang Namtha has allocated 240,050 ha of land [26% of total land] in the province as agricultural land for rice paddy, crop rotations, and plantations (Table 10).

Table 10. Primary agricultural land use in Luang Namtha

Type	Area	Portion
Paddy	16,900ha	7.04 %
short-rotation of cash crops	26,535ha	11.05 %
Rubber or eucalyptus plantations:	196,615ha	81.91 %

115. With the dominance of steep land with relatively poor fertility land suitable for rice and short-rotation cash crop production is limited. Only 912 ha in the province are considered to have high fertility followed by 5,852 ha providing “medium“ fertility, with 16,087 ha considered “fair” fertility. Most of fertile land is found in Muang Sing district from which rice and sugar cane are exported to China. Another 22% of allocated agricultural land is considered “low“ fertility. Moreover, 68% is considered to have either “very low” or “extremely low” fertility rendering it unusable as crop land, albeit, useable for tree plantations, The potential for mixed short-rotation crops and trees, i.e., agro-forestry production has yet to be fully explored in the province.

116. Rice is the most important crop with rice self-sufficiency considered as the key indicator of lively-hood sustainability. The limited rice paddy land is in high demand. Presently the provincial Agriculture and Forestry Office (PAFO) calculates the area of paddy rice production to be 10,368 ha. However, provincial and district officials admit to only monitoring paddy land gained each year, and not paddy lands lost to residential and other development activities so actual land area under paddy could be less than that reported.

117. Upland swidden rice production supplements lowland paddy rice but with a much lower yield per ha. Eighty-three percent of the provincial population practices swidden agriculture with traditional swidden involving crop rotations wide areas leaving fallow lands to recover their fertility for 10 – 20 years. Present population levels in many areas make such practices are set to discourage swidden agriculture. “Pioneering” swidden, in which areas of primary forest are burned to produce new fields destroys valuable forestland. It is estimated that an area burned to produce swidden valued at US $500 contains an average of $20.00 of timber.

5. Land Resources

118. Luang Namtha province has allocated 930,320 ha for conservation and utilization. The conservation land of 764.000 ha consists of 488,000 ha of protected forest, 271,000 ha of conservation forest, and 5,000 ha of wetland. Total land for utilization is 166,320 ha which is apportioned to 43,300 ha of agricultural, 45,000 ha for production forest, and 78,020 ha for construction and development. Environmental issues related to the conservation and utilization lands focus on the negative impacts associated with concession granted for mining extraction, plantation, and shifting of forest land into agricultural lands.

6. Forest Resources

119. There are four national protection forests in Luang Namtha defined by Phou-Samyoth (39,341 ha), Shieng-Kheng (50,000 ha), and Nam Fa (56,400 ha). There are two provincial protection forest, namely Nam-Shock in Sing district, (19,000 ha), Phou-Kone Meuang in Long district (21,000 ha), and three district protection forests defined by the Laos-China border protection forest of the Nam La watershed in Sing district (4,401 ha), Phu Kuien in Long district (6,000 ha), and Phupakham in Long district (3,500 ha). The timber species important for socioeconomic are Makham, Kuang Deang, Xylia, Xylocarpa Var, Chong Hom, Cinnamomum Liseafolium, Yom Him, Ha Nam, Deang Nam, Teak, and Tectona Crandis.

120. Forest decline stems from slash and burn cultivation, bushfire, timber harvest, natural forest substitution for plantation development, road and power transmission development, and timber harvesting for construction materials.

7. Biodiversity

121. Similar to Bokeo province biodiversity in the province of Luang Namtha is high due to the presence of a NPA which in Luang Namtha is the Nam Ha NPA (Figure 18). The provincial wildlife assemblage includes 37 species of mammals, 297 species of birds as well as a rich assemblage of large mammals defined by elephants, Indochinese tigers, leopards, Bengal tigers, gaurs, black-sheek gibbons, and great hornbills[30]. Despite the current richness biodiversity has decreased from habitat destruction, deforestation, slash and burn cultivation, and unsustainable exploitation of forest products.

8. Land Use Planning and Allocation

122. Land Use Planning and Land Allocation (LUPLA) has been conducted in the five districts. An objective of LUPLA is to limit swidden cultivation through allocation to agricultural land, residential land, village forest for use, village conservation forest, etc. Villagers report being limited to three to four swidden plots per family. Frequently the result has been a shortening of swidden cycles to unsustainable levels, and a subsequent loss of soil fertility. The failure of land use planning is cited as the chief cause of poverty in northern Lao PDR.

123. There are several government and NGO programs to introduce more sustainable, sedentary agricultural techniques and to provide support for their implementation. However, the new techniques take a long time to become established, and the local needs of the various ethnic groups for more sustainable land use planning could be accomplished.

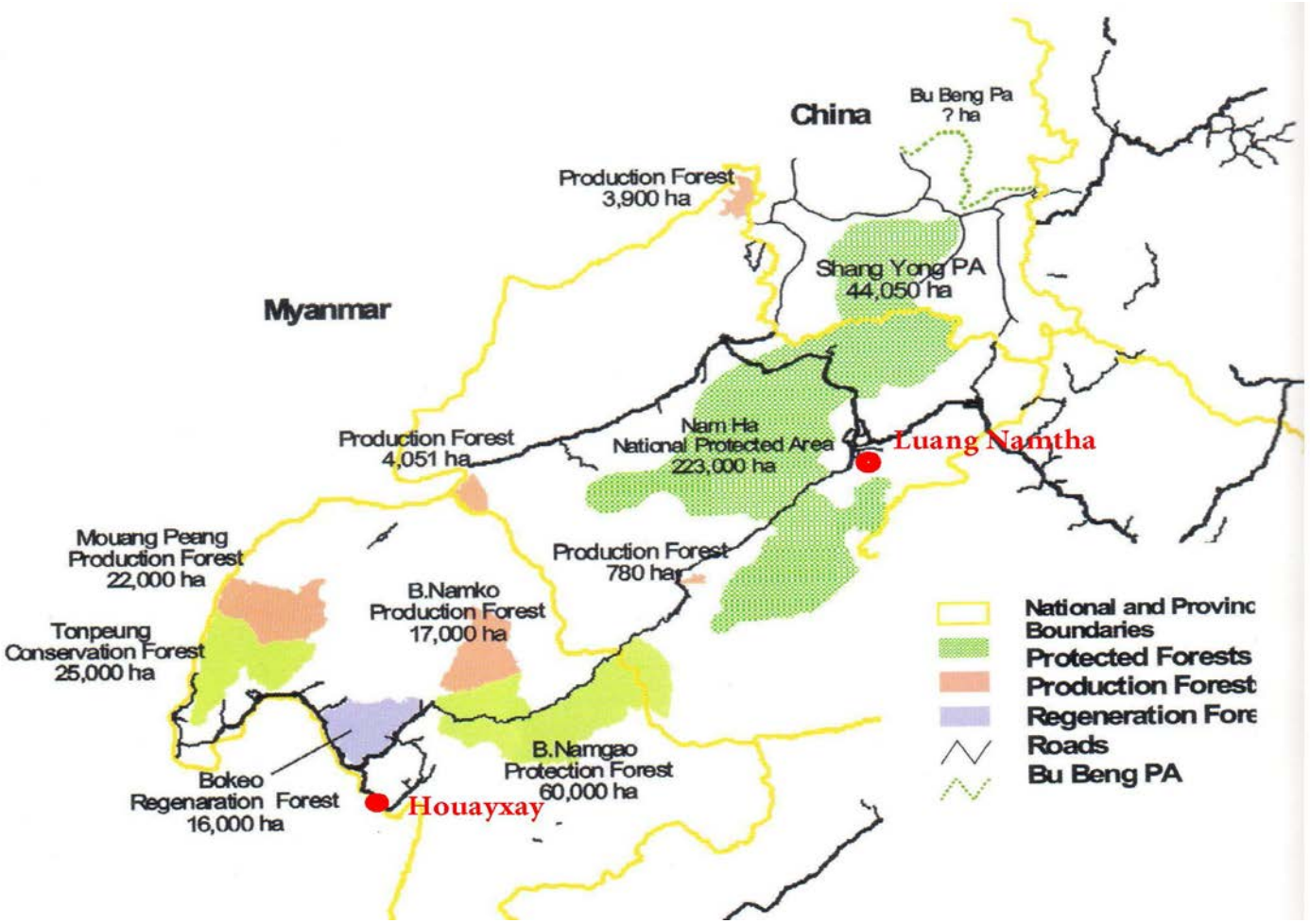
9. National Protected Areas of Subproject Areas

124. The Nam Ha National Protected Area (NHNPA) including the prominent Nam Ha river (Figures 18) was originally gazetted in 1993 as the Nam Ha National Biodiversity Conservation Area (NBCA) as part of the Lao PDR protected area system. In 1999 the NBCA, Nam Ha NBCA West, and the Nam Kong protected area amalgamated to form the NHNPA which forms a continuous ecological protection system with the Shiang Yong protected area to the north in Yunnan Province of the PRC China (Figure 24).

[30] NTNPA, 2003 Luang Namtha Biodiversity Report

125. The Nam Ha Nam NPA now expands an area of 2,230 km2 or 24% of Luang Namtha province. The elevation of the NHNPA ranges from the flood plain of the Nam Tha river in Luang Namtha town to the highland peaks at 2,094 masl. Portions of all five districts in Luang Namtha Province are included within the boundaries of the NHNPA.

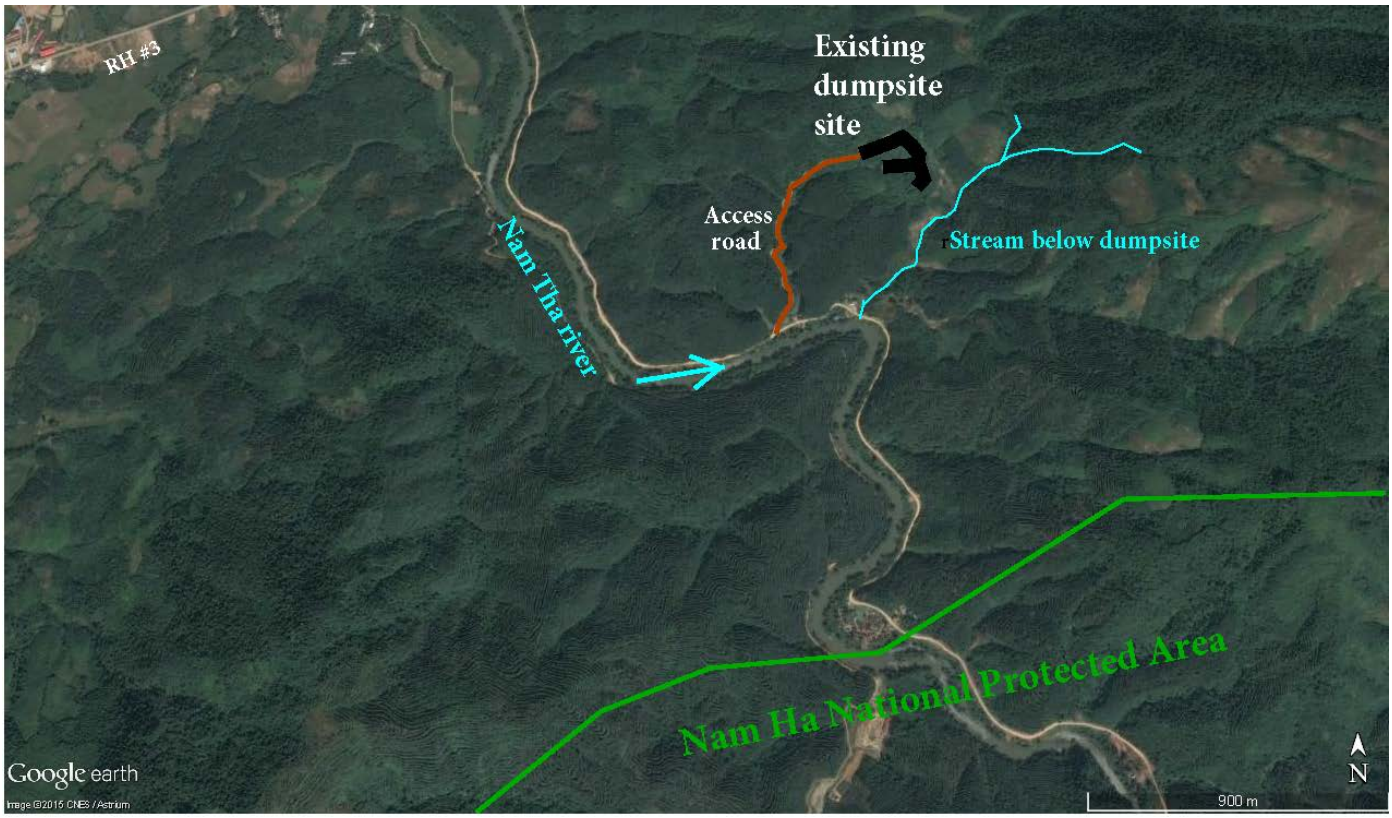
Figure 24. Protected and production forest areas of Houayxay and Bokeo provinces



126. To the south of the NHNPA is the relatively new Nam Kan NPA which straddles the boundaries of Luang Namtha and Bokeo provinces. Together the two NPAs provide the transboundary wildlife corridor, especially for wild Asian Elephants and other endangered wildlife species that require large territories to maintain viable populations. Figure 20 also identifies the different protected forest types in Luang Namtha and Bokeo provinces which are not near the subproject areas of both towns.

127. The NHNPA is close to the existing landfill (Figures 24 and 25) which indicates that the plan to upgrade the existing dumpsite to controlled landfill status should benefit the quality of the downstream Nam Tha river, and NHNPA.

