Environmental Management Plan

January 2014

Lao People's Democratic Republic: Greater Mekong Subregion Tourism Infrastructure for Inclusive Growth Project

Subprojects in Khammouane Province

Prepared by the Ministry of Information, Culture and Tourism, Lao People's Democratic Republic, for the Asian Development Bank.

ABBREVIATIONS

ADB	Asian Development Bank
AH	affected household
BOD	biological oxygen demand
COD	chemical oxygen demand
DPWT	Department of Public Works and Transport
DONRE	Department of Natural Resources and Environment
EA	environmental assessment
EA	executing agency
ECC	environmental compliance certificate
EIA	environment impact assessment
EMP	environment management plan
EMR	environmental monitoring report
EERT	external emergency response team
ERT	emergency response team
ERTL	emergency response team leader
SS	safeguards specialist
EO	environmental officer
ES	environmental specialist
GMS	Greater Mekong Subregion
Government	Government of Lao PDR
IEE	initial environmental examination
MONRE	Ministry of Natural Resources and Environment
MPCTC	Ministry of Post, Construction, Transport and Communication
MPWT	Ministry of Public Works and Transport
NGOs	non government organization
O&M	operation and maintenance
PCU	project co-ordination unit
PIU	project implementing unit
UDAA	urban development and administration authority
USD	United States Dollar
UXO	unexploded ordnance

WEIGHTS AND MEASURES

km	Kilometre
kg	Kilogram
ha	Hectare
mm	Millimeter

In this report, "$" refers to US dollars.

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I. INTRODUCTION

1. An environmental management plan (EMP) has been prepared for the two subprojects of Khammouane province defined by: 1) the Xang Cave Access Improvements subproject; and 2) That Sikhottabong Environmental Improvement subproject. The EMP is one of three provincial EMPs that have been prepared for the GMS Tourism Infrastructure for Inclusive Growth project (the project) in Lao PDR. The other two EMPs are for subprojects in the provinces of Luang Prabang and Oudomxay.

2. A single Initial Environmental Examination (IEE) was prepared for the three EMPs which are found under separate cover. Details of the subproject and the overall project in Lao PDR can be found in the parent IEE.

A. Xang Cave Access Improvements Subproject

3. The Xang Cave lies approximately 6 km east of Thakhek town in Thakhek District. Main access to the site is via National Highway 12 followed by a secondary unpaved road (1.7 km) to Ban Tham village. The initial 1.3 km of the unpaved road runs along a raised embankment through farmland and crossing one small bridge. From Ban Tham village the access road continues for 2.0 km to Ban Xene Vaen. Access to the cave is from Ban Tham along a motorable track (0.40 km) which crosses a small river. Table 1 reproduces the list of activities of the subproject from the IEE.

Table 1: Xang Cave Access Improvements

Activity	General Specifications
Upgrade existing access road to Xang Cave and nearby Xiang Vaen village	• 4.0 km X 6.0 m • DBST surface • existing bridge only concrete decking required
Construct new secondary access road	• 500m • 100m footbridge • 20 ford crossing with box culverts
Construct 2 new vehicle parks at Xang cave entrance Xiang Vaen village	• 4,000 m^2 , 1,000 m^2 • gravel surface
Construct new multi-purpose tourist information & reception center near cave entrance	• utilize existing structure
Construction of new public toilet blocks	• with ABR system
Construction of new vendor kiosks with landscaping	
Upgrade existing steps and footpaths to cave	• with handrails
Improve existing cave lighting system	
Install new rubbish bins at key locations	
Placement of new signage and information boards	

B. That Sikhottabong Environmental Improvement

4. The Sikhottabong Stupa lies approximately 5 km south of the town center of Thakhek and is located in a walled 5 ha compound with other religious and cultural buildings. The compound is bounded between the east bank of the Mekong River and National Highway 11 to the west. The planned improvements to the Stupa compound from the IEE are listed in

Table 2.

Table 2: Sikhottabong Stupa Environmental Improvements

Activity	General Specifications
Upgrade existing internal road network in compound	• 2km • sealed gravel
Rehabilitate existing internal road bridges	
Upgrade existing vehicle park	• 4,000 m^2 • sealed gravel surface
Construction of 20 new public toilets	• with ABR septic system
Rehabilitate existing 2 storey structure to a tourist reception and information center	• exhibition area and interpretation facilities
Construct new food and beverage kiosks	
Installation of new souvenir, food and beverage stalls	
Develop hard and soft landscape features	• to create public green space for residents and tourists
Construct a new solid waste transfer station	• with small MRF
Install rubbish bins	
Placement of new **s**ignage and information boards	

II. INSTITUTIONAL ARRANGEMENTS & RESPONSIBILITIES

A. Organization of Management

5. At the feasibility stage the primary management framework[1] responsible for the implementation of the environmental management plan (EMP) for Khammouane subprojects is summarized in Figure 1 which elaborates an excerpt of the full project management organization in Lao PDR (Annex 1).

6. The Ministry of Information and Culture and Tourism (MICT) which is the executing agency (EA) for the project, will take overall responsibility for successful implementation of the EMP. The EA will establish a Vientiane-based Project Coordination Unit (PCU) within the Tourism Development Department which, among other things, will provide Safeguards and Monitoring Coordination for the EMP. The provincial Department Information and Culture and Tourism (DICT) in which the project implementation unit (PIU) will be created will implement the EMP with support from the PCU. The PIU will be comprised of two technical teams (Infrastructure and Tourism). The infrastructure team will be cross appointed from the Department of Public Works and Transport (DPWT). The infrastructure team will include a Safeguards Specialist who will lead the implementation of the EMP in conjunction with the Environmental Officer(s) (EO) of the construction contractor(s).