Figure 25. Nam Ha National Protected Area & existing dumpsite



10. Provincial Heritage

128. The heritage values of Luang Namtha centre on historical archeology, and natural and traditional culture. Historical sites include the 'Sieng Tueng' pagoda, 'Sieng Kang' pagoda, 'Pune Pu' pagoda, 'Kong Bang', and 'Pu Samyord' located on the east of provincial municipality. The latter high altitude area is where archeological remains from the war to liberate Luang Namtha. However, the subproject component will not impinge on the heritage areas or values.

129. The natural heritage includes Nam Ha National Protected Area with the beautiful vistas which form the international continuum with the conservation forest of San Yong-China to the north. There are also provincial and district conservation forests suiting for tracking, kayaking, and sightseeing along waterfalls, caves and springs. Traditional culture is diverse with local languages, clothing, and spiritual beliefs unique to each ethnic group. These traditional and heritage values attract foreign and domestic visitors into the province.

11. Features of Luang Namtha Subproject

130. Wastewater pond #2 (Figures 12 & 13) and example wastewater drains that will be upgraded by the subproject are shown in Figure 26. The banks of the WW pond #2 will be

Figure 26. Wastewater pond #2 and example drains

stabilized and heightened to increase the capacity of the pond, and the integrity of the discharge canal and outfall to the Nam Tha river fortified with concrete. Pond #1 that will be constructed behind the hospital (Figures 12 & 13) will be designed similar to pond 32. The natural drains to the ponds will be lined excavated with concrete where necessary to increase performance.

131. Figure 27 shows the existing dumpsite south of town just north of the NHNPA. The original septage facility at the dumpsite is located just east of the dumpsite, but was abandoned due to the garbage build-up.

Figure 27. Dumpsite with abandoned septage facility beyond pile in left background

132. Example village upgrade demonstrations are shown in Figure 28. Infrastructure of the villages will be upgraded including road widening and drainage.

Figure 28. Two demonstration villages in Luang Namtha

133. The dry season ford across the Nam Tha river at Donsamphan village across which the new bridge and road to Thongdi village (Figure 17) will be constructed is shown in Figure 29.

Figure 29. Site of new bridge on Nam Tha river for new road east to Thongdi village

12. Natural Hazards and UXO

134. The recurring natural hazard to which the subprojects in Houayxay and Lunag Namtha are exposed is seasonal flooding which is more prevalent in Luang Namtha given the town is located on the flood plain of the Nam Tha river. While being on the shore of the Mekong river, Houayxay is less sensitive to flooding because riverbank is high. Being inland both towns are not sensitive to coastal typhoon surge.

135. The years of being neighbours with the Viet Nam-American war has resulted in the continued risk of UXO harm especially in areas of new excavation. Both subproject sites need careful screening for UXO during the pre-construction phase.

V. PUBLIC CONSULTATION

136. The stakeholder consultations were developed to meet the requirements of meaningful consultation as stipulated by the ADB SPS (2009) and Public Communication Policy (2012). The consultation strategy embodied the principles of transparency, participation, and inclusiveness to ensure that affected and marginalized groups such as women, and the poor, were given equal opportunities to participate in the design of the project. The stakeholder consultations on environment issues in Houayxay and Luang Namtha were conducted with the following three avenues of inquiry and data collection:

1. As part of the household and village leader interviews conducted by the social development team with provincial agencies and other stakeholders conducted by social development team; and
2. Separate interviews of provincial and national environmental management agencies conducted by the international environmental specialist.

137. Public Consultation will continue during the detailed design phase and construction as per the PCP (2012) and general requirements of Lao PDR[31] Table 2 in section summarizes the insertion points for public consultation in the final design and implementation of he subprojects.

A. Identification of Stakeholders

138. Stakeholders were identified and engaged in a participatory manner. Stakeholder communication to date has focused on institutional stakeholders, affected communities, and persons directly affected by proposed subproject interventions. Project stakeholders include:

- Institutional stakeholders including the (i) project EAs and IUs (ii) provincial and national agencies, and chambers of commerce;
- Mass organizations such as the Lao Women's Union (LWU) provided input for the design of the various subproject interventions, and which might participate in implementation of measures and interventions;
- Villages directly affected by subproject components who will benefit or be adversely affected, and who have an interest in the identification and implementation of measures to avoid or minimize negative impacts; and

[31] Lao PDR, 2012. Environmental Impact Assessment Guidelines, 94 pgs + 11 Appendices

- Vulnerable and/or marginalized groups who have an interest in the identification and implementation of measures that support and promote their involvement and participation in the project.

B. Discussion Guide

139. Five questions (Table 11) were posed to stakeholders to guide discussions. To help orient the discussions of environmental issues and concerns of subprojects a list of environmental components (Table 12) was introduced to the stakeholders ahead of the question & answer period. Stakeholders were encouraged to add their own components of environment to the discussions.

Table 11. Guiding Questions for Stakeholder Consultations

1. What will be the benefits of the subproject?

   Please list benefits of project.

2. Do you have any environmental concerns with the subproject?

   Please list environmental concerns of project.

3. Do you any have environmental concerns with the **construction activities** of the subproject?

   Please list environmental concerns of construction phase activities.

4. Do you have environmental concerns with the **completed operation phase** of the completed subproject?

   Please list environmental concerns of the operation of completed subproject.

5. Do you think the subproject design or operation should be changed to prevent negative environmental, or community impacts?

   Please list changes to subproject that you think will prevent or reduce negative environmental, or community impacts?

Table 12: Example environmental components used to guide stakeholder discussions.

• drinking water quality & availability • surface water quality and quantity • groundwater quality & quantity • air quality • climate • land and soil quality • rivers, reservoirs, • trees, other vegetation, • terrestrial resources e.g., minerals, salt	• terrestrial & aquatic animals, e.g., fish, birds, small mammals ecological protected areas (e.g., national parks, wildlife sanctuaries), • land uses (e.g., agriculture, fisheries, forestry, navigation, aquaculture, commercial, other), • public safety, • public movement & access • physical cultural values (e.g., pagodas,

beds, geology	cemeteries, monuments)

C. Summary of Public Consultation

140. The stakeholder consultations for environmental issues associated with the subprojects in Houayxay and Luang Namtha are summarized in Tables 12 and 13. Appendix B summarizes the participants, venue, and date of the consultations. The results of the social impact assessments for the subprojects are summarized in the Social Assessment and Analysis[32] of the project prepared separately.

141. The stakeholder consultations showed overall positive support for the project. Tables 13 and 14 summarize the comments and concerns of individual households & village heads, district and provincial stakeholders. Also summarized is how the EMPs for Houayxay and Luang Namtha will respond to the environmental issues and concerns that were raised by stakeholders. The follow-up stakeholder consultations that may be required during detailed design phase will begin with a review of the issues and mitigations initially identified by the stakeholders.

Table 13: Summary of provincial stakeholder views of in Houayxay

<table>
<tr><th colspan="3">Benefits of Ecological and Recreational Park
February 2, 2015</th></tr>
<tr><td colspan="3">• Create a new tourist attraction site
• Create recreation place for local people for relaxation and site-seeing
• Generate income for local people and business
• Opportunity for night market
• Reduced traffic accidents from improved roads
• Provincial public gathering site
• Opportunity for small business such as gift-shop, coffee shop, pub and restaurant
• Allow chance for impacted stakeholders to take part in the project
• Good for the country
• Good for the people in Houay Xay District
• Existing trash and littering problems will be solved</td></tr>
<tr><td></td><td></td><td>Project Response[33]</td></tr>
<tr><td>Construction phase issues</td><td>• Trash and littering
• Social issues with worker force
• Dust and noise
• Traffic problems created
• Construction waste
Proper disposal of excavated soil and debris</td><td>• The EMP of the subproject specifies mitigation sub-plans to control construction traffic to prevent local traffic congestion, manage and dispose of all construction waste, measures to minimize dust and noise, and potential social issues with migrant worker and any small worker camps</td></tr>
</table>

[32] Poverty and Social Analysis, Greater Mekong Subregion Second Corridor Towns and Development Project
[33] Addressed in EMP and final designs

Operational phase issues	• Trash and littering problems caused by careless people • Impact on residential and non-residential property • Illegal trash disposal • Soil erosion	• The operation of the new recreation park will include an O&M budget to manage solid waste of park users including regular emptying of well distributed waste bins, and signage directing users to dispose waste accordingly. • The landscaping design of park will prevent soil erosion.
Stakeholder suggested additions to subproject, and impact mitigation measures	• Need to have public rest rooms • Needs to have an adequate parking lot • Need to add night market on site • Need a separate complete recreation center for children • Apply wetting agents to construction roads • Enforce posted speed limits • Establish and enforce operating and management rules for new park • Establish adequate O&M, and repair erosion etc when occurs	• All the requested amenities, services, and regulations for users of the park will be included in the final design. • As indicated above a key component of the operational phase of park is sufficient O&M budget.

Table 14: Summary of provincial and village stakeholder views of Luang Namtha

Benefits of Subproject: **March 16, 17 - 2015**		
• Comfortable traveling, town cleaning, aesthetic. • Reduced odour from open drains, and reduced mosquito habitat • Convenient passage for vehicles. • Reduced flooding • Higher income to people and poverty reduction • Improved quality of life. • Fluent traffic will, reduce traffic jams and reduce accidents. • Reduction of dust, and solid waste pollution. • Landfill site will be improved and made convenient to make the town Cleaner. • Improved drainage		
		Project Response[34]
Construction phase issues	• Dust, and noise pollution, • Local access and movement will be obstructed • Garbage and wastewater not manage.	• The EMP of the subproject prescribes mitigation sub-plans for all of the construction disturbances and impacts identified on left including loss of local access,

[34] Addressed in EMP and final designs

	• Construction activities too early in morning • Traffic problems & risk of accidents • Obstruction to the people traveling. • Impact to people during the construction period such as noise pollution to community, dusty and waste. • Disease outbreak from workers such as HIV. • Damage to fences, houses, trees and agriculture	including use of wetting agents to control dust, and construction traffic management measures. • EMP prescribes requirement for optimal day-time construction schedules • EMP includes a site restoration plan including 3:1 tree replacement to tree loss • Measures to minimize use of migrant workers, and education and awareness to prevent social issues within and outside worker population is prescribed by EMP.
Operational phase issues	• Road will be broken before the life time if overloaded vehicles use roads without warning signs • Garbage discarded at urban park restoration and on road (if no regulation control). • Drains get blocked producing bad odour if lack of maintenance. • Regulation management issues and in proper use. • Should provide equipment, budget to maintenance. • Should be unit or sector responsibility. • Regulation issue and dissemination. • Should have organization concerned take a responsibility in order to make subproject component sustainable. • Set up regulation on management and maintenance. • Monitoring by responsibility sector. • Dissemination to all community.	• The design of all roads is appropriate to vehicle type and use, and O&M budget is integral in the operational phase. • Speed limits will be posted and enforced • The sustainable operation of all completed subproject components will be supported with enforced updated existing regulations, or new regulations. • Appropriate O&M budgets are included with components such as for sustained operation of wastewater drains, and garbage collection and disposal • DPWT and UDAA will be responsible to manage the completed subproject components
Stakeholder suggested impact mitigation measures	• Agreed based on the actual data of project, and refer to regulation, law, technical, budget and it should be less impact to the environment, the resulting high profit and the most benefit to people. • Agreed with the subproject design. • Some people required that have to Change if a lot of impact in order to match actual situation. • Negative environmental impacts of operational subproject should be addressed with compensation if appropriate	• Compensation is part of design phase. Operational phase compensation is responsibility of government.

VI. POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATIONS

142. The assessment of potential impacts of the two subprojects is structured by subproject town following the Description of Subprojects and Affected Environments. Because some of the numerous subproject components are similar in type and/or location, similar components are assessed together. With this approach redundant assessment is prevented, and important component-specific impacts can be identified and assessed most clearly.

143. The area of influence of the subprojects combines direct and indirect effects which are is delimited by the area immediately affected by the infrastructure developments, and the "downstream" effects defined by for example receiving water quality, socioeconomic and cultural effects of centre-town enhancements and improved garbage management, expanded access to previously seasonally flooded areas, and reduced incidence of waterborne disease.

A. Subproject Benefits

144. The benefits of the subprojects in Houayxay and Luang Namtha are summarized below which reflect the output of the stakeholder consultations.

1. Houayxay

145. The diversity of subproject components in Houayxay will cumulate to greatly increase to environmental quality of the town, and significantly expand the scope of Houayxay as a tourist destination and the overall appeal of Houaxay for tourism. The ecological park, upgraded river port, and new riverside walkway will stimulate visitors to stay and spend time in the town, and not just transit from/to Thailand and Myanmar as is the current practice. The cleaner urban environment with less seasonal flooding, and the greater opportunities for tourists will lead to socioeconomic development in the town and surrounding areas.

2. Luang Namtha

146. Similar to Houayxay the assemblage of completed subproject components will lead to socioeconmic development in Luang Namtha and area as a result of the improved environmental quality and enhanced tourism. Notable will be the effect of the new road and bridge across the Nam Tha river east to the existing highway and Thongdi village on local transportation, the addition of new WW pond and drains on local pollution and flooding, and upgraded park on local residents and tourists.

147. A major potential benefit of the renovation of the dumpsite in Luang Namtha to a more modern controlled landfill is improvement to the water quality of the receiving stream and downstream Nam Tha river (Figure 25) as a result of installation of a controlled and contained leachate collection system in the renovated landfill. Moreover, the Nam Tha river flows into the Nam Ha National Protected Area located approximatley 6-7 km below the existing dumpsite.

B. Subproject Impacts and Mitigations

1. Approach to Assessment and Reporting

148. The assessment of the potential negative impacts of the subprojects is structured by the three development phases of the subprojects defined by: 1) Pre-construction preparation; 2)

Construction; and 3) Post-construction operation. This reporting format is carried forward and used for the two EMPs for Houayxay and Luang Namtha subprojects.

2. Pre-construction Phase

149. Negative impacts associated with the pre-construction phases of the sub-projects primarily concern the social issues of land acquisition and resettlement. At the feasibility design stage of the subprojects the following issues of land loss and resettlement are identified.

Houayxay

150. In Houayxay, the key impacts will be as follows: (i) Component 1A – Riverbank Upgrading and Protection – will require acquisition of 837m^2 of private land affecting 11 households (67 APs). Among them 7 households (46 APs) will have structures affected and 3 of them (27 APs) will loose business opportunity, (ii) Component 1C – River port Rehabilitation – will affect 49 m^2 of private land belonging to the boat association; (iii) Component 1D – Ecological Park and Recreational Area – will require land acquisition of 280,899m^2 privately owned affecting 33 HHs (173 APs). Assets affected due to land acquisition for the Eco Park are crops/garden/vegetables (15 HHs), Pond (1 HH), Trees (9 HHs), Structures (4 HHs) and 2 HHs affected by business losses. The losses have been estimated and will be compensated; and (iv) the component 3 - Urban road and drainage uprading – has one household (4 APs) on the right of way that will need to be relocated outside ROW within its owned area. For the whole subproject there are 45 AHs with 244 APs and out of 45, 29 AHs (148 APs) will be severely affected (more than 10% of their productive land). The households severely affected are all from the ecological park component. From the whole AHs, there are 5 poor AHs, 5 are FHH and 9 AHs are from Ethnic minority.

Luang Namtha

151. In Luang Namtha, the key impacts will be as follow: (i) Component 2 – Urban Village Upgrading – will require the acquisition of 2,509m^2 of private land affecting 7 HHs (92APs); (ii) Component 3 – Urban Roads Drainage – will require 6,386 m^2 of public land and 352 m^2 of private land, affecting 3 HHs (15 APs). Among the 10 AHs for these two components, none of them will be severely affected in terms of loss of land: the percentage of land loss for each of the AH is below 10% of the total land they own. There is no impacts on structures and no resettlement. The 3 HHs affected in the Urban Road Drainage component will loose 15 teak trees and for the urban village upgrading the 7 AHs will lose 39 trees (Teak, mango, bamboo).

a. Groundwater Analyses

152. The renovation of the landfills in Houayxay and Luang Namtha require an understanding of the depth of the water table, and groundwater quality at both sites in order to complete the designs for the renovations. Soil type and porosity at each site should also be analyzed in order to complete the design the lined cells of the landfills. A draft TOR for groundwater study is provided in Appendix C.

b. Updating EMPs

153. The two subproject EMPs will need to be updated during the pre-construction phase to ensure they meet the safeguard requirements of the final detailed designs of the subprojects. This will involve finalization of mitigation sub-plans to manage potential impact areas such erosion, sedimentation of surface waters, noise, dust and air quality, spoil disposal, traffic, and worker and public safety at the project sites. The impact mitigations of the pre-construction phase are detailed in the EMPs.

154. Key impact mitigation measures of the pre-construction phase are:

1) Initiation of required land acquisition and compensation for each subproject;
2) Completion of TOR for groundwater study;
3) Completion of detailed designs of the subprojects; and
4) Updating and initiation the subproject EMPs.

155. Updating the EMPs involves finalization of mitigation sub-plans for specific impact modes such erosion, sedimentation of surface waters, noise, dust and air quality, spoil disposal, traffic, and worker and public safety at the project sites. Details of the mitigations of the pre-construction phase are provided in the EMPs.

3. Construction Phase

156. To prevent redundant assessment and reporting the common potential impacts & mitigations of subproject components are addressed together allowing subsequent clearer assessment and reporting of subproject-specific impacts and mitigations.

a. Common potential impacts of Houayxay and Luang Namtha subproject components

157. Potential environmental impacts of the subprojects are associated primarily with the short-term construction phase of the subproject components. Common impacts of construction civil works activities are for example, reduced and/or blocked public access, disrupted business and recreation, noise, dust and air pollution caused by increased truck traffic and heavy equipment use, soil and surface water pollution caused by equipment operation and maintenance, public and worker accidents, increased traffic accidents, land erosion and surface water sedimentation, drainage and flooding problems, solid and domestic waste from worker camps, social issues and community problems caused by migrant workers.

158. The short-term construction impacts and disturbances will vary depending on the magnitude the subproject component(s) and location of implementation. For example, the potential sedimentation of the Mekong river is much greater than the sedimentation of the Nam Tha river due to the number and magnitude of component activities that will occur along the Mekong river.

i. Common mitigation measures

159. Measures to mitigate and manage potential common impacts associated with the construction phase of the subprojects are exemplified below. The mitigation measures are detailed further in the EMPs for Houayxay and Luang Namtha subprojects. The regulations on construction in Lao PDR are not well developed. The construction guidelines developed by the

MOF[35], and when necessary appropriate regulations or guidelines of the IFC/World Bank Environment, Health, and Safety Guidelines (2007) should be followed.

1) Care must be taken to ensure that sites for earthworks (e.g., excavations, trenches) that are suspected to have unexploded ordnance (UXO) should be surveyed by UXO Lao prior to construction. If such ordnance is detected clearing work will need to be commissioned prior to undertaking civil works.
2) Open excavations should be fenced, and trenches covered where public walkways or vehicles must cross.
3) A chance find management plan must be in place for cultural artifacts and property.
4) Regular use of wetting agents should be employed at construction sites to minimize dust.
5) All construction vehicles and equipment should be maintained in proper working order, and not operated at night if possible to minimize noise.
6) Speed limits should be posted and adhered to by construction vehicles.
7) Where possible construction vehicles should use different roads or dedicated lanes of roads shared by the public.
8) Trees and other vegetation at all construction sites and along road corridors should be protected with minimal removal. No tree removal in protected and conservation (preservation forests).
9) Present and past land use should be reviewed to assess whether excavated soils are contaminated spoil. Contaminated spoil should be disposed at nearest landfill, or a location approved by the provincial DONRE.
10) Berms and/or silt curtains should be constructed around all excavation/trench sites and along all surface waters to prevent soil erosion and surface water sedimentation.
11) Local workers should be used as much as possible to prevent or minimize influx of migrant workers, and incidence of social disease and community unrest.
12) Worker camps must have adequate domestic waste collection facilities and sufficient pit latrines that are located away from public areas and surface waters as per Law on Industry No. 01/99/NA (1999).
13) Dedicated fuel storage areas must be established away from public areas and marked clearly.
14) To minimize the impact of construction on the public, and workers national regulations guidelines for worker and public safety I the workplace should be followed. The IFC World Bank Environment, Health, and Safety Guidelines (2007) cited above that govern the safe and orderly operation of civil works should be followed if national directives are incomplete or absent.
15) The creation of new borrow pits must be approved by DONRE, and begin with a plan to restore the pit to the original state as possible with vegetation and fencing and signage to protect the public.
16) Aggregates (e.g., sand, gravel, rock) that are transported by truck should be covered.
17) Prolonged use of temporary storage piles of fill should be avoided, or covered, or wetted regularly to prevent dust and erosion.
18) If suitable land-based borrow pits are not available then sand or aggregate extraction from rivers should be done at DONRE-approved locations licensed areas only. This is especially important for the riverbank work along the Mekong river.
19) Storage of bulk fuel should be on covered concrete pads away from the public and worker camp. Fuel storage areas and tanks must be clearly marked, protected and lighted. Contractors should be required to have an emergency plan to handle fuel and oil spillage.

[35] (MOF, 2009) School Construction Guidelines

b. Subproject-specific impacts & mitigations

160. Listed below are potential construction-related impacts specific to subproject components, or potential common impacts identified above that need to be highlighted for mitigation.

Houayxay

Riverbank Upgrading & Protection, Riverside Road & Walkway, and Port Rehabilitation

Sedimentation and pollution

161. The installation of "green" slope stabilizing technologies, the construction of the riverside roadway and pedestrian promenade, and rehabilitation of the port will expose the river to significant sedimentation from soil erosion, and pollution from liquid and solid construction waste.

162. The identified options for upgrading and protecting of the riverbank at the town centre (para 32) need to be reviewed and clarified at detailed design phase. The potential impacts of optional placements of erosion and slope protection technologies on the western main river side of the island versus on the eastern mainland adjacent to the island (Figure 3) are different. Moreover, the option of mining the island for required fill for the riverbank protection work as opposed to obtain fill elsewhere needs to be reviewed.

163. The potential sedimentation and pollution of the Mekong river from upgrading and protecting the riverbank on the west side of the island facing the main stem river would be much greater than protecting the riverbank on the mainland east of the island. The main stem of the Mekong river would be protected from erosion and sedimentation from riverbank work on the mainland east of the island whereas would be exposed to sedimentation from riverbank protection works on western side of the island.

Mitigation

164. To minimize sedimentation of the river all shoreline subproject activities should occur during the dry season when maximum riverbank is out of water, and when the river most effectively can be isolated from the civils works on the shoreline. Where possible temporary earth berms or continuous plastic fences should be placed between civils works areas and the river to contain loose soil. If possible a silt curtain parallel to the shore should be installed just offshore to contain civil works activities and sedimentation that does occur to the inshore area away from the main Mekong river.

165. An enforced formal construction waste collection and disposal plan is needed to ensure all liquid and solid construction waste is not discarded into the river. All solid waste should be routinely collected for disposal in landfill. Construction worker latrines should not be installed near the river and are cleaned regularly. Similarly, all other domestic wastewater should be contained away from river, and regularly disposed at DONRE-approved sites.

Disruption of boat traffic and river activities

166. Shoreline subproject components, in particular port rehabilitation, will potentially disrupt normal boat traffic and increase risk of traffic accidents on the river. Any in-river shoreline

protection and riverside road construction activities with boats or barges could affect local boat traffic especially near the riverbank works. Normal tourist passenger and commercial boat schedules at the ferry terminal will need to be modified when the port is upgraded. Complete disruption of ferry traffic will occur if the present boat docks and ramps are removed without temporary facilities installed.

167. The increased boat traffic in river caused by the addition of construction boat or barge traffic in the river would increase the risk of boat accidents. Activities and uses of the river such as fishing could be affected by construction boat traffic.

168. Access to fishing areas could be impaired or prevented. The two community managed fishing areas at Tin That and Pa Oy villages on the Mekong river at Houayxay (Figure 19) could be affected by the riverbank protection works.

Mitigation

169. Schedule any required riverbank work from boats or barges to miss fishing peak boat traffic periods on the river. If possible designate areas along shoreline or navigation lanes of river for construction boat/barge traffic to separate from other normal boat traffic on river. Install shoreline and floating signage indicating riverbank works in progress, and to direct the public must stay clear of the construction areas. All construction boat/barge traffic must stay clear of the community managed fishing areas in the river, and the fishing areas should be well marked including floating makers at the area boundaries.

Ecological Park and Recreation Area

170. The landscaping and civil works that will be necessary to develop the park will potentially cause sedimentation and pollution of the lake which will become the focal point of the park. The small fish community in the lake will be negatively affected by those construction disturbances, as will current casual fishing by local residents.

Mitigation

171. The lake of the future ecological park in Houayxay must be protected from all development activities with the construction of a temporary, continuous berm and plastic or dense-link fence around the entire shoreline to prevent sedimentation from loose soil, and pollution from discarded liquid and solid construction waste. Similar to construction phase of other components a formal construction waste collection and management plan should be created and implemented for the development of the ecological park.

172. The area and volume of soil that will be excavated/dredged from the riverbank/shoreline or infilled to complete the riverbank, river port, and ecological park components is not clear at the feasibility stage. The actual volumes soil removed or filled along the riverbank/shoreline must wait until detailed designs of the individual components are complete including the length of riverbank protection, and area of passenger staging area of port. However, explicit in the EMP is minimal excavation of riverbank and only inshore dredging when essential.

Solid Waste Management

173. The renovation of the existing dumpsite, and access road could negatively affect normal dumping operations of municipal waste, and the activities, livelihoods, and safety of the waste pickers. The renovation of the dumpsite and overall waste management system must not prevent or interfere with ongoing solid waste collection, transport, and management.

Mitigation

174. Renovation activities must be scheduled in view of regular garbage truck movement to/from the dumpsite in order to not interefere with normal dumping operations. The wastepicker population must be made aware and understand the renovation plan, schedule, and timeline. The consolidation and covering of the old waste heap and fields must follow the preparation of the new and renovated waste cells so that shift of garbage dumping from old to renovated is not dsrupted. Civil works for access road upgrades should be scheduled to avoid interference with regular garbage truck movement on the road. Wetting agents should be applied to the access road while being upgraded.

Influence of Thai Recycling Company

175. The understanding obtained from the DPWT in Hoauaxay is that the operations of the Thai Recycling and Oil Recovery Plant located at the dumpsite contributed to the current suboptimal function of the originally designed dumpsite. Thus, the design and sustainability of the renovated dumpsite to controlled landfill status requires a good understanding of the current and expected future waste management practices of the Thai company. Moreover, if the waste type and management practice of the Thai recycling company cannot be compatible with the planned dumpsite renovations then the M/DPWT needs to determine at detailed design phase: a) if and how the Thai company must change their operations; and/or b) how the feasibility designed renovation must be modified to ensure a sustainable renovated landfill site.

Mitigation

176. At the detailed design phase the feasibility design of the dumpsite renovations, and the waste management practices of the the Thai company must be reviewed and modified where necessary to ensure that the renovated landfill will operate sustainably.

Urban Roads and Drainage, and Wastewater Collection

177. The upgrades to the town drains, roads, and wastewater collection will increase local dust levels and noise, create traffic congestion, and block or reduce access by residents. Increased traffic along the affected roads from construction vehicles will increase risk of traffic accidents with local vehicles. All components will require removal of vegetation and some trees.