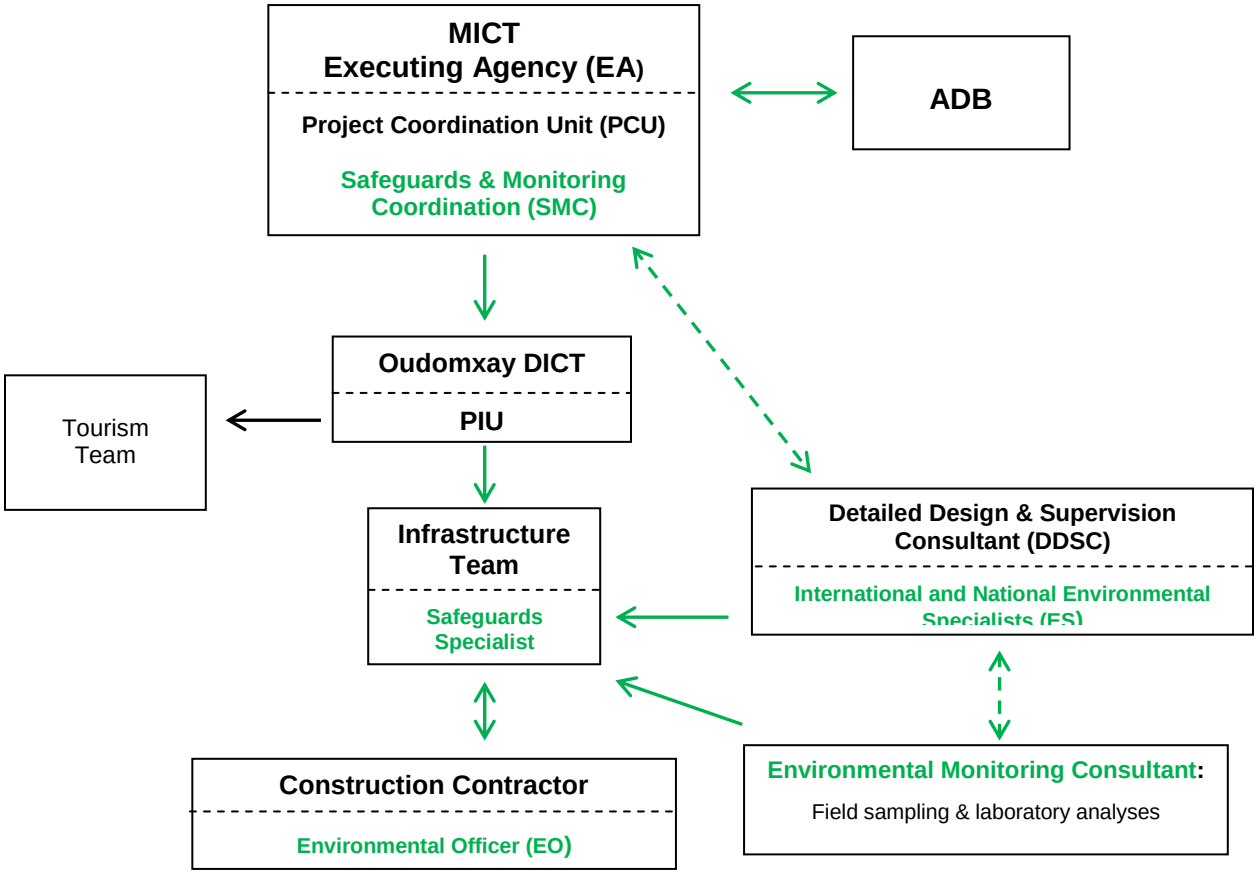
7. The S*afeguards* and Monitoring Coordination unit of the PCU will provide operational guidance to the PIU for implementation of the EMP, and will liaise with the ADB on safeguard reporting and issues. The *Safeguards Specialist* of the PIU will oversee the work of the EO of the contractor on the implementation of the CEMP[2] for the particular construction package.

[1] Adapted from the Project Administration Manual.
[2] Contractor Environmental Management Plan prepared by contractor as part of bid documents based on updated EMP

8. External support of the PIU for the implementation of the EMP will be provided by the International and National Environment Specialists (ES) of the Detailed Design and Supervision Consultant[3] (DDSC), and an external Environmental Monitoring Consultant (EMC) which will be required to conduct the field sampling and laboratory analyses of field samples (e.g., water quality, air quality) that cannot be that cannot be performed by the contractor or PIU.

9. The responsibilities of the different agencies of the management framework in Figure 1 are listed in Annex 2. Found below is a summary of responsibilities for implementation of the EMP.

Figure 1: Management framework for implementation of EMP



10. The responsibilities of the EA as supported by PCU include:

1. Provide coordination role for environmental and social safeguards and monitoring for PIU;
2. Liaise with ADB on the implementation of the EMP; and
3. Coordinate resolution with PIU, and ADB if necessary with issues arising from the implementation of EMP.

11. The responsibilities of the Safeguards Specialist (SS) of PIU include:

1. Initially assist DDSC with updating the EMP to meet final detailed subproject designs;

[3] DDSC to be defined.

2. Notify DONRE to verify Government approvals of project are met, and that EMP compliant with Environmental Compliance Certificate (ECC) of project;
3. Assist DDSC with inclusion of CEMP requirements in contractor bid documents including bid evaluations based on updated EMP;
4. Undertake day to day management of EMP implementation activities;
5. Work with EMC on implementation of monitoring plan of EMP;
6. Ensuring compliance with loan covenants and assurances in respect of all subprojects, including EMPs (as well as IPPs, GAPs, resettlement plans);
7. Lead follow-up meetings with all affected stakeholders;
8. Prepare and submit quarterly reports on EMP implementation to PCU;
9. Oversee implementation of CEMP by contractor;
10. Coordinate with ES of DDSC for EMP implementation;
11. Undertake regular construction site inspections to ensure contractor implements CEMP properly; and
12. Ensure EO of contractor submits monthly reports on construction mitigations and monitoring.

12. The responsibilities of the ES of the DDSC are detailed in the Terms of Reference for the two positions in Annex 3. Key responsibilities for the EMP are listed below:

1. Updating the EMP to meet final detailed designs of subprojects;
2. Provide technical direction and support to PIU for implementation of EMP;
3. Oversee design and delivery of capacity development & training of PIU and EO of contractor(s);
4. Provide advice and support to EMC with their monitoring activities;
5. Review all reports prepared by PIU and EMC for PCU and ADB; and
6. Review location of any possible contaminated sites near subprojects.

13. The responsibilities of Environmental Officer (EO) of Contractor include:

1. Implement CEMP for construction phase of subprojects; and
2. Prepare and submit monthly reports on mitigation and monitoring activities of CEMP any environmental issues at construction sites.

14. The responsibilities of Environmental Monitoring Consultant (EMC) include:

1. Implement the environmental sampling required for monitoring plan of EMP that cannot be conducted by the contractor and PIU.
2. Perform required laboratory analyses for monitoring program detailed in EMP; and
3. Prepare and submit quarterly reports to PIU on monitoring activities.

15. The Department of Natural Resources and Environment (DONRE) is the provincial agency which oversees environmental management of Khammouane. The DONRE with District staff provides direction and support for environmental protection-related matters including application of the Law on Environmental Protection No. 02/99/NA (1999), EIA, and environmental standards.

16. The ADB provides guidance to EA/PCU with any issues related to EMP, and reviews biannual reports on EMP activities compiled and submitted by PCU.

B. Worker and Community Health and Safety

17. Central to construction and operation phases of all subprojects is to ensure workers and the public are not harmed from construction activities and ultimately the operation of the completed subprojects.

18. Based on the New Global strategies in Occupational Safety and Health (OSH) developed by the International Labour Organization (ILO) in 2003 the Ministry of Labour and Social Welfare (MLSW) of Government is currently developing the Lao PDR National OSH Programme[4]. To facilitate the development of the OSH the National Occupational Health & Safety Programme (2005-2010) was initiated.

19. The emerging OSH, *inter alia,* addresses worker and public safety in the construction and operation of small-medium enterprises and notably rural roads. The EA/PCU as supported by the PIUs must obtain and implement the directives of the OSH Programme. Pertinent associated laws and policy include the Labour Law of Lao PDR, and Decree No. 24/PR of the President of Republic, dated 21 April 1994, promulgating law No. 002/NA of 14 March 1994, concerning Labour.

20. To supplement the OSH the IFC/World Bank Environment, Health, and Safety Guidelines (2007) should also be consulted the IFC EHS guidelines currently provide the international standard for worker and public safety.