Mitigation

178. Traffic congestion and risk of accidents can be mitigated with scheduled construction traffic to avoid peak local traffic time on the roads, and use of dedicated roads or lanes if possible for constrution vehicles. Wetting agents should be applied regularly to roads and construction areas to minimize dust. To minimize loss of vegetation and trees, road widening and width of improved or new drains should be as minimal as possible, and a formal tree replacement and site restoration plan should be instituted. The plan should prescribe the planting of 3 trees to replace every tree that is removed.

Luang Namtha

Improvements to Wastewater Drains, and Road Drainage

179. Similar to Houaxay the upgrades to the town wastewater drains and wastewater pond #2 (Figures 12 & 13), construction of Pond #1, and improved road drainage will create traffic congestion, block or reduce access by residents, and increase risk of traffic accidents as a

result of increased traffic congestion from construction vehicle traffic. Tree and vegetation removal will be required.

Mitigation
180. Traffic congestion and risk of accidents can be mitigated with construction traffic scheduled to avoid peak local traffic time on the roads, and use of dedicated roads or lanes if possible for constrution vehicles. To minimize loss of vegetation and trees, road widening and width of improved or new drains should be as minimal as possible, and a formal tree replacement and site restoration plan should be instituted. The plan should prescribe the planting of 3 trees to replace every tree that is removed. Wetting agents should be applied regularly to roads and construction areas to minimize dust.

Solid Waste Management

181. The renovation of the existing dumpsite and access road could negatively affect normal municipal waste dumping operations, and the activities, livelihoods, and safety of the waste pickers. The renovation of the dumpsite and overall waste management system must not prevent or interfere with ongoing solid waste collection, transport, and management.

Mitigation
182. Renovation activities must be scheduled in view of regular garbage truck movement to and from the dumpsite to not interefere with normal dumping operations. The wastepicker population must be made aware and understand the renovation plan, schedule, and timeline. The consolidation and covering of the old waste heap and fields must follow the preparation of the new and renovated waste cells so that shift of garbage dumping from old to renovated is not dsrupted. Civil works for access road upgrades should be scheduled to avoid interference with regular garbage truck movement on the road. Wetting agents should be applied to the access road while being upgraded.

Urban Recreation Facilities and Village Upgrading

183. The upgrades to the roads, drainage, and infrastructure of the five (5) widely spread demonstration villages (Figure 12) will create traffic congestion, dust and noise, and block or reduce access by residents. Increased traffic along the affected roads from construction vehicles will increase risk of traffic accidents with local vehicles. All components will require removal of vegetation and some trees.

Mitigation
Traffic congestion and risk of accidents can be minimized with scheduled construction traffic to avoid peak local traffic time on the roads, and use of dedicated roads or lanes if possible for constrution vehicles. To minimize loss of vegetation and trees a formal tree replacement and site restoration plan should be instituted. The plan should prescribe the planting of 3 trees to replace every tree that is removed. Wetting agents should be applied regularly to roads and construction areas to minimize dust.

Nam Tha River Bridge

184. The construction of the bridge over the Nam Tha river for the road to Thongdi village (Figures 17 & 29) will potentially result in pollution, and major sedimentation of the river from soil erosion, and discarded liquid and solid construction waste. Loss of aquatic habitat will also occur if bridge support pilings are constructed in the river.

Mitigation

185. The design of the bridge should locate bridge support piles on both riverbanks not in the river to prevent major disturbance to aquatic habitat. To prevent or minimize heavy sedimentation of river from erosion, earthen berms and plastic sheet fencing should be placed along both river banks extending well above and below the bridge alignment to isolate river from shoreline civil works, and loose soils at construction site should be wetted regularly. Similar to other subprject componenets a formal construction waste collection and management plan should be implemented at the bridge construction area to keep all waste out of river.

C. Induced and Cumulative Impacts

186. A potential induced spatial or temporal cumulative impact of the targeted increase in socioeconomic development of the two corridor towns of Houayxay and Luang Namtha is increased consumption of natural resources, and pollution. Houayxay would likely be the most sensitive to increased consumption and pollution due to the tourist and commercial development that is supported by the Mekong river, and the juxtaposition of Houayxay with Myanmar, Thailand, and PRC China

D. Climate Change

1. Projections

187. Recent reports and summaries, e.g.,[36],[37],[38] of climate change scenarios for Cambodia based on the most recent climate change projections of the different Global Circulation Models (GCM) and Regional Climate Models (RCM) indicate that by 2100 average annual air temperature in the country may increase between 1.4 - 4.3C^{o}, and total annual rainfall increases in northern Laos of +4.3% with the greatest increase during the rainy season. Frequency of extreme weather events is expected to increase. Being landlocked sea level rise is not an issue with Laos subprojects.

2. Climate Risk and Vulnerability

188. The sensitivity to climate change of the subprojects in Houayxay and Luang Namtha was screened *Low* with the initial REA of subproject (Appendix A) due to the relatively high inland locations of the subprojects, and because explicit in the design of the subproject components in or near low lying areas, or on riverbanks is resilience to increased rainfall and seasonal flood levels caused by climate change. With the overall sensitivity to climate change being the next steps in the climate risk assessment flowchart[39] defined by applying the AWARE sensitivity assessment and then the more in-depth CVRA are not necessary.

[36] UNEP, 2010. Assessment of Capacity Gaps and Needs of Southeast Asian Countries Addressing Impacts, Vulnerabilities, and Adaption to Climate Variability and Climate Change, 215 pgs + references
[37] World Bank, GFDDR, 2011. Vulnerability, Risk Reduction, and Adaptation to Climate Change: Lao PDR, 15 pgs.
[38] ADB, 2014. ADB Support to Climate Change in Laos, statement provide by S. Schipani, LRM
[39] ADB (2014) Climate Proofing ADB Investment in the Transport Sector: Initial Experience, 88 pgs + Appendices

3. Contribution to Global Climate Change

a. Greenhouse gas emissions

i. Overview

189. The single potential significant source of GHGs of the subprojects in Houayxay and Luang Namtha is the solid waste management (SWM) components. The production of methane (CH_4) occurs from anaerobic decomposition of solid organic matter in the cells of landfills[40],[41] which is emitted to the atmosphere unless captured and flared, or otherwise neutralized. Methane is the most important GHG because the greenhouse gas effect of CH_4 is 40-50 times stronger than the effect of carbon dioxide (CO_2).

190. Similarly, wastewater treatment can also produce methane and other GHGs depending on the extent of anaerobic treatment processes via anaerobic lagoons which are also released to the atmosphere unless captured and neutralized. However, the WWT components of the two subprojects in Houayxay and Luang Namtha will not generate GHGs because the subprojects will only improve existing raw drainage and collection ponds - not develop active WW treatment processes with new WWTPs.

191. The SWM components in Houayxay and Luang Namtha consist of renovating the currently unmanaged dumpsites in both towns to more modern managed landfills which will include lined, covered waste cells, groundwater monitoring tube wells, and leachate collection and storage. Expectedly, the renovated landfills will produce more methane than currently produced by the existing unmanaged dumpsites because by design the new solid waste cells of the renovated landfill will be more anaerobic than the existing less confined - scattered piles of solid waste at the existing dumpsites which undergo more aerobic decomposition[42].

ii. Feasibility design

192. Thus, expected increases in GHG production caused by the renovation of the existing dumpsites will be marginal to the GHGs currently being produced and released to the atmosphere by the dumpsites. At the feasibility design stage there is no plan to capture and flare, or otherwise neutralize the methane produced from the renovated landfills, thus methane that is produced will be emitted to the environment. SWM activities that act as credits to reduce GHG emissions / tonne of waste transported to the landfills are recycling and use of larger more fuel efficient garbage trucks[43]. While new trucks are part of the renovated solid waste management systems of both towns, formal Material Recycling Facilities (MRF) are not included in the feasibility design of the SWM components of the subprojects, therefore, anticipated increases in recycling at the renovated landfills will be passive at best.

[40] Bogner et al. 2007. Waste Management, In Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA
[41] Doorn and Irving 2006. IPCC Guidelines for Greenhouse Gas Inventories, Wastewater Treatment & Discharge
[42] Footnote 40
[43] Footnote 39

193. Consideration should be given at detailed engineering design stage of including methane flaring at the renovated dumpsites, and developing more modern on-site MRFs to actively promoting recycling. These technical options will act to offset the production of GHGs.

iii. Retroactive estimation of GHGs

194. A defensible, retroactive quantitative assessment of the effect of the SWM components on GHG production is strongly limited by the uncertainties and lack of information on key parameters such as biophysical features of the dumpsite areas, inventory of types and volumes of solid waste, and unknown future changes to recycling. The GHG assessment parameters need to be explicit in the design of the PPTA otherwise only qualitative estimations of the impact of the subprojects on GHGs are defensible.

IGES GHG Simulation Model

195. An example tool for estimating GHG production and emissions from landfills is the simulation model developed by the Institute for Global Environmental Studies (IGES). The model integrates the range of factors influencing GHG production and emissions of SWM activities from the literature into a commercial spreadsheet to allow simulation of the effects of different types of SWM techniques and activities for different combinations of solid wastes on GHG emissions including recycling and garbage truck transport. However, for credible estimations the model requires detailed information on biophysical conditions, accurate solid waste types and volumes, and transportation which are beyond the scope of the PPTA design.

196. Assuming that all activities of SWM at the dumpsite sites remain the same and only an increase in the anaerobic decomposition of solid waste occurred with the installation of the modern waste cells, the SWM IGES model would simulate a general marginal increase in GHG production from the renovated landfills. However, again the simulation is decidedly crude because of the absence of detailed input data for the simulation.

197. Consideration of climate change can include measures to reduce other contributions of the subprojects to greenhouse gas production. Efforts through design will be taken to reduce the carbon footprint of the project by ensuring for example that speed limits along upgraded roads are established and subsequently enforced, vehicles that use the upgraded roads are maintained in good working order, and all lighting installed at the subproject component sites use light bulbs that are energy efficient.

VII. ANALYSIS OF ALTERNATIVES

1. Houayxay

198. The analysis of subproject alternatives considered the Mekong riverbank protection subcomponent. Initially the EA requested that a continuous [ca 5-6 km] section of riverbank be upgraded and protected from the town centre south to the international bridge (Figure 2). However, after inspection of the entire section of riverbank from a slow boat the PPTA determined that only a short continuous section at the town centre needed of upgrading, and that only a few shorter intermittent sections south of the town centre required protection.

2. Luang Namtha

199. The 5-7 demonstration villages selected for upgrading was reduced significantly from the original list of villages requested by the EA.

VIII. INFORMATION DISCLOSURE AND PUBLIC GRIEVANCE MECHANISM

200. As described above the subproject components were introduced to affected stakeholders as part of the joint social-environment surveys and consultations. Verbal and visual presentations of the subprojects were provided to all stakeholders ahead of the facilitated consultation discussions.

201. The formal disclosure of information in the local language to affected persons and stakeholders that occurred during the development of the IEE is meant to form the beginning of continued information disclosure and stakeholder involvement as the project is implemented. As part of the stakeholder communication strategy developed for IEE regular information exchange meetings with stakeholders is required throughout implementation of the subprojects.

202. The IEE must be easily available to the stakeholders contacted during examination in written and verbal forms in the local language. The IEE should be available on the provincial DPWT web sites, at DPWT offices, district offices, and subproject sites. Similarly, all project reporting with specific reference to stakeholder consultation minutes, environmental monitoring, and reports on EMP implementation released by the EA/PSC should be available at the same offices and web sites. The IEE will also be available on the ADB web site. And after implementation of subprojects begins, all environmental and EMP reporting submitted by the EA/PSC will also be available on the ADB web site.

203. A well-defined grievance redress and resolution mechanism will be established to address all affected stakeholders grievances and complaints regarding environment, land acquisition, compensation and resettlement in a timely and satisfactory manner. Given the project's joint approach to consultation of the same mechanism will be used for issues of environmental impact or disturbance at any stage of the implementation of all subprojects. All stakeholders will be made fully aware of their rights, and the detailed procedures for filing grievances and an appeal process will be published through an effective public information campaign. The grievance redress mechanism and appeal procedures will also be explained in a project information booklet (PIB) that will be distributed to all stakeholders.

204. Stakeholders or persons affected by the subprojects are entitled to lodge complaints regarding any environmental issue or any aspect of the land acquisition and resettlement requirements such as, entitlements, rates and payment and procedures for resettlement and income restoration programs. Stakeholder complaints can be made verbally or in written form. In the case of verbal complaints, the committee on grievance will be responsible to make a written record during the first meeting with the stakeholders.

205. A Grievance Committee will be organized in villages comprising local leaders designated for such tasks. The designate officials shall exercise all efforts to settle affected stakeholder issues at the village level through appropriate community consultation. All meetings shall be recorded by the grievance committee and copies shall be provided to affected stakeholders. A copy of the minutes of meetings and actions undertaken shall be provided to the DPWT, IUs, DONREs, and ADB upon request.

206. The procedures for grievance redress are set out below. The procedure described below should apply easily to both social and environmental issues and be consistent with the legal process for resolution of disputes in Lao PDR, and exemplifies the desired collaboration among the different levels of government as recently described by Decision 7536/MONRE (2012).

i) Stage 1: Complaints from affected stakeholders for the first time shall be lodged verbally or in written form with the village head or commune leader. The complaints shall be discussed with the affected stakeholder and the designated Head of Grievance Committee or members of the committee. It will be the responsibility of the Head of Grievance Committee to resolve the issue within 15 days from the date the complaint is received. All meetings shall be recorded and copies of the minutes of meetings will be provided to APs.

ii) Stage 2: If no understanding or amicable solution can be reached or if no response is received from the grievance committee within 15 days from filing the complaint, the affected stakeholder can elevate the case to the District Grievance Committee. The District Grievance Committee is expected to respond within 15 days upon receiving the affected stakeholder's appeal.

iii) Stage 3: If the affected stakeholder is not satisfied with the decision of the District Office, or in the absence of any response, the APs can appeal to the Provincial Grievance Committee (PGC). The PGC will review and issue a decision on the appeal within 30 days from the day the complaint is received.

iv) Stage 4: If the affected stakeholder is still not satisfied with the decision of the PGC or in the absence of any response within the stipulated time, the affected stakeholder's, as a last resort may submit his/her case to the provincial court. The court will address the appeal by written decision and submit copies to the respective entities which include the DPWT, DONRE, DGC/PGC and the affected stakeholder. If however, the affected stakeholder is still not satisfied the court's decision, the case may be elevated to the provincial court. If however, the decision of the provincial court is still unsatisfactory to the affected stakeholder, the affected stakeholder may bring the complaints to the Higher Court.