C. Regulatory Framework and Guidelines for Subproject

21. The complete list of environment-related laws and regulations of the Government are described in Annex 4. Applicable regulations and guidelines for the Khammouane subproject are summarized in Table 3. The regulations and guidelines, *inter alia,* assist with how access road upgrades and civil works in tributaries of the Mekong river shoreline works should be implemented to prevent or minimize negative impacts on the environment.

III. SUMMARY OF POTENTIAL IMPACTS

22. The environmental potential impacts of the two subprojects in Khammouane identified by the IEE are summarized in Table 4.

23. The civil works and widening of the access road to Xang Cave will directly affect roadside vegetation and agriculture. The sections of the road that pass through and Ban Tham and Ban Xieng Vaen villages will not be widened as much as the openland areas, however, some village land (e.g. homestead gardens) will be required because of the narrowness of sections of the road through the villages.

24. The DONRE confirmed[5] that the land through which the access road traverses is designated as agriculture or productive forest land. No protected forest exists along the road or in the villages of Ban Xieng Vaen and Ban Tham**.**

[4] ILO. 2009. Asean-Oshnet, Occupational Safety and Health Practices.
[5] Mr. P. Khanthavong of DONRE, Thakhek, Khammouane, June 17/13.

Table 3: Regulations and Guidelines Applicable to Subprojects.[6]

Road Upgrades
• Lao PDR Road Design Manual with reference to AASHTO A Policy on Geometric Design of Highways and Streets, 5th edition. • RDA's Lao Bridge Design Manual, 1998 with reference to AASHTO LRFD Bridge Design Specifications, 4th, Edition, 2007 • Transport Research Laboratory's (TRL) Road Note 31, 4th edition. • Road Development Authority (RDA's) standards incorporating relevant standards from the AASHTO Highway Drainage Guidelines. • MPWT (2006). Specifications for drainage system, culverts, street lighting and tree planting
Mekong Riverbank Works
• The Manual and Study on Mekong Riverbank Protection around the Vientiane Municipality, Lao PDR. Draft Final Report. JICA September 2004 • California Bank and Shore Rocks Slope Protection Design, Practitioner's Guide and Field Evaluations of Riprap Methods Final Report No. FHWA-CA-TL-95-10, Caltrans Study No.F90TL03, Third Edition - Internet October 2000, Prepared in Cooperation with the US Department of Transportation Federal Highway Administration • Highway Design Manual, Chapter 870 Channel and Shoe Protection Erosion Protection Control, 26 June, 2006. • NRCS Stream Restoration Design Handbook, Stone Sizing Criteria, National Handbook, 210-NEH, August 2007.
Sanitation and MRF
• Decree No 520 / TCPC, dated 23 Feb 2007: on disposal site management regulating site selection and design of disposal sites. • Decree No 1705 / MoH, July 20, 2004 on sanitation of public areas (Articles 3, 4, 12, 15). • Decree No 520 / TCPC, dated 23 Feb 2007: on disposal site management, Article 9.
Occupational and Public Health and Safety
• MSLW, Lao PDR Occupational, Safety, and Health Guidelines Programme, Draft 2005-2010 • IFC/World Bank, 2007. Environment, Health, and Safety Guidelines
Environmental Standards
• National Environmental Standard Order No. 2734/PMU-DONRE (2009): See Monitoring Plan (section V) below and Annex 5 for GoL environmental standards.

25. The construction of the ford and foot bridge across the small river in front of the cave could interfere with fish movement in the river. Flood season migration of fish poulations occurs during the rainy season as confirmed by the Fisheries Section of the MAF in Vientiane[7]. However, all subproject activities at and in front of the cave entrance will potentially disturb protected forest.

26. The entire tourst reception area in front of the cave is located on village-agricultural land, but the cave itself is inside protected forest. Thus, the upgrades cave facilities such as walkways and steps to the cave could negatively affect protected forest. Planned improvements to lighting and walkways inside the notably shallow cave could disturb existing wildlife and geological formations of the cave.

27. The expanded solid waste collection and disposal system (i.e., bins and disposal) at Xang Cave and the solid waste transfer station and MRF inside the Sikhottabong Stupa compund could easily create solid waste and litter problems if the appropriate collection and disposal plan and schedule for the facilities are not implemented inadequately. Similarly, if the

[6] Regulations and guidelines compiled by study from agencies, earlier IEEs, and internet.
[7] Mr. B. Viengsombath, Fisheries Division, MAF, Vientiane, June 21/13

additional toilet blocks and supporting ABR septic system are not maintained according to specification pollution events could occur such as pollution of land and adjacent streams, and the production of odour.

Table 4: Summary of Potential Environmental Impacts of Subprojects

Pre-construction Phase
Xang Caves Access Improvements Subproject • Some loss homestead gardens inside two villages
That Sikhottabong Environmental Improvement • Temporary displacement of merchants in Stupa compound.
Construction Phase
Common potential impacts: • Reduced and/or blocked public access, disrupted business and recreation, noise, dust and air pollution from NOx, SOx, & CO caused by increased truck traffic and heavy equipment use, soil and surface water pollution caused by equipment operation and maintenance, public and worker accidents, disruption of traffic, 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. These short-term impacts will vary in magnitude with construction activities of the different subprojects.
Xang Caves Access Improvements Subproject: • Comparatively large loss of vegetation & agricultural land along the widened access road • Loss of trees of protected forest surrounding Xang Cave • Blockage of fish passage in stream to be forded.
That Sikhottabong Environmental Improvement Subproject • Common construction impacts defined above
Operation Phase
Xang Cave Access Improvements Subproject • Increased traffic on upgraded access road, risk of accidents, and air pollution • Solid and domestic waste pollution due to insufficient garbage collection & disposal, and un-maintained toilets and ABR septic systems.
That Sikhottabong Environmental Improvement Subproject • Solid and domestic waste pollution due to inadequate operation of solid waste transfer station and MRF, and un-maintained toilets and ABR septic systems.

A. Public Consultation

28. The stakeholder consultation strategy that was developed for the IEE will be continued with the start of the pre-construction phase of the subproject. The first step will be the disclosure of the IEE to the affected stakeholders identified in the IEE for their review and comment.

1. Follow-up Consultation

29. As indicated in the IEE, the primary concern of the public and stakeholders of the subproject were disturbances during construction of the upgrades to roads, and the effect of the upgraded road on increased traffic, and traffic accidents. These issues plus any others will be reviewed during follow-up consultations throughout the pre-construction, construction, and operation of the completed subproject components.

IV. MITIGATION PLAN

30. The mitigation measures of the EMP are presented in a comprehensive mitigation plan for the subproject in Table 5. Following the IEE, the mitigation plan is structured by the three development phases of the subproject defined by the pre-construction; construction; and post construction operational phase. The mitigation plan addresses the environmental issues and concerns raised at the stakeholder meetings.

31. The mitigation plan combines construction phase impacts common to all subproject components for which single mitigation measures are prescribed. In this way redundant mitigation measures are not re-stated numerous times. However, impacts and required mitigations specific to a subproject are also identified. Or, common mitigations that are particularly important for a subproject component are underscored.

32. The mitigation plan identifies potential impacts, required mitigations, responsible parties, location, timing, and indicative costs. The mitigation plan is comprehensive and will need to be updated to meet the final detailed designs of the subproject.

Table 5: Environmental Impact Mitigation Plan

Subproject Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[8] (USD)	Responsibility	
							Supervision	Implementation
Pre-Construction, Detailed Design Phase								
Confirmation of required resettlement, relocations, & compensation	No negative environmental impacts	1. Affected persons well informed well ahead of subproject implementation.	All affected persons in subproject areas	Before detailed designs initiated	See resettlement plans	See resettlement plan	PCU/PIU/SS	Resettlement committees
Disclosure, & engagement of community	No community impacts	2. Initiate Information Disclosure and Grievance process of IEE	For all construction sites.	Before detailed designs initiated	Quarterly	No marginal cost[9]	PIU/SS	PIU
Recruit cave development consultant	No negative impact	3. Source and procure a cave specialist knowledgeable of Lao caves to assist with design of walkways and lighting in Xang Cave	Vientiane / Thakhek	Before detailed designs initiated	Single report , for detailed designs	tbd	DDSC/PIU	PIU
Establish collaboration with management board of Stupa	No cultural impacts	4. The management board of Stupa should join the detailed design team at formulation stage to ensure all parties share same understanding subproject designs	Thakhek	Before detailed designs initiated	As needed	No marginal cost	DDSC/PIU	PIU
Contact Fisheries Section of MAF	No negative impact	5. Clarify periods during rainy season when fish migration to Mekong river floodplains occurs, and species of fish using the stream	Vientiane / Thakhek	Before detailed designs initiated	Single report , for detailed designs	No marginal cost	DDSC/PIU	PIU
Government approvals	No negative impact	6. Notify DONRE of subproject initiation to complete EA requirements, and obtain required project permits and certificates.	Entire subproject	Before construction	As required	No marginal cost	PIU/DONRE	DONRE
Detailed designs of subproject,	Minimize negative environmental impacts	7. Work by environment specialist of DDSC[10] to complete detailed designs of all components of both subprojects. Ensure the following measures are included: a) identification of spill management prevention plans, and emergency response plans for all construction sites; b) no disturbance or damage to culture property and values; c) minimal acquisition of agriculture and	Final siting	Before construction initiated	Once with detailed designs documents	No marginal cost	DDSC	EA/PIU

[8] Costs will need to be updated during detailed design phase.
[9] No marginal cost indicates that costs to implement mitigation are to be built into cost estimates of bids of contractors
[10] DDSC is detailed design and supervision consultant to be determined

Subproject Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[8] (USD)	Responsibility	
							Supervision	Implementation
		forested lands, no cutting of trees in protected forest; d) locate aggregate borrow pits and rock supply areas away from human settlements with fencing and access barriers; e) no, or minimal disruption to village water supplies along access roads, utilities, and electricity with contingency plans for unavoidable disruptions; f) no, or minimal disruption to normal pedestrian and vehicle traffic along all road segments with contingency alternate routes; g) for village areas include specific plan to notify & provide residents and merchants of construction activities & schedule to minimize disruption to normal commercial and residential activities.						
Update EMP	Positive environmental impacts	8. Review final RoW of access road to Xang Cave to confirm absence of valued ecological or cultural resources including aquatic biota in stream crossings. 9. Re-clarify with DONRE that no known rare or endangered species inhabit the subproject areas 10. Identify any new potential impacts of subprojects and include in EMP with special attention to all affected villages and tourist reception areas. 11. Confirm all ABR drainage field locations, and septage disposal site with DONRE 12. Update mitigation measures and monitoring requirements of EMP where necessary to meet detailed designs, and to protect affected environments. 13. Submit updated EMP with new potential impacts to ADB to review. 14. Develop individual management sub-plans for: a) Construction drainage; b) Erosion; c) Noise and Dust; d) Contaminated Spoil Disposal; e) Solid and Liquid Waste	All sites	Before construction initiated	Once with detailed designs documents	No marginal cost	DDSC	EA/PIU

Subproject Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[8] (USD)	Responsibility	
							Supervision	Implementation
		Disposal; f) Construction & Urban Traffic; g) Utility and Power Disruption; h) Worker and Public Safety; i) Tree and Vegetation Removal and Site Restoration; j) Construction Materials Acquisition, Transport, & Storage, and k) Cultural chance finds.						
Confirm Government approved construction waste disposal sites	No negative impact	15. Notify DONRE, DAF, and DPWT to confirm locations of sites for borrow pits and disposal areas for construction and hazardous waste for subprojects, and obtain required permits.	Entire subproject	Before construction	As required	No marginal cost	PIU/DONRE/ DAF/DPWT	PIU
UXO survey, & removal	Injured worker or public	16. Ensure GoL and UXO LAO is consulted and clears areas where necessary	All construction sites.	Beginning of subproject	Once	See Monitoring Plan below	EA/PIU	UXO LAO
Create awareness of physical cultural resources in area	No negative environmental impact	17. DICT to review potential locations of physical resources, and explain possible PCR to contractors and DDSC	All subproject areas	Before construction begins	Once	No marginal cost	DICT	DICT
Develop bid documents	No negative environmental impact	18. Ensure updated EMP is included in contractor tender documents, and that tender documents specify requirements of the CEMP must be budgeted. 19. Specify in bid documents that contractor must have experience with implementing EMPs, or provide staff with the experience.	All subproject areas	Before construction begins	Once for all tenders	No marginal cost	DDSC	PIU
Obtain & activate permits and licenses	Prevent or minimize impacts	20. Contractors to comply with all statutory requirements set out by GoL for use of construction equipment, and operation construction plants such as concrete batching.	For all construction sites	Beginning of construction	Once	No marginal cost	DDSC	PIU & contractors
Capacity development	No negative environmental impact	21. Develop and schedule training plan for (PIU/SS) to be able to fully implement EMP, and to manage implementation of mitigation measures by contractors. 22. Create awareness and training plan for contractors whom will implement mitigation measures.	All subproject areas	Before construction begins	Initially, refresher later if needed	No marginal cost	DDSC	DDSC

Subproject Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[8] (USD)	Responsibility	
							Supervision	Implementation
Recruitment of workers	Spread of sexually transmitted disease	23. Use local workers as much as possible thereby reducing number of migrant workers	All work forces.	Throughout construction phase	Worker hiring stages	No marginal cost	EA/PIU	Contractor's bid documents
Construction Phase of Subproject Components								
Initiate EMP & sub-plans,	Prevent or minimize impacts	24. Initiate updated EMP & CEMP including individual management sub-plans for different potential impact areas that are completed in pre-construction phase (see sub-plan guidance below).	For all construction sites	Beginning of construction	Once	No marginal cost	DDSC	PIU & contractors
Cave walkways and lighting	Prevent unnecessary impact on cave wildlife and geology	25. Initiate construction of specially designed cave walkways & installation of cave lighting	Inside Xang Cave	Beginning of construction	Once	No marginal cost	DDSC	PIU & contractors
Worker camps	Pollution and social problems	26. Locate worker camps away from human settlements. 27. Ensure adequate housing and waste disposal facilities including pit latrines and garbage cans. 28. A solid waste collection program must be established and implemented that maintains a clean worker camps 29. Locate separate pit latrines for male and female workers away from worker living and eating areas. 30. A clean-out or infill schedule for pit latrines must be established and implemented to ensure working latrines are available at all times. 31. Worker camps must have adequate drainage. 32. Local food should be provided to worker camps. Guns and weapons not allowed in camps. 33. Transient workers should not be allowed to interact with the local community. HIV Aids education should be given to workers. 34. Camp areas must be restored to original condition after construction completed.	All worker camps	Throughout construction phase	Monthly	No marginal cost	DDSC/PIU	contractor