207. The External Monitoring Organization (EMO) will be responsible for checking the procedures and resolutions of grievances and complaints. The EMO must have expertise and experience in social and environmental issues associated with infrastructure developments. The EMO may recommend further measures to be taken to redress unresolved grievances. The Project Supervising Consultants will provide the necessary training to improve grievance procedures and strategy for the grievance committee members when required.

208. The executing agency will shoulder all administrative and legal fees that will be incurred in the resolution of grievances and complaints if the affected stakeholder wins the case. Other costs incurred by legitimate complaints will also be refunded by the project if the affected stakeholder wins their case.

209. In cases where affected stakeholder does not have the writing skills or are unable to express their grievances verbally, affected stakeholder is encouraged to seek assistance from the recognized local groups, district DONRE staff, or NGO or other family members, village heads or community chiefs to have their grievances recorded in writing, and to have access any

environmental or social surveys or valuation of assets, to ensure that where disputes do occur, all the details have been recorded accurately enabling all parties to be treated fairly. Throughout the grievance redress process, the responsible committee will ensure that the concerned affected stakeholder is provided with copies of complaints and decisions or resolutions reached.

210. If efforts to resolve disputes using the grievance procedures remain unresolved or unsatisfactory, affected stakeholder has the right to directly discuss their concerns or problems with the ADB Southeast Asia Department through the ADB Lao PDR Resident Mission (LRM). If APs are still not satisfied with the responses of LRM, they can directly contact the ADB Office of the Special Project Facilitator (OSPF).

IX. CONCLUSIONS AND RECOMMENDATION

211. The examination of the subprojects in Houayxay and Luang Namtha indicates that the potential environmental impacts are largely restricted to the construction phase of the subproject components. The civil construction disturbances such dust, noise, traffic disruptions, erosion and sedimentation, and public and worker safety can be managed effectively with standard construction practices (e.g., IFC/World Bank 2007).

212. The description of the feasibility designs of the two subprojects combined with available information on the affected environment is sufficient to identify the scope of potential environmental impacts of the project. Providing that significant changes do not occur to the design of one or more of the subproject components, and that new sensitive environmental or social receptor data is not discovered, a further detailed environmental impact assessment (EIA) of the project is not required.

213. The separate EMPs developed for the subprojects provide impact mitigation plans, environmental monitoring plans, and specify the institutional responsibilities and capacity needs for the environmental management of the subprojects. The EMPs will need to be reviewed and updated at the detailed design phase to ensure that they fully address the potential impacts of the final subproject designs.

APPENDIX A: RAPID ENVIRONMENTAL ASSESSMENTS OF SUBPROJECTS

Houayxay Subproject

Rapid Environmental Assessment (REA) Checklist **Ports and Harbours**

Country/Project Title: Second Corridor Towns Development Project, PPTA 8425 VIE – **Houayxay**

Sector Division: Riverbank Upgrading and River Port Rehabilitation / Urban Development / SERD

Screening Questions	Yes	No	Remarks
A. Project Siting Is the Project area adjacent to, or within any of the following environmentally sensitive areas?			
▪ Cultural heritage site		X	
▪ Protected Area		X	
▪ Wetland		X	
▪ Mangrove		X	
▪ Estuarine		X	
▪ Buffer zone of protected area		X	
▪ Special area for protecting biodiversity		X	
B. Potential Environmental Impacts Will the Project cause…			
▪ encroachment on precious ecology resulting in loss or damage to fisheries and fragile coastal habitats such as coral reefs, mangroves, and seagrass beds?		X	
▪ short-term increase in turbidity and sunlight penetration as well as changes in sediment pattern and flows at dredging site?	X		The EMP for project prescribes mitigation measures to minimize erosion and sedimentation of Mekong river
▪ removal and disturbance of aquatic flora and fauna at dredging site?		X	No dredging is planned for riverbank or port rehabilitation works
▪ deterioration of water quality due to silt runoff and sanitary wastes from worker-based camps and chemicals used in construction?	X		The EMP for project prescribes mitigation measures to prevent worker camp waste runoff to Mekong river
▪ alteration of bottom surface and modifications to bathymetry, causing changes in tidal bore, river circulation, species diversity, and salinity?		X	

Screening Questions	Yes	No	Remarks
▪ changes in sediment pattern and littoral drift that may cause beach erosion of neighboring areas?		X	
▪ modification of terrestrial habitat by upland disposal of dredged material or covering of potential archaeological sites with dredge spoil?		X	
▪ short-term air quality degradation due to dredging-related operations?		X	
▪ noise and vibration due to blasting and other civil works?		X	
▪ risks and vulnerabilities related to occupational health and safety due to physical, chemical, biological, and radiological hazards during project construction and operation?		X	
▪ dislocation or involuntary resettlement of people?		X	
▪ disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?		X	
▪ other social concerns relating to inconveniences in living conditions in the project areas?		X	
▪ social conflicts if construction depletes local fishery resources on which communities depend for subsistence?		X	
▪ poor sanitation and solid waste disposal in construction camps and work sites, and possible transmission of communicable diseases from workers to local populations (such as STI's and HIV/AIDS)?	X		The EMP for project prescribes mitigation sub-plan to manage worker camp waste. Social diseases will be prevented with education, and a small migrant worker population
▪ social concerns relating to local inconveniences associated with port operation (e.g. increased volume of port traffic, greater risk of accidents, communicable disease transmission)?		X	
▪ deterioration of water quality due to ship (e.g. ballast water, oil waste, lubricant and fuel spills, sewage) and waterfront industry discharges?		X	

Screening Questions	Yes	No	Remarks
▪ increased noise and air pollution resulting from airborne emissions (e.g. gas, smoke, fumes) from maneuvering and berthing ships and the waterfront industry?	X		Minor short-term decreases in air quality from shoreline earthwork machines will be managed with prescribed equipment maintenance program
▪ large population increase during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)?		X	
▪ social conflicts especially when workers from other areas are hired?	X		Minor potential impact due to anticipated small migrant worker population
▪ risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel and other chemicals during construction and operation?		X	
▪ community safety risks due to both accidental and natural hazards, especially where the structural elements or components of the project are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning?		X	

A Checklist for Preliminary Climate Risk Screening

Country/Project Title: GMS Second Corridor Towns Development Project PPTA 8474 REG

Sector: Urban Development

Subsector: Riverbank Upgrading and River Port Rehabilitation

Division/Department: Urban Development / SERD

Screening Questions		Score	Remarks
Location and Design of project	Is siting and/or routing of the project (or its components) likely to be affected by climate conditions including extreme weather related events such as floods, droughts, storms, landslides?	0	By design the developed or rehabilitated riverbank, and rehabilitated port will be designed to be resilient to seasonal high water levels of Mekong river now, and in climate change rainfall scenarios
	Would the project design (e.g. the clearance for bridges) need to consider any hydro-meteorological parameters (e.g., sea-level, peak river flow, reliable water level, peak wind speed etc)?	1	As above.
Materials and	Would weather, current and likely future climate conditions (e.g. prevailing humidity level, temperature	0	

Maintenance	contrast between hot summer days and cold winter days, exposure to wind and humidity hydro-meteorological parameters likely affect the selection of project inputs over the life of project outputs (e.g. construction material)?		
	Would weather, current and likely future climate conditions, and related extreme events likely affect the maintenance (scheduling and cost) of project output(s) ?	0	
Performance of project outputs	Would weather/climate conditions, and related extreme events likely affect the performance (e.g. annual power production) of project output(s) (e.g. hydro-power generation facilities) throughout their design life time?	0	

Options for answers and corresponding score are provided below:

Response	Score
Not Likely	0
Likely	1
Very Likely	2

Result of Initial Screening (Low, Medium, High): Low **Other Comments: n/a**

Rapid Environmental Assessment (REA) Checklist **Roads and Highways**

Country/Project Title: Second Corridor Towns Development Project, PPTA 8425 VIE – **Houayxay**

Sector Division: Riverside road and walkway / Urban Development / SERD

Screening Questions	Yes	No	Remarks
A. Project Siting Is the project area adjacent to or within any of the following environmentally sensitive areas?			
▪ Cultural heritage site		x	
▪ Protected Area		x	
▪ Wetland		x	
▪ Mangrove		x	
▪ Estuarine		x	
▪ Buffer zone of protected area		x	
▪ Special area for protecting biodiversity		x	
B. Potential Environmental Impacts Will the Project cause…			

Screening Questions	Yes	No	Remarks
▪ encroachment on historical/cultural areas; disfiguration of landscape by road embankments, cuts, fills, and quarries?		x	
▪ encroachment on precious ecology (e.g. sensitive or protected areas)?		x	
▪ alteration of surface water hydrology of waterways crossed by roads, resulting in increased sediment in streams affected by increased soil erosion at construction site?	x		The EMP for project will prescribe mitigation measures to manage erosion and sedimentation of small streams and Mekong river during construction phase
▪ deterioration of surface water quality due to silt runoff and sanitary wastes from worker-based camps and chemicals used in construction?	x		The EMP will prescribe worker camp waste management plans
▪ increased local air pollution due to rock crushing, cutting and filling works, and chemicals from asphalt processing?		x	
▪ risks and vulnerabilities related to occupational health and safety due to physical, chemical, biological, and radiological hazards during project construction and operation during project construction and operation?		X	
▪ noise and vibration due to blasting and other civil works?	X		The EMP for project prescribes mitigation sub-plans for noise. Blasting is not required.
▪ dislocation or involuntary resettlement of people?	X		Not sure at this time
▪ dislocation and compulsory resettlement of people living in right-of-way?	X		Not sure at this time
▪ disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?		X	
▪ other social concerns relating to inconveniences in living conditions in the project areas that may trigger cases of upper respiratory problems and stress?		X	
▪ hazardous driving conditions where construction interferes with pre-existing roads?	X		The EMP prescribes construction traffic management to protect the local public
▪ poor sanitation and solid waste disposal in construction camps and work sites, and possible transmission of communicable diseases (such as STI's and HIV/AIDS) from workers to local populations?	X		The EMP for project prescribes plan for waste management at construction sites and work camps. STIs and HIV are not expected to be a problem due to mostly local worker force
▪ creation of temporary breeding habitats for diseases such as those transmitted by mosquitoes and rodents?		X	

Screening Questions	Yes	No	Remarks
▪ accident risks associated with increased vehicular traffic, leading to accidental spills of toxic materials?	X		The EMP for project prescribes mitigation measures to manage the increased construction traffic. Transport of toxic materials during, and after construction is not planned
▪ increased noise and air pollution resulting from traffic volume?	X		The EMP for project prescribes mitigation measures for increased noise and local air pollution from increased traffic during construction, and after roads are completed
▪ increased risk of water pollution from oil, grease and fuel spills, and other materials from vehicles using the road?	X		The EMP for project prescribes mitigation measures to manage waste hydrocarbons at construction sites
▪ social conflicts if workers from other regions or countries are hired?		X	
▪ large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)?	X		Mostly local worker force is expected for construction phase which will not strain urban utilities
▪ risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel and other chemicals during construction and operation?		X	
▪ community safety risks due to both accidental and natural causes, especially where the structural elements or components of the project are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning.		X	

A Checklist for Preliminary Climate Risk Screening

Country/Project Title: GMS Second Corridor Towns Development Project PPTA 8474 REG

Sector: Urban Development

Subsector: Riverside road and walkway

Division/Department: Urban Development / SERD

Screening Questions		Score	Remarks
Location and Design of project	Is siting and/or routing of the project (or its components) likely to be affected by climate conditions including extreme weather related events such as floods, droughts, storms, landslides?	1	The designs including grading of upgraded roads and proposed shore road will need to be designed to be resilient to increases in local rainfall/flooding events, and erosion

			due to climate change.
	Would the project design (e.g. the clearance for bridges) need to consider any hydro-meteorological parameters (e.g., sea-level, peak river flow, reliable water level, peak wind speed etc)?	0	
Materials and Maintenance	Would weather, current and likely future climate conditions (e.g. prevailing humidity level, temperature contrast between hot summer days and cold winter days, exposure to wind and humidity hydro-meteorological parameters likely affect the selection of project inputs over the life of project outputs (e.g. construction material)?	0	
	Would weather, current and likely future climate conditions, and related extreme events likely affect the maintenance (scheduling and cost) of project output(s) ?	0	
Performance of project outputs	Would weather/climate conditions, and related extreme events likely affect the performance (e.g. annual power production) of project output(s) (e.g. hydro-power generation facilities) throughout their design life time?	0	

Options for answers and corresponding score are provided below:

Response	Score
Not Likely	0
Likely	1
Very Likely	2

Result of Initial Screening (Low, Medium, High): Low **Other Comments**: n/a

Rapid Environmental Assessment (REA) Checklist **SOLID WASTE**

Country/Project Title: Second Corridor Towns Development Project, PPTA 8425 VIE – **Houayxay**

Sector Division: Solid Waste Management / Urban Development / SERD

Screening Questions	Yes	No	Remarks
A. Project Siting Is the project area			• Rehabilitated landfill
▪ Densely populated?		X	
▪ Heavy with development activities?		X	
▪ Adjacent to, or within any environmentally sensitive areas?			
• Cultural heritage site		X	
• Protected Area		X	
• Wetland		X	
• Mangrove		X	