Subproject Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[8] (USD)	Responsibility	
							Supervision	Implementation
Training & capacity	Prevent of impacts through education	35. Implement training and awareness plan for PIU/SS and contractors.	PIU office, construction sites	Beginning of construction	After each event	No marginal cost	DDSC	DDSC/PIU
Implement construction materials acquisition, transport, and storage sub-plan	Pollution, injury, increased traffic, disrupted access	36. All borrow pits and quarries should be approved by DONRE. 37. Select pits and quarries in areas with low gradient and as close as possible to construction sites. 38. Required aggregate volumes must be carefully calculated prior to extraction to prevent wastage. 39. Pits and quarries should not be located near surface waters, forested areas, critical habitat for wildlife, or cultural property or values. 40. If aggregate mining from fluvial environments is required small streams and rivers should be used, and dry alluvial plains preferred. 41. All topsoil and overburden removed should be stockpiled for later restoration. 42. All borrow pits and quarries should have a fence perimeter with signage to keep public away. 43. After use pits and quarries should be dewatered and permanent fences installed with signage to keep public out, and restored as much as possible using original overburden and topsoil. 44. Unstable slope conditions in/adjacent to the quarry or pit caused by the extractions should be rectified with tree planting. 45. Define & schedule how materials are extracted from borrow pits and rock quarries, transported, and handled & stored at sites. 46. Define and schedule how fabricated materials such as steel, wood structures, and scaffolding will transported and handled. 47. All aggregate loads on trucks should be covered.	For all construction areas.	Throughout construction phase	Monthly	No marginal cost	DDSC/PIU	contractor

Subproject Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[8] (USD)	Responsibility	
							Supervision	Implementation
DBST production, and application	Air pollution, land and water contamination, and traffic & access problems,	48. Piles of aggregates at sites should be used/or removed promptly, or covered and placed in non-traffic areas 49. Store DBST materials well away from all human activity and settlements, and cultural (e.g., schools, hospitals), and ecological receptors. Bitumen production and handling areas should be isolated. 50. Contractors must be well trained and experienced with the production, handling, and application of bitumen. 51. All spills should be cleaned immediately and handled as per hazardous waste management plan, and according to GoL regulations. 52. Bitumen should only be spread on designated road beds, not on other land, near or in any surface waters, or near any human activities. 53. Bitumen should not be used as a fuel.	For all construction areas.	Throughout construction phase	Monthly	No marginal cost	DDSC & PIU	contractor
Implement Spoil management sub-plan	Contamination of land and surface waters from excavated spoil, and construction waste	54. Uncontaminated spoil to be disposed of in GoL-designated sites, which must never be in or adjacent surface waters. Designated sites must be clearly marked and identified. 55. Spoil must not be disposed of on sloped land, near cultural property or values, ecologically important areas, or on/near any other culturally or ecologically sensitive feature. 56. Where possible spoil should be used at other construction sites, or disposed in spent quarries or borrow pits. 57. A record of type, estimated volume, and source of disposed spoil must be recorded. 58. Contaminated spoil disposal must follow GoL regulations including handling, transport, treatment (if necessary), and disposal. 59. Suspected contaminated soil must be tested, and disposed of in designated sites	All excavation areas	Throughout construction phase	Monthly	See Monitoring Plan for contaminated soil analyses	DDSC & PIU & DONRE	contractor

Subproject Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[8] (USD)	Responsibility	
							Supervision	Implementation
		identified as per GoL regulations. 60. Before treatment or disposal contaminated spoil must be covered with plastic and isolated from all human activity.						
Implement Solid and liquid construction waste sub-plan	Contamination of land and surface waters from construction waste	61. Management of general solid and liquid waste of construction will follow GoL regulations, and will cover, collection, handling, transport, recycling, and disposal of waste created from construction activities and worker force. 62. Areas of disposal of solid and liquid waste to be determined by Government. 63. Disposed of waste should be catalogued for type, estimated weigh, and source. 64. Construction sites should have large garbage bins. 65. A schedule of solid and liquid waste pickup and disposal must be established and followed that ensures construction sites are as clean as possible. 66. Solid waste should be separated and recyclables sold to buyers in community. <u>Hazardous Waste</u> 67. Collection, storage, transport, and disposal of hazardous waste such as used oils, gasoline, paint, and other toxics must follow GoL regulations. 68. Wastes should be separated (e.g., hydrocarbons, batteries, paints, organic solvents) 69. Wastes must be stored above ground in closed, well labeled, ventilated plastic bins in good condition well away from construction activity areas, all surface water, water supplies, and cultural and ecological sensitive receptors. 70. All spills must be cleaned up completely with all contaminated soil removed and handled with by contaminated spoil sub-plan.	All construction sites and worker camps	Throughout construction phase	Monthly	No marginal cost	DDSC & PIU & DONRE	contractor
Implement noise	Dust	71. Regularly apply wetting agents to exposed	All	Fulltime	Monthly	No marginal	DDSC & PIU	contractor

Subproject Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[8] (USD)	Responsibility	
							Supervision	Implementation
and dust sub-plan	Noise	soil and construction roads. 72. Cover or keep moist all stockpiles of construction aggregates, and all truck loads of aggregates. 73. Minimize time that excavations and exposed soil are left open/exposed. Backfill as soon as activity completed. 74. As much as possible restrict working time between 07:00 and 17:00. In particular are activities such as pile driving. 75. Maintain equipment in proper working order 76. Replace unnecessarily noisy vehicles and machinery. 77. Vehicles and machinery to be turned off when not in use. 78. Construct temporary noise barriers around excessively noisy activity areas where possible.	construction sites.			cost		
Implement Utility and power disruption sub-plan	Loss or disruption of utilities and services such as water supply and electricity	79. Develop carefully a plan of days and locations where outages in utilities and services will occur, or are expected. 80. Contact local utilities and services with schedule, and identify possible contingency back-up plans for outages. 81. Contact affected community to inform them of planned outages. 82. Try to schedule all outages during low use time such between 24:00 and 06:00.	All construction sites.	Fulltime	Monthly	No marginal cost	DDSC & PIU & Utility company	contractor
Implement tree and vegetation removal, and site restoration sub-plan	Damage or loss of trees, vegetation, and landscape	83. Contact provincial forestry department for advice on how to minimize damage to trees and vegetation, and to work in protected forest at Xang Cave. No tree removal in protected forest 84. Restrict tree and vegetation removal to within RoWs. 85. Within RoWs minimize removals, and install protective physical barriers around trees that do not need to be removed. 86. All RoWs to be re-vegetated and landscaped after construction completed.	All construction sites.	Beginning and end of subproject	Monthly	No marginal cost	DDSC & PIU	contractor

Subproject Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[8] (USD)	Responsibility	
							Supervision	Implementation
		Consult provincial forestry department to determine the most successful restoration strategy and techniques. Aim to replant three trees for each tree removed.						
Implement Erosion control sub-plan	Land erosion	87. Berms, and plastic sheet fencing should be placed around all excavations and earthwork areas. 88. Earthworks should be conducted during dry periods. 89. Maintain a stockpile of topsoil for immediate site restoration following backfilling. 90. Protect exposed or cut slopes with planted vegetation, and have a slope stabilization protocol ready. 91. Re-vegetate all exposed soil immediately after activity is completed.	All construction sites	Throughout construction phase	Monthly	No marginal cost	DDSC & PIU	contractor
Implement worker and public safety sub-plan	Public and worker injury, and health	92. Proper fencing, protective barriers, and buffer zones should be provided around all construction sites. 93. Sufficient signage and information disclosure, and site supervisors and night guards should be placed at all sites. 94. Worker and public safety guidelines should be followed (Lao PDR OSH Programme section III). 95. Population near blast areas should be notified 24 hrs ahead, and evacuated well before operation. Accepted GoL blast procedures and safety measures implemented. 96. Speed limits suitable for the size and type of construction vehicles, and current traffic patterns should be developed, posted, and enforced on all roads used by construction vehicles. 97. Standing water suitable for disease vector breeding should be filled in. 98. Worker education and awareness seminars for construction hazards should be given at beginning of construction	All construction sites.	Fulltime	Monthly	No marginal cost	DDSC & PIU	contractor

Subproject Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[8] (USD)	Responsibility	
							Supervision	Implementation
		phase, and at ideal frequency of monthly. A construction site safety program should be developed and distributed to workers. 99. Appropriate safety clothing and footwear should be mandatory for all construction workers. 100. Adequate medical services must be on site or nearby all construction sites. 101. Drinking water must be provided at all construction sites. 102. Sufficient lighting is used during necessary night work. 103. All construction sites should be examined daily to ensure unsafe conditions are removed.						
Civil works	Degradation of water quality & aquatic resources	104. Protective coffer dams, berms, plastic sheet fencing, or silt curtains should be placed between all earthworks and surface waters. 105. Erosion channels must be built around aggregate stockpile areas to contain rain-induced erosion. 106. Earthworks should be conducted during dry periods. 107. All construction fluids such as oils, and fuels should be stored and handled well away from surface waters. 108. No waste of any kind is to be thrown in surface waters. 109. No washing or repair of machinery near surface waters. 110. Pit latrines to be located well away from surface waters. 111. No unnecessary earthworks in or adjacent to water courses. 112. No aggregate mining from rivers or lakes. 113. All irrigation canals and channels to be protected the same way as rivers, streams, and lakes	All construction sites	Throughout construction phase	Monthly	No marginal cost	DDSC & PIU	contractor
Civil works	Degradation of terrestrial	114. All construction sites should be located away forested or all plantation areas as	All construction	Throughout construction	Monthly	No marginal cost	DDSC & PIU	contractor

Subproject Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[8] (USD)	Responsibility	
							Supervision	Implementation
	resources	much as possible. 115. No unnecessary cutting of trees. No tree removal in protected forest at Xang Cave 116. All construction fluids such as oils, and fuels should be stored and handled well away from forested and plantation areas. 117. No waste of any kind is to be discarded on land or in forests/plantations.	sites	phase				
Civil works: Cultural chance finds sub-plan	Damage to cultural property or values, and chance finds	118. As per detailed designs all civil works should be located away from all cultural property and values. DICT identified potential sites and types of PCR in pre-con phase. 119. Chance finds of valued relics and cultural values should be anticipated by contractors. Site supervisors should be on the watch for finds. 120. Upon a chance find all work stops immediately, find left untouched, and PIU notified to determine if find is valuable. Culture section of DICT notified by telephone if valuable. 121. Work at find site will remain stopped until DICT allow work to continue.	All construction sites	At the start , and throughout construction phase	Monthly	No marginal cost	DDSC & PIU	
Implement Construction and urban traffic sub-plan	Traffic disruption, accidents, public injury	122. Schedule construction vehicle activity during light traffic periods. Create adequate traffic detours, and sufficient signage & warning lights. 123. Post speed limits, and create dedicated construction vehicle roads or lanes. 124. Inform community of location of construction traffic areas, and provide them with directions on how to best co-exist with construction vehicles on their roads. 125. Demarcate additional locations where pedestrians can develop road crossings away from construction areas. 126. Increase road and walkway lighting.	All construction sites	Fulltime	Monthly	No marginal cost	DDSC & PIU	contractor
Implement Construction	Loss of drainage &	127. Provide adequate short-term drainage away from construction sites to prevent	All areas with surface	Design & construction	Monthly	No marginal cost	DDSC & PIU	contractor

Subproject Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[8] (USD)	Responsibility	
							Supervision	Implementation
Drainage sub-plan	flood storage	ponding and flooding. 128. Manage to not allow borrow pits and quarries to fill with water. Pump periodically to land infiltration or nearby water courses. 129. Install temporary storm drains or ditches for construction sites 130. Ensure connections among surface waters (ponds, streams) are maintained or enhanced to sustain existing storm water storage capacity. 131. Protect surface waters from silt and eroded soil.	waters	phases				
Specific Mitigations for Civil Works for Upgrading of All Bridges, and New Ford on Rivers								
Civil works for new ford in river	Erosion / Sedimentation	132. Implement subproject during the dry season 133. Minimize all digging and infilling as much as possible, wet aggregate piles regularly, and cover until replaced, or removed. Use erosion berms, on shoreline to separate shoreline construction works for from river.	River crossing in front of cave	Throughout construction period	Monthly	No marginal cost	DDSC & PIU	contractor
Civil works for new ford in river	Blockage of fish passage, loss of aquatic habitat	134. Implement subproject during the dry season. Construct temporary channel around ford construction area, minimize in-river civil works for ford construction	River crossing in front of cave	Throughout construction period	Monthly	No marginal cost	DDSC & PIU	contractor
Upgrading bridge top	Erosion / Sedimentation	135. Implement subproject during the dry season 136. Remove old bridge top without dropping materials into river, wet aggregate piles regularly, and cover until replaced, or removed. Use erosion berms, and install industrial silt curtain parallel in river to separate entire construction zone from river.	River crossing in main access road to Ban Tham village	Throughout construction period	Monthly	No marginal cost	DDSC & PIU	contractor
Upgrading internal bridges in Stupa compound	Erosion / Sedimentation / loss of aquatic habitat	137. Implement subproject during the dry season 138. Minimize all digging and infilling as much as possible, wet aggregate piles regularly, and cover until replaced, or removed. Use erosion berms, on shoreline to separate	Stupa compound	Throughout construction period	Monthly	No marginal cost	DDSC & PIU	contractor