Screening Questions	Yes	No	Remarks
• Estuarine		X	
• Buffer zone of protected area		X	
• Special area for protecting biodiversity		X	
• Bay		X	
B. Potential Environmental Impacts Will the Project cause…			
▪ impacts associated with transport of wastes to the disposal site or treatment facility		X	
▪ impairment of historical/cultural monuments/areas and loss/damage to these sites?		X	
▪ degradation of aesthetic and property value loss?		X	
▪ nuisance to neighboring areas due to foul odor and influx of insects, rodents, etc.?		X	
▪ dislocation or involuntary resettlement of people?		X	
▪ disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?		X	
▪ risks and vulnerabilities related occupational health and safety due to physical, chemical, biological, and radiological hazards during project construction and operation?		X	
▪ public health hazards from odor, smoke from fire, and diseases transmitted by flies, insects, birds and rats?		X	
▪ deterioration of water quality as a result of contamination of receiving waters by leacheate from land disposal system?	X		Upgraded landfill will include leachate collection and storage system which will improve quality of discharge to stream below.
▪ contamination of ground and/or surface water by leach ate from land disposal system?	X		Upgraded landfill will be lined with clay and include leachate collection and storage system which should improve affected qroundwater quality.
▪ land use conflicts?		X	
▪ pollution of surface and ground water from leachate coming form sanitary landfill sites or methane gas produced from decomposition of solid wastes in the absence of air, which could enter the aquifer or escape through soil fissures at places far from the landfill site?	X		Upgraded landfill will be lined with clay and include leachate collection and storage system which should improve affected discharge stream and qroundwater quality. Methane gas produced by landfill will dissipate uncollected.
▪ inadequate buffer zone around landfill site to alleviate nuisances?		X	

Screening Questions	Yes	No	Remarks
▪ road blocking and/or increased traffic during construction of facilities?		X	
▪ noise and dust from construction activities?	X		The EMP prescribes mitigation measures for controlling noise and dust during construction at site and along access road
▪ temporary silt runoff due to construction?		X	
▪ hazards to public health due to inadequate management of landfill site caused by inadequate institutional and financial capabilities for the management of the landfill operation?		X	
▪ emission of potentially toxic volatile organics from land disposal site?		X	
▪ surface and ground water pollution from leach ate and methane gas migration?		X	Clay liner and leachate collection system should prevent contamination of groundwater by leachate. Methane gas will dissipate freely
▪ loss of deep-rooted vegetation (e.g. tress) from landfill gas?		X	
▪ explosion of toxic response from accumulated landfill gas in buildings?		X	
▪ contamination of air quality from incineration?		X	
▪ public health hazards from odor, smoke from fire, and diseases transmitted by flies, rodents, insects and birds, etc.?	X		Landfill located away from settlements
▪ health and safety hazards to workers from toxic gases and hazardous materials in the site?		X	
▪ large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)?		X	Local worker force is expected
▪ social conflicts if workers from other regions or countries are hired?		X	Local worker force is expected
▪ risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel and other chemicals during construction and operation?		X	
▪ community safety risks due to both accidental and natural hazards, especially where the structural elements or components (e.g., landfill or incinerator) of the project are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning?		X	

A Checklist for Preliminary Climate Risk Screening

Country/Project Title: GMS Second Corridor Towns Development Project PPTA 8474 REG

Sector: Urban Development

Subsector: Solid Waste Management

Division/Department: Urban Development / SERD

Screening Questions		Score	Remarks
Location and Design of project	Is siting and/or routing of the project (or its components) likely to be affected by climate conditions including extreme weather related events such as floods, droughts, storms, landslides?	0	Existing landfill is located at an elevation that is not susceptible to flooding
	Would the project design (e.g. the clearance for bridges) need to consider any hydro-meteorological parameters (e.g., sea-level, peak river flow, reliable water level, peak wind speed etc)?	0	
Materials and Maintenance	Would weather, current and likely future climate conditions (e.g. prevailing humidity level, temperature contrast between hot summer days and cold winter days, exposure to wind and humidity hydro-meteorological parameters likely affect the selection of project inputs over the life of project outputs (e.g. construction material)?	0	
	Would weather, current and likely future climate conditions, and related extreme events likely affect the maintenance (scheduling and cost) of project output(s) ?	0	
Performance of project outputs	Would weather/climate conditions, and related extreme events likely affect the performance (e.g. annual power production) of project output(s) (e.g. hydro-power generation facilities) throughout their design life time?	0	

Options for answers and corresponding score are provided below:

Response	Score
Not Likely	0
Likely	1
Very Likely	2

Result of Initial Screening (Low, Medium, High): Low

Other Comments: A groundwater study to determine water table depth and groundwater quality will need to be conducted at detailed design phase.

Rapid Environmental Assessment (REA) Checklist **URBAN DEVELOPMENT**

Country/Project Title: Second Corridor Towns Development Project, PPTA 8425 VIE – **Houayxay**

Sector Division:

Ecological Park, Urban Roads & Drainage, and Wastewater Collection / Urban Development /

Screening Questions	Yes	No	Remarks
A. Project Siting Is the project area			
▪ Densely populated?		X	

Screening Questions	Yes	No	Remarks
▪ Heavy with development activities?		X	
▪ Adjacent to or within any environmentally sensitive areas?		X	
• Cultural heritage site		X	
• Protected Area		X	
• Wetland		X	
• Mangrove		X	
• Estuarine		X	
• Buffer zone of protected area		X	.
• Special area for protecting biodiversity		X	
• Bay		X	
B. Potential Environmental Impacts Will the Project cause…			
▪ impacts on the sustainability of associated sanitation and solid waste disposal systems and their interactions with other urban services.		X	
▪ deterioration of surrounding environmental conditions due to rapid urban population growth, commercial and industrial activity, and increased waste generation to the point that both manmade and natural systems are overloaded and the capacities to manage these systems are overwhelmed?		X	
▪ degradation of land and ecosystems (e.g. loss of wetlands and wild lands, coastal zones, watersheds and forests)?		X	
▪ dislocation or involuntary resettlement of people?	X		Unsure at this time
▪ disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable group?		X	
▪ degradation of cultural property, and loss of cultural heritage and tourism revenues?		X	
▪ occupation of low-lying lands, floodplains and steep hillsides by squatters and low-income groups, and their exposure to increased health hazards and risks due to pollutive industries?		X	

Screening Questions	Yes	No	Remarks
▪ water resource problems (e.g. depletion/degradation of available water supply, deterioration for surface and ground water quality , and pollution of receiving waters?		X	
▪ air pollution due to urban emissions?		X	
▪ risks and vulnerabilities related to occupational health and safety due to physical, chemical and biological hazards during project construction and operation?		X	
▪ road blocking and temporary flooding due to land excavation during rainy season?		X	
▪ noise and dust from construction activities?	X		The EMP for project prescribes mitigation measures for noise and dust during construction.
▪ traffic disturbances due to construction material transport and wastes?	X		The EMP for project prescribes mitigation measures for increased traffic and risk of traffic accidents during construction.
▪ temporary silt runoff due to construction?		X	
▪ hazards to public health due to ambient, household and occupational pollution, thermal inversion, and smog formation?		X	
▪ water depletion and/or degradation?		X	
▪ overpaying of ground water, leading to land subsidence, lowered ground water table, and salinization?		X	
▪ contamination of surface and ground waters due to improper waste disposal?		X	
▪ pollution of receiving waters resulting in amenity losses, fisheries and marine resource depletion, and health problems?		X	
▪ large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)?		X	
▪ social conflicts if workers from other regions or countries are hired?		X	
▪ risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel and other chemicals during operation and construction?		X	

Screening Questions	Yes	No	Remarks
▪ community safety risks due to both accidental and natural hazards, especially where the structural elements or components of the project are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning?		X	

A Checklist for Preliminary Climate Risk Screening

Country/Project Title: GMS Second Corridor Towns Development Project PPTA 8474 REG

Sector: Urban Development

Subsector: Ecological Park, Urban Roads & Drainage, and Wastewater Collection

Division/Department: Urban Development / SERD

Screening Questions		Score	Remarks
Location and Design of project	Is siting and/or routing of the project (or its components) likely to be affected by climate conditions including extreme weather related events such as floods, droughts, storms, landslides?	1	Design of ecological park facilities will need to consider increased frequency and severity of rainfall events/flooding around lake area caused by climate change. Similarly, for roan upgrades
	Would the project design (e.g. the clearance for bridges) need to consider any hydro-meteorological parameters (e.g., sea-level, peak river flow, reliable water level, peak wind speed etc)?	0	
Materials and Maintenance	Would weather, current and likely future climate conditions (e.g. prevailing humidity level, temperature contrast between hot summer days and cold winter days, exposure to wind and humidity hydro-meteorological parameters likely affect the selection of project inputs over the life of project outputs (e.g. construction material)?	0	
	Would weather, current and likely future climate conditions, and related extreme events likely affect the maintenance (scheduling and cost) of project output(s) ?	0	
Performance of project outputs	Would weather/climate conditions, and related extreme events likely affect the performance (e.g. annual power production) of project output(s) (e.g. hydro-power generation facilities) throughout their design life time?	0	

Options for answers and corresponding score are provided below:

Response	Score
Not Likely	0
Likely	1
Very Likely	2

Result of Initial Screening (Low, Medium, High): Low **Other Comments**: n/a

Luang Namtha Subproject

Rapid Environmental Assessment (REA) Checklist: SEWAGE TREATMENT

Country/Project Title: Second Corridor Towns Development Project, PPTA 8425 VIE – **Luang Namtha**

Sector Division: Improved Wastewater Treatment and Drainage / Urban Development / SERD

Screening Questions	Yes	No	Remarks
B. Project Siting Is the project area in.			• Improved wastewater drains and treatment ponds
▪ Densely populated?		X	
▪ Heavy with development activities?		X	
▪ Adjacent to or within any environmentally sensitive areas?			
• Cultural heritage site		X	
• Protected Area		X	
• Wetland		X	
• Mangrove		X	
• Estuarine		X	
• Buffer zone of protected area		X	
• Special area for protecting biodiversity		X	
• Bay		X	
A. Potential Environmental Impacts Will the Project cause…			
▪ impairment of historical/cultural monuments/areas and loss/damage to these sites?		X	
▪ interference with other utilities and blocking of access to buildings; nuisance to neighboring areas due to noise, smell, and influx of insects, rodents, etc.?		X	
▪ dislocation or involuntary resettlement of people?		X	

Screening Questions	Yes	No	Remarks
▪ disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?		X	
▪ impairment of downstream water quality due to inadequate sewage treatment or release of untreated sewage?	X		The quality of effluent discharged from ponds will be improved
▪ overflows and flooding of neighboring properties with raw sewage?		X	
▪ environmental pollution due to inadequate sludge disposal or industrial waste discharges illegally disposed in sewers?	X		A new DONRE-approved sludge disposal facility will be built at upgraded landfill site
▪ noise and vibration due to blasting and other civil works?	X		The EMP for project prescribes mitigation measures for construction noise. Blasting is not required.
▪ risks and vulnerabilities related to occupational health and safety due to physical, chemical, and biological hazards during project construction and operation?		X	
▪ discharge of hazardous materials into sewers, resulting in damage to sewer system and danger to workers?		X	
▪ inadequate buffer zone around pumping and treatment plants to alleviate noise and other possible nuisances, and protect facilities?		X	
▪ road blocking and temporary flooding due to land excavation during the rainy season?		X	
▪ noise and dust from construction activities?	X		As above the EMP for project prescribes mitigation sub-plans short-term noise, and dust disturbances
▪ traffic disturbances due to construction material transport and wastes?	X		The EMP for project prescribes mitigation measures for short-term construction-caused traffic problems
▪ temporary silt runoff due to construction?	X		The EMP for project prescribes mitigation measures to prevent or contain land erosion and sedimentation of Nam Tha river during construction phase
▪ hazards to public health due to overflow flooding, and groundwater pollution due to failure of sewerage system?		X	
▪ deterioration of water quality due to inadequate sludge disposal or direct discharge of untreated sewage water?		X	A new DONRE-approved sludge disposal facility will be built at upgraded landfill site
▪ contamination of surface and ground waters due to sludge disposal on land?		X	A new DONRE-approved sludge disposal facility will be built at upgraded landfill site
▪ health and safety hazards to workers from toxic gases and hazardous materials which may be contained in confined areas, sewage flow and exposure to pathogens in untreated sewage and un-stabilized sludge?		X	

Screening Questions	Yes	No	Remarks
▪ large population increase during project construction and operation that causes increased burden on social infrastructure (such as sanitation system)?		X	
▪ social conflicts between construction workers from other areas and community workers?	X		Migrant worker population is expected to be small, however, the EMP for project prescribes mitigation sub-plans for these social local issues.
▪ risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel and other chemicals during construction and operation?		X	
▪ community safety risks due to both accidental and natural hazards, especially where the structural elements or components of the project are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning?		X	

A Checklist for Preliminary Climate Risk Screening

Country/Project Title: GMS Second Corridor Towns Development Project PPTA 8474 REG

Sector: Urban Development

Subsector: Drainage and Wastewater Treatment

Division/Department: Urban development / SERD

Screening Questions		Score	Remarks
Location and Design of project	Is siting and/or routing of the project (or its components) likely to be affected by climate conditions including extreme weather related events such as floods, droughts, storms, landslides?	0	The existing series of wastewater ponds formed from the oxbow tributary of Nam Tha river are influenced directly by the river flow. The improved pond embankments will increase resilience of ponds to flood conditions. The design of new pond beside the hospital, and the upgraded wastewater drainage canals will be resilient to severe flooding events.
	Would the project design (e.g. the clearance for bridges) need to consider any hydro-meteorological parameters (e.g., sea-level, peak river flow, reliable water level, peak wind speed etc)?	0	
Materials and Maintenance	Would weather, current and likely future climate conditions (e.g. prevailing humidity level, temperature contrast between hot summer days and cold winter days, exposure to wind and humidity hydro-meteorological parameters likely	0	