Subproject Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Location	Timing	Activity Reporting	Estimated Cost[8] (USD)	Responsibility	
							Supervision	Implementation
		shoreline construction works for from river. Minimize use of heavy equipment in streams/rivers						
Specific Mitigations for Civil Works in Xang Cave Area								
Upgrading facilities in cave	Possible loss or damage to protected forest guidelines	139. After consultation with forestry department, upgrade cave walkways and steps, and install lighting without removing or damaging trees	At, and inside Xang Cave	Throughout construction period	Monthly	No marginal cost	DDSC & PIU	contractor
Specific Mitigations for Civil Works in That Sikhottabong Compound								
Implementation of all subproject activities	Disruption of tourist visits, and merchant activities	140. Schedule subproject activities during low tourist season 141. Inform merchants of compound of schedule of activities	Entire compound	Throughout construction period	Monthly	No marginal cost	DSC & PIU	contractor
Post-construction Operation of Upgraded Access Road to Ban Tham Village								
Operation of upgraded road to Ban Tham village	Increased risk of traffic accident or injury.	142. Enforce well marked speed limits, provide guard rails along road where needed, and educate village communities on new road safety.	Upgraded road	Fulltime	Biannual	O&M	DPWT	
	Increased air pollution & noise	143. Ensure vehicles maintained in proper working condition	Upgraded road	Periodic checks	Biannual	O&M	DPWT	
Post-construction Operation of Improved Tourist Facilities at Xang Cave and Stupa Compound Sites								
Operation of improved tourist facilities	Solid and domestic waste pollution	144. Ensure ABR waste system is maintained with septage removed regularly and disposed in DONRE- approved areas that may need to be identified. 145. Garbage bins must be emptied and garbage removed regularly, and disposed in DONRE- approved site that may need to be identified 146. Ensure solid waste transfer station and MRF in Stupa compound is operated properly and according to specification	Xang Cave and Stupa compound	Regularly	Biannual	O&M	DICT/DPWT	

V. MONITORING PLAN

33. The environmental monitoring plan for the EMP is provided in Table 6. The monitoring plan focuses on all three phases (pre-construction, construction, post-construction operation) of the subproject and consists of environmental indicators, the sampling locations & frequency, method of data collection, responsible parties, and estimated costs. The purpose of the monitoring plan is to determine the effectiveness of the impact mitigations, and to document any unexpected positive or negative environmental impacts of the subproject.

A. Environmental Standards for Subproject Components

34. Environmental standards for ambient water quality in urban areas in Lao PDR are provided by the National Environmental Standard Order No. 2734/PMU-WREA (2009). The list of existing standards is found in Annex 5. The environmental standards provided by the Environmental, Health and Safety Guidelines of the IFC/World Bank (2007) (e.g., ambient air quality & noise) should be followed to supplement standards that are not provided by the GoL.

35. An independent environmental monitoring consultant (EMC) will be required to implement the environmental monitoring program. The EMC will be responsible for the sampling of environmental parameters that must be analyzed in a laboratory. The SS/PIU and EO will coordinate with the EMC. The DDSC/PIU will provide logistical support to the EMC where necessary for the implementation of environmental monitoring plan.

36. After construction is completed and the upgraded access road, and tourist facilities at Ban Tham village, Xang Cave and the Sikhottabong Stupa are in operation the impact the road upgrades on traffic patterns and frequency of accidents should be monitored by the DICT with assistance from the DPWT. The natural environment at the Xang Cave should be monitored by the DICT. Monitoring of the success of compensation for loss of land, or minor resettlement at the Xang Cave villages will be undertaken as part of the separate RAP prepared for the subproject.

B. Performance Monitoring

37. Performance monitoring is required to assess the overall performance of the EMP. A performance monitoring system is normally developed by the EA for the entire subproject. Select indicators of major components of the environment that will be affected primarily by the construction phase are drawn from the mitigation and monitoring plans and summarized in Table 7.

VI. REPORTING

38. Regular reporting on the implementation of mitigation measures, and on monitoring activities during construction phase of the subproject is required. Reporting is the responsibility of PIU and should be conducted in conjunction with regular meetings with stakeholders as part of the continuation of stakeholder communications. The mitigation and monitoring plans (Tables Table 5Table 6) summarize proposed timing of reporting. A report on environmental monitoring and implementation of EMP will be prepared quarterly for the EA/PCU by the PIU. The PIU report will compile monthly reports provided by the EO of contractor, the reports of the EMC on monitoring, and input from the ES of the DDSC. The PIU report will also be sent to the DONRE and the PCU for consolidation and transmission to ADB. The reports will table all indicators measured with the monitoring plan of EMP including performance monitoring indicators (Table 7), and will include relevant Government environmental quality standards.

Table 6: Environmental Monitoring Plan

ENVIRONMENTAL EFFECTS MONITORING							
Environmental Indicators	**Location**	**Means of Monitoring**	**Frequency**	**Reporting**	**Responsibility**		**Estimated Cost (USD)**
					Supervision	**Implementation**	
Pre-construction Phase – Update Baseline Conditions							
Update baseline on sensitive receptors (e.g., cultural property & values, new schools or hospitals, rare/endangered species, critical habitat), and aquatic resources and human uses of affected rivers	A) Final RoWs for access road to Ban Tham village B) Xang Caves area including small river in front of cave C) Surface waters in Stupa compound	Original field work, community consultations	Once	Once	EA/PIU	Environmental Monitoring Consultant	$2,500.
A) Air quality: dust, CO, NOx, SOx, noise, wind, temperature, and vibration levels B) Affected surface water quality: TSS, heavy metals (As, Cd, Pb,) oil and grease, pH, DO, COD, BOD_5, temperature, TDS, NH_3, NH_4, other nutrient forms of N & P	A) In two villages & Stupa compound B) In rivers at all bridge and ford crossing sites	Using field and analytical methods approved by DONRE.	One day and one night measurement during rainy & dry seasons.	One baseline supplement report before construction phase starts	PIU	Environmental Monitoring Consultant	A) $2,000. B) $4,000.
Inventory of present and past land uses that could cause contaminated soil.	Possible contaminated lands at all excavation sites	Using field and analytical methods approved by DONRE.	Once	Once	PIU	Environmental Monitoring Consultant	$500.
Construction Phase of Road Upgrade to Ban Tham Village and Xang Cave							
Incidence of tree felling in protected forests	Xang cave	Visual Observation	Continually	For each incident	PIU	PIU/EO	No marginal cost
Incidence of dead fish or blocked tributary during construction	Stream crossing in front of Xang cave, and at bridge crossing in access road	Visual Observation	Continually	For each incident	DDSC/PIU	PIU/EO	No marginal cost
Analysis of soil quality (heavy metals (As, Cd, Pb, oil & grease, hydrocarbons).	Possible contaminated lands at all excavation sites	Using field and analytical methods approved by DONRE.	Once if needed	Once	PIU	Environmental Monitoring Consultant	$2,500.
A) Air quality: dust, CO, NOx, SOx, noise, wind, temperature, and vibration levels B) Affected surface water quality: TSS, heavy metals (As, Cd, Pb,) oil and grease, pH,	A & B) Baseline sites of pre-construction phase.	A – C: Using field and analytical methods approved by DONRE. Include visual	(A – B): Quarterly during construction periods Daily visual	Monthly	(A - D): PIU	Monitoring	A & B:

DO, COD, BOD_5, temperature, TDS, NH_3, NH_4, other nutrient forms of N & P C) Analysis of soil quality (heavy metals (As, Cd, Pb, Hg, Mn), hydrocarbons. D) Domestic (worker) and construction solid waste inside & outside construction sites including worker camps. E) Public comments and complaints F) Incidence of worker or public accident or injury	 C) At sites where contaminated soil is suspected. D) All construction sites and worker camps E) Using hotline number placed at construction areas F) At all construction areas	observations of dust and noise from contractor & public reports . C) Once at start of excavations D) Visual observation E) Information transferred by telephone hotline number posted at all construction sites. F) regular reporting by contractors/PIU	records C) Once at start of excavations D) Monthly E) Continuous public input F) Continuous		 (E & F) & daily observations: EA/PIU	Consultant contractor	$14,000./yr C: $3,000./yr D: $0.0 E: $1,000./yr F: $0.0
Operation of Upgraded Access Road to Ban Tham Village and Xang Cave							
Air quality: dust, CO, NOx, SOx, noise and vibration levels	Baseline sites of pre-construction phase.	Using field and analytical methods approved by DONRE.	Quarterly for 5 years	Biannual	DPWT		$3,000./yr
Traffic accidents	New or upgraded roads.	Regular record keeping.	Continuously	For each event	DPWT		$0.0
Incidence of flooding	Adjacent to new or upgraded roads	Surveys, public complaints	Seasonal for 5 years	Seasonal	DPWT		$600./yr
Operation of Upgraded Tourist Facilities at Xang Cave and The Sikhottabong Stupa							
Incidence of garbage and litter	Tourist reception areas of Stupa compound, and Xang Cave including inside cave.	Visual inspection	Weekly	Quarterly	MICT		O&M
Pollution caused by toilets and septic ABR: odor, fecal coliform bacteria, NH_3, NH_4, other nutrient forms of N & P	Near toilet blocks and infiltration fields, and in adjacent streams	Smell, & river sampling	Biannually	Biannually	MICT/DONRE		$4000./yr

Table 7: Performance Monitoring Indicators for Khammouane Subprojects

Major Environmental Component	Key Indicator	Performance Objective	Data Source
Pre-construction Phase			
Public Consultation & Disclosure	Affected public & stakeholders	Meetings with stakeholders contacted during IEE & new stakeholders convened for follow-up consultation & to introduce grievance mechanism	Minutes of meeting, and participants list
EMP	Updated EMP	All stakeholders contacted during IEE re-contacted for follow-up consultation	EMP
Bid Documents	Requirements of EMP (CEMP)[11]	EMP appended to bidding documents with clear instructions to bidders for CEMP	Bid documents
Training of DICT/PIU	Training course(s) & schedule	By end of preconstruction phase, required course(s) that will be delivered are designed and scheduled	Course(s) outline, participants, and schedule
Construction Phase			
All subproject areas	Critical habitat, rare or endangered species if present	All present critical habitat and R & E species if unchanged, and unharmed	Monitoring by EMC[12]
Affected water quality	TSS, DO, BOD, COD, pH, oil & grease, nutrient forms of T & N, metals (Pb, Fe, As)[13]	Government environmental standards & criteria met	Monitoring by EMC
Air quality	SOx, NOx, dust, CO, noise, vibration[14]	Levels never exceed pre-construction baseline levels	EMC & contractor monitoring reports,
Soil quality	Solid & liquid waste	Rigorous program of procedures & rules to collect and store all waste from construction camps and sites practiced.	Contractor and EMC monitoring reports
Hazardous materials & waste	Oil, gasoline, grease, alum, chlorine, soda	Rigorous program of procedures to manage and store all waste from construction camps and sites practiced.	Contractor and EMC monitoring reports
Public & worker safety	Frequency of injuries	Adherence to Government OHS programme policy and site-specific procedures to prevent accidents[15]	Contractor reports
Cultural property	Incidence of damage, or complaints	No valued cultural property, or unearthed valuable relic is harmed in any way	Public input, contractor reports, public input, EMC reports
Traffic	Frequency of disruptions & blocked roadways	Disruptions, stoppages, or detours are managed to absolute minimum.	Public input, contractor reports, EMC reports
Operation Phase of Upgraded Roads			
Traffic safety	Frequency of accidents	No increase in pre-construction frequency	DPWT
Air quality	SOx, NOx, dust, CO, noise along upgraded roads[16]	Levels never exceed pre-construction baseline levels	MONRE,

[11] Contractor Environmental Management Plan developed from EMP in contractor bidding document
[12] Environmental Monitoring Consultant hired to assist implementation of Environmental Monitoring Plan
[13] See Annex 5 for environmental standards
[14] Footnote 12
[15] MLSW GoL, Occupational Safety & Health Programme *or* IFC World Bank EHS (2007)
[16] Footnote 12

VII. ESTIMATED COST OF EMP

39. The costs for implementing the EMP are primarily for environmental monitoring because the marginal costs for implementing impact mitigation measures are included with the construction costs in contractor bid documents. From Table 6 the preliminary costs for the implementation of the EMP for the Khammouane subprojects are summarized in Table 8. These costs include per diem technician fees. These costs include per diem technician fees. Note that the PPTA economist has added a margin of cost uncertainty to the total EMP cost.

40. An estimated budget of USD $15,000.00 is required for capacity building for environmental management in conjunction with other capacity development activities of the project such as occurring as part of Output 3. The costs will need to be updated by the DDSC in conjunction with the PIU during the pre-construction phase.

Table 8: Estimated costs for Environmental Monitoring Plan

Activity Type	Estimated Cost (USD)
Pre-construction Phase	
Updating Environmental Baseline	
cultural receptors	$2,500.00
environmental quality	$6,500.00
Construction Phase	
environmental quality	$36,500.00
public consultation	$2,000.00
Post-construction Operation Phase	
environmental quality	$35,000.00
public input	$3,000.00
Total	**$85,500.00**

VIII. EMERGENCY RESPONSE PLAN

41. The Contractor must develop emergency or incident response procedures during construction. In the operational phase the operator/civil authorities will have responsibility for any emergencies or serious incidents. The construction phase should ensure:

i) Emergency Response Team (ERT) of the Contractor as initial responder;
ii) the District fire and police departments, emergency medical service, the Department of Public Health (DPH), collectively referred to as the External Emergency Response Team (EERT), as ultimate responders.

42. The Contractor will provide and sustain the required technical, human and financial resources for quick response during construction.

Table 9: Roles and Responsibilities in Emergency Incident Response

Entity	Responsibilities
Contractor Team (ERT)	- Communicates / alerts the EERT. - Prepares the emergency site to facilitate the response action of the EERT, e.g., vacating, clearing, restricting site. - When necessary & requested by the EERT, lends support / provides assistance during EERT's response operations.
External Emergency Response Team (EERT)	- Solves the emergency/incident
Contractor Resources	- Provide and sustain the people, equipment, tools & funds necessary to ensure Subproject's quick