Screening Questions		Score	Remarks
	affect the selection of project inputs over the life of project outputs (e.g. construction material)?		
	Would weather, current and likely future climate conditions, and related extreme events likely affect the maintenance (scheduling and cost) of project output(s) ?	0	

Options for answers and corresponding score are provided below:

Response	Score
Not Likely	0
Likely	1
Very Likely	2

Result of Initial Screening (Low, Medium, High): Low **Other Comments**: n/a

Rapid Environmental Assessment (REA) Checklist **SOLID WASTE**

Country/Project Title: Second Corridor Towns Development Project, PPTA 8425 VIE – **Luang Namtha**

Sector Division: Solid Waste Management / Urban Development / SERD

Screening Questions	Yes	No	Remarks
A. Project Siting Is the project area			
▪ Densely populated?		X	
▪ Heavy with development activities?		X	
▪ Adjacent to, or within any environmentally sensitive areas?			
• Cultural heritage site		X	
• Protected Area		X	Existing landfill is approximately 7.0 km north of Nam Ha National Biodiversity Conservation Area
• Wetland		X	
• Mangrove		X	
• Estuarine		X	
• Buffer zone of protected area		X	
• Special area for protecting biodiversity		X	

Screening Questions	Yes	No	Remarks
• Bay		X	
B. Potential Environmental Impacts Will the Project cause…			
▪ impacts associated with transport of wastes to the disposal site or treatment facility		X	
▪ impairment of historical/cultural monuments/areas and loss/damage to these sites?		X	
▪ degradation of aesthetic and property value loss?		X	
▪ nuisance to neighboring areas due to foul odor and influx of insects, rodents, etc.?		X	
▪ dislocation or involuntary resettlement of people?		X	
▪ disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?		X	
▪ risks and vulnerabilities related occupational health and safety due to physical, chemical, biological, and radiological hazards during project construction and operation?		X	
▪ public health hazards from odor, smoke from fire, and diseases transmitted by flies, insects, birds and rats?		X	
▪ deterioration of water quality as a result of contamination of receiving waters by leacheate from land disposal system?	X		Upgraded landfill will include leachate collection and storage system which will improve quality of discharge to Nam Tha river.
▪ contamination of ground and/or surface water by leach ate from land disposal system?	X		Upgraded landfill will be lined with clay and include leachate collection and storage system which should improve affected qroundwater quality.
▪ land use conflicts?		X	
▪ pollution of surface and ground water from leach ate coming form sanitary landfill sites or methane gas produced from decomposition of solid wastes in the absence of air, which could enter the aquifer or escape through soil fissures at places far from the landfill site?	X		Upgraded landfill will be lined with clay and include leachate collection and storage system which should improve affected discharge stream and qroundwater quality. Methane gas produced by landfill will dissipate uncollected.
▪ inadequate buffer zone around landfill site to alleviate nuisances?		X	
▪ road blocking and/or increased traffic during construction of facilities?		X	
▪ noise and dust from construction activities?	X		The EMP prescribes mitigation measures for controlling noise and dust during construction at site and along access road

Screening Questions	Yes	No	Remarks
▪ temporary silt runoff due to construction?		X	
▪ hazards to public health due to inadequate management of landfill site caused by inadequate institutional and financial capabilities for the management of the landfill operation?		X	
▪ emission of potentially toxic volatile organics from land disposal site?		X	
▪ surface and ground water pollution from leach ate and methane gas migration?		X	Clay liner and leachate collection system should prevent contamination of groundwater by leachate. Methane gas will dissipate freely
▪ loss of deep-rooted vegetation (e.g. tress) from landfill gas?		X	
▪ explosion of toxic response from accumulated landfill gas in buildings?		X	
▪ contamination of air quality from incineration?		X	
▪ public health hazards from odor, smoke from fire, and diseases transmitted by flies, rodents, insects and birds, etc.?	X		Landfill located 6.5 km from nearest settlement town
▪ health and safety hazards to workers from toxic gases and hazardous materials in the site?		X	
▪ large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)?		X	Local worker force is expected
▪ social conflicts if workers from other regions or countries are hired?		X	Local worker force is expected
▪ risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel and other chemicals during construction and operation?		X	
▪ community safety risks due to both accidental and natural hazards, especially where the structural elements or components (e.g., landfill or incinerator) of the project are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning?		X	

A Checklist for Preliminary Climate Risk Screening

Country/Project Title: GMS Second Corridor Towns Development Project PPTA 8474 REG

Sector: Urban Development

Subsector: Solid Waste Management

Division/Department: Urban Development / SERD

Screening Questions	Score	Remarks

Location and Design of project	Is siting and/or routing of the project (or its components) likely to be affected by climate conditions including extreme weather related events such as floods, droughts, storms, landslides?	0	Existing landfill is at an elevation that is not susceptible to flooding
	Would the project design (e.g. the clearance for bridges) need to consider any hydro-meteorological parameters (e.g., sea-level, peak river flow, reliable water level, peak wind speed etc)?	0	
Materials and Maintenance	Would weather, current and likely future climate conditions (e.g. prevailing humidity level, temperature contrast between hot summer days and cold winter days, exposure to wind and humidity hydro-meteorological parameters likely affect the selection of project inputs over the life of project outputs (e.g. construction material)?	0	
	Would weather, current and likely future climate conditions, and related extreme events likely affect the maintenance (scheduling and cost) of project output(s) ?	0	
Performance of project outputs	Would weather/climate conditions, and related extreme events likely affect the performance (e.g. annual power production) of project output(s) (e.g. hydro-power generation facilities) throughout their design life time?	0	

Options for answers and corresponding score are provided below:

Response	Score
Not Likely	0
Likely	1
Very Likely	2

Result of Initial Screening (Low, Medium, High): Low

Other Comments: A groundwater study to determine water table depth and groundwater quality will need to be conducted at detailed design phase.

Rapid Environmental Assessment (REA) Checklist **Roads and Highways**

Country/Project Title: Second Corridor Towns Development Project, PPTA 8425 VIE – **Luang Namtha**

Sector Division: Road Upgrades and Bridge Construction / Urban Development / SERD

Screening Questions	Yes	No	Remarks
A. Project Siting Is the project area adjacent to or within any of the following environmentally sensitive areas?			• A new road and bridge • Upgraded urban roads
▪ Cultural heritage site		x	
▪ Protected Area		x	
▪ Wetland		x	
▪ Mangrove		x	

Screening Questions	Yes	No	Remarks
▪ Estuarine		x	
▪ Buffer zone of protected area		x	
▪ Special area for protecting biodiversity		x	
C. Potential Environmental Impacts Will the Project cause…			
▪ encroachment on historical/cultural areas; disfiguration of landscape by road embankments, cuts, fills, and quarries?		x	
▪ encroachment on precious ecology (e.g. sensitive or protected areas)?		x	
▪ alteration of surface water hydrology of waterways crossed by roads, resulting in increased sediment in streams affected by increased soil erosion at construction site?	x		The EMP for project will prescribe mitigation measures to manage erosion and sedimentation of Nam Tha river during construction phase
▪ deterioration of surface water quality due to silt runoff and sanitary wastes from worker-based camps and chemicals used in construction?	x		The EMP will prescribe worker camp waste management plans
▪ increased local air pollution due to rock crushing, cutting and filling works, and chemicals from asphalt processing?		x	
▪ risks and vulnerabilities related to occupational health and safety due to physical, chemical, biological, and radiological hazards during project construction and operation during project construction and operation?		X	
▪ noise and vibration due to blasting and other civil works?	X		The EMP for project prescribes mitigation sub-plans for noise. Blasting is not required.
▪ dislocation or involuntary resettlement of people?	X		Not sure at this time
▪ dislocation and compulsory resettlement of people living in right-of-way?	X		Not sure at this time
▪ disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?		X	
▪ other social concerns relating to inconveniences in living conditions in the project areas that may trigger cases of upper respiratory problems and stress?		X	
▪ hazardous driving conditions where construction interferes with pre-existing roads?	X		The EMP prescribes construction traffic management to protect the local public

Screening Questions	Yes	No	Remarks
▪ poor sanitation and solid waste disposal in construction camps and work sites, and possible transmission of communicable diseases (such as STI's and HIV/AIDS) from workers to local populations?	X		The EMP for project prescribes plan for waste management at construction sites and work camps. STIs and HIV are not expected to be a problem due to mostly local worker force
▪ creation of temporary breeding habitats for diseases such as those transmitted by mosquitoes and rodents?		X	
▪ accident risks associated with increased vehicular traffic, leading to accidental spills of toxic materials?	X		The EMP for project prescribes mitigation measures to manage the increased construction traffic. Transport of toxic materials during, and after construction is not planned
▪ increased noise and air pollution resulting from traffic volume?	X		The EMP for project prescribes mitigation measures for increased noise and local air pollution from increased traffic during construction, and after roads are completed
▪ increased risk of water pollution from oil, grease and fuel spills, and other materials from vehicles using the road?	X		The EMP for project prescribes mitigation measures to manage waste hydrocarbons at construction sites
▪ social conflicts if workers from other regions or countries are hired?		X	
▪ large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)?	X		Mostly local worker force is expected for construction phase which will not strain urban utilities
▪ risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel and other chemicals during construction and operation?		X	
▪ community safety risks due to both accidental and natural causes, especially where the structural elements or components of the project are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning.		X	

A Checklist for Preliminary Climate Risk Screening

Country/Project Title: GMS Second Corridor Towns Development Project PPTA 8474 REG

Sector: Urban Development

Subsector: Road Upgrades and Bridge Construction

Division/Department: Urban Development / SERD

Screening Questions		Score	Remarks
Location and Design of project	Is siting and/or routing of the project (or its components) likely to be affected by climate conditions including extreme weather related events such as floods, droughts, storms, landslides?	1	The designs including grading of upgraded roads will need to be resilient to increases in local rainfall/flooding events, and erosion due to climate change.
	Would the project design (e.g. the clearance for bridges) need to consider any hydro-meteorological parameters (e.g., sea-level, peak river flow, reliable water level, peak wind speed etc)?	1	Similarly, the design and elevation of the new bridge over the Nam Tha river will need to consider increases in extreme river levels caused by climate change-induced increases in severity of rainfall/flooding eventsbe resilient to climate change.
Materials and Maintenance	Would weather, current and likely future climate conditions (e.g. prevailing humidity level, temperature contrast between hot summer days and cold winter days, exposure to wind and humidity hydro-meteorological parameters likely affect the selection of project inputs over the life of project outputs (e.g. construction material)?	0	
	Would weather, current and likely future climate conditions, and related extreme events likely affect the maintenance (scheduling and cost) of project output(s) ?	0	
Performance of project outputs	Would weather/climate conditions, and related extreme events likely affect the performance (e.g. annual power production) of project output(s) (e.g. hydro-power generation facilities) throughout their design life time?	0	

Options for answers and corresponding score are provided below:

Response	Score
Not Likely	0
Likely	1
Very Likely	2

Result of Initial Screening (Low, Medium, High): Low **Other Comments**: n/a

Rapid Environmental Assessment (REA) Checklist **URBAN DEVELOPMENT**

Country/Project Title: Second Corridor Towns Development Project, PPTA 8425 VIE – **Luang Namtha**

Sector Division: Urban Village Upgrades / Urban Development / SERD

Screening Questions	Yes	No	Remarks
A. Project Siting Is the project area			• Upgrades to market facilities and village infrastructure

Screening Questions	Yes	No	Remarks
▪ Densely populated?		x	
▪ Heavy with development activities?		X	
▪ Adjacent to or within any environmentally sensitive areas?		X	
• Cultural heritage site		X	
• Protected Area		X	
• Wetland		X	
• Mangrove		X	
• Estuarine		X	
• Buffer zone of protected area		X	.
• Special area for protecting biodiversity		X	
• Bay		X	
B. Potential Environmental Impacts Will the Project cause…			
▪ impacts on the sustainability of associated sanitation and solid waste disposal systems and their interactions with other urban services.		X	
▪ deterioration of surrounding environmental conditions due to rapid urban population growth, commercial and industrial activity, and increased waste generation to the point that both manmade and natural systems are overloaded and the capacities to manage these systems are overwhelmed?		X	
▪ degradation of land and ecosystems (e.g. loss of wetlands and wild lands, coastal zones, watersheds and forests)?		X	
▪ dislocation or involuntary resettlement of people?	X		Unsure at this time
▪ disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable group?		X	
▪ degradation of cultural property, and loss of cultural heritage and tourism revenues?		X	
▪ occupation of low-lying lands, floodplains and steep hillsides by squatters and low-income groups, and their exposure to increased health hazards and risks due to pollutive industries?		X	

Screening Questions	Yes	No	Remarks
▪ water resource problems (e.g. depletion/degradation of available water supply, deterioration for surface and ground water quality , and pollution of receiving waters?		X	
▪ air pollution due to urban emissions?		X	
▪ risks and vulnerabilities related to occupational health and safety due to physical, chemical and biological hazards during project construction and operation?		X	
▪ road blocking and temporary flooding due to land excavation during rainy season?		X	
▪ noise and dust from construction activities?	X		The EMP for project prescribes mitigation measures for noise and dust during construction.
▪ traffic disturbances due to construction material transport and wastes?	X		The EMP for project prescribes mitigation measures for increased traffic and risk of traffic accidents during construction.
▪ temporary silt runoff due to construction?		X	
▪ hazards to public health due to ambient, household and occupational pollution, thermal inversion, and smog formation?		X	
▪ water depletion and/or degradation?		X	
▪ overpaying of ground water, leading to land subsidence, lowered ground water table, and salinization?		X	
▪ contamination of surface and ground waters due to improper waste disposal?		X	
▪ pollution of receiving waters resulting in amenity losses, fisheries and marine resource depletion, and health problems?		X	
▪ large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)?		X	
▪ social conflicts if workers from other regions or countries are hired?		X	
▪ risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel and other chemicals during operation and construction?		X	

Screening Questions	Yes	No	Remarks
▪ community safety risks due to both accidental and natural hazards, especially where the structural elements or components of the project are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning?		X	

A Checklist for Preliminary Climate Risk Screening

Country/Project Title: GMS Second Corridor Towns Development Project PPTA 8474 REG

Sector: Urban Development

Subsector: Urban Development

Division/Department: Urban Development / SERD

Screening Questions		Score	Remarks
Location and Design of project	Is siting and/or routing of the project (or its components) likely to be affected by climate conditions including extreme weather related events such as floods, droughts, storms, landslides?	1	Village and market upgrades will need to consider increased frequency and severity of rainfall events/flooding caused by climate change
	Would the project design (e.g. the clearance for bridges) need to consider any hydro-meteorological parameters (e.g., sea-level, peak river flow, reliable water level, peak wind speed etc)?	0	
Materials and Maintenance	Would weather, current and likely future climate conditions (e.g. prevailing humidity level, temperature contrast between hot summer days and cold winter days, exposure to wind and humidity hydro-meteorological parameters likely affect the selection of project inputs over the life of project outputs (e.g. construction material)?	0	
	Would weather, current and likely future climate conditions, and related extreme events likely affect the maintenance (scheduling and cost) of project output(s) ?	0	
Performance of project outputs	Would weather/climate conditions, and related extreme events likely affect the performance (e.g. annual power production) of project output(s) (e.g. hydro-power generation facilities) throughout their design life time?	0	

Options for answers and corresponding score are provided below:

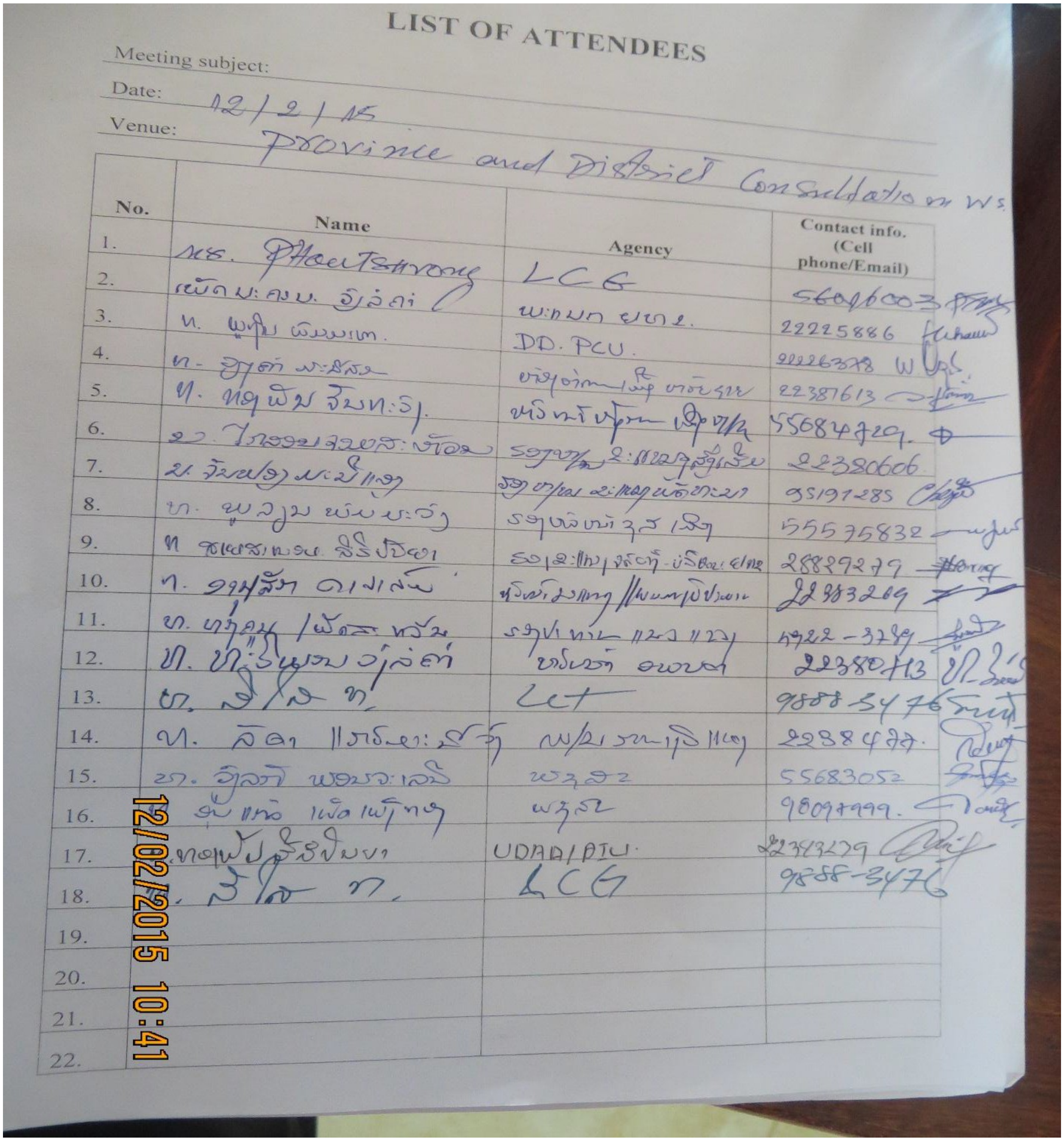
Response	Score
Not Likely	0
Likely	1
Very Likely	2

Result of Initial Screening (Low, Medium, High): Low

Other Comments: n/a

APPENDIX B: STAKEHOLDER CONSULTATIONS ON ENVIRONMENT

Stakeholder consultations conducted in Houayxay on February 2, 2015



LIST OF ATTENDEES

Meeting subject:

Date: 12/2/15

Venue: Province and District Consultation WS

No.	Name	Agency	Contact info. (Cell phone/Email)
1.	Ms. Phoutsavong	LCG	
2.	[illegible]	[illegible]	56096003
3.	[illegible]	DD. PCU.	22225886
4.	[illegible]	[illegible]	22263378
5.	[illegible]	[illegible]	22387613
6.	[illegible]	[illegible]	55684729
7.	[illegible]	[illegible]	22380606
8.	[illegible]	[illegible]	95191285
9.	[illegible]	[illegible]	55575832
10.	[illegible]	[illegible]	28829279
11.	[illegible]	[illegible]	22383209
12.	[illegible]	[illegible]	4922-3789
13.	[illegible]	Lct	22380413
14.	[illegible]	[illegible]	9888-5476
15.	[illegible]	[illegible]	22384977
16.	[illegible]	[illegible]	55683052
17.	[illegible]	UDAA/PIU	98097999
18.	[illegible]	LCG	22383279 / 9888-5476
19.			
20.			
21.			
22.			

Stakeholder consultations conducted in Luang Namtha on March 16, 2015

NO	Name and Surname ຊື ແລະນາມສະກຸນ	Position ຕຳແໜ່ງ	From Organization ມາຈາກພາກສ່ວນ	TEL/E-mail ເບີໂທລະສັບ/ອີເມວ	Signature ລາຍເຊັນ
1.				55686849	
2.				55390936	
3.				28910555	
4.				55686741	
5.				99891300	
6.				28917477	
7.				55375928	
8.				56028753	
9.				22390546	
10.				29167444	
11.				55686680	
12.				58710888	
13.				56161500	
14.				22 99 53 55	
15.				22226378	

 Deputy Project Coordinator Explained the Sub Project Components	 Provincial consultation with stakeholder at Luangnamtha District

APPENDIX C: DRAFT TOR FOR GROUNDWATER STUDY

GMS Second Corridor Towns Development Project
GMS PPTA 8425 REG

Groundwater Sampling and Analysis in Houayxay and Luang Namtha, Lao PDR

Terms of Reference

DRAFT

April, 2015

Introduction & Rationale

214. The Asian Development Bank (ADB) is supporting small infrastructure developments the towns of Houayxay and Luang Namtha Laos with the objective to improve both urban environments and stimulate socioeconomic development. The project will renovate the existing dumpsites in Houayxay (HXY) to bring them up to controlled landfill status with lined cells, leahate collection, and groundwater monitoring. The renovation of the landfills requires information on local groundwater as well as the proximity of nearby active domestic wells.

215. These draft ToRs were prepared to provide the basis for a Request for Quote (RFQ) for a groundwater study in both towns as part of the ADB PPTA. The quote should include costs for all field and laboratory analyses, and costs for travel to/from Vientiane.

Objectives

216. The objective of the assignment is to determine the depth and quality of groundwater in the area of the existing dumpsites in HXY and LN. The scope of the assignment includes:

1) Identification of existing active domestic wells near existing dumpsites sites;

2) Bore hole drilling at the sites to supplement any existing active wells; and

3) Sampling and laboratory analyses of groundwater quality from domestic wells and from new bore hole sites;

4) Report preparation

217. The assignment will be coordinated with the national engineers of the ADB project who is overseeing the renovations of the dumpsites. The locations of all groundwater sampling locations will be determined in consultation with the engineers.

Detailed Requirements

The requirements of the assignment are as follows:

1) Confirm the location of existing active domestic wells that are near the dumpsites..

2) Identify the number of supplementary bore holes that need to be drilled to provide a total of 4 equidistant sampling sites on an approximate 500-800 m radius around each dumpsite. Two of the sampling sites must be down-slope of the site. The sites chosen must also be useful for future groundwater monitoring;

3) Collect and preserve the groundwater samples from the 4 sites using accepted International procedures (e.g., AWWA)[44] to maintain the in situ quality of the samples while they are transported to laboratory in Vientiane.

4) Analyze samples in laboratory using accepted International procedures (e.g., AWWA).

218. The groundwater parameters that need to be sampled and analyzed at both existing dumpsits are listed in Table 14.

Table 15. Groundwater variables to be determined at landfill and WWTP sites.

Groundwater Variable	Location of Analysis
depth of water table	at well site
temperature (C^o)	at well site with meter
dissolved oxygen DO (mg/l)	at well site with meter
pH	at well site with meter
conductivity	at well site with meter
chemical oxygen demand COD (mg/l)	in laboratory
total dissolved solids DS (mg/l)	in laboratory
heavy metals: As, Cd, Fe, Pb, Zn, Cu (mg/l))	in laboratory
oil and grease (mg/l)	in laboratory
total and faecal coliform bacteria (mpn)	in laboratory
nitrogen: TN, NH_3, NO_3, NO_2 (mg/l)	in laboratory
phosphorus: TP, PO_4 (mg/l)	in laboratory
hydrogen sulphide H_2S, (mg/l)	in laboratory
surfactants (detergents) (mg/l)	in laboratory
Quality Control & Assurance Samples	
2 field sampling blanks with distilled water: 1 for existing landfill and 1 for new SLF	

[44] American Water Works Association AWWA, 2013). Standard Methods for Examination of Water and Wastewater: Water Wells.

Groundwater Variable	Location of Analysis
2 laboratory analysis blanks: 1 for samples from existing landfill, and 1 for new SLF samples	

1. Reporting

219. A report on the above field and laboratory investigations must be prepared.

a. Location of sampling sites

220. The report must provide simple maps indicating the location of the groundwater sampling sites at both future renovated landfill sites. Each sampling site must include a latitude and longitude coordinate. The maps should also indicate the location of the nearest houses or settlements. The sampling locations and data summary must distinguish the bore hole sites from existing domestic well sites.

b. Groundwater quality

221. In a table format the report must provide the groundwater quality variables from Table 7 that were determine in the field, and in the laboratory for both sites. The tables should also include the QA/QC samples for all variables from Table 7.

c. Sampling & Analysis Methodology

222. The report must include a brief description of all field and laboratory methods that were used to sample and analyze the groundwater samples.

APPENDIX D: INDICATIVE LANDFILL RENOVATION PROCEDURE

GMS Second Corridor Towns Development Project
GMS PPTA 8425 REG

Indicative Landfill Renovation for Houayxay and Luang Namtha, Lao PDR

DRAFT

To be Finalized by PPTA Engineers

April 2015

Current Situation:

The existing landfills in Houayxay and Luang Namtha are unmanaged dumpsites of simplest design, without segregated cells, or a liner, or a leachate collection system. The operation of the landfills appears ad hoc and not adequately organised.

The following draft indicative criteria were adopted for the renovation of the landfills in Houayxay and Luang Namtha:

a. Consolidate the waste field into a smaller area;
b. completely cover the consolidated field;
c. prevent rain water and surface water from penetrate into consolidated field; and
d. provide a solution for oxidation or removal of methane (CH_4) from the site.

Indicative Renovation:

Based on a preliminary assessment the following draft indicative renovation procedure has been identified:

1. Garbage pickers and sorters notified of renovation of landfill.
2. A perimeter fence installed around area that will be closed with signs indicating area closed.
3. Level & shape landfill consolidated area made convex with a minimum slope of 2% letting rain water flow to the adjacent perimeter.
4. Ensure open cut-off ditches capture & discharge rain water to outside the site area.
5. Lay down 40 cm of impermeable clay excavated from DONRE-authorized areas at or

near the site.

6. Add a 10 cm layer of sandy material excavated from DONRE-authorized areas at or near consolidated site that provides drainage for rainwater to the sides that distributes gas emanating from solid waste below.
7. Lay down a 20 cm top layer of soil suitable for grass re-vegetation, and for supporting bacteria oxidization of methane gas (local soil mixed with earth); and
8. Plant robust grass as top vegetation.
9. As part of renovated landfill monitor groundwater quality from existing or newly established bore holes biannually for 3 years.

The cost for this preliminary procedure has not been estimated in detail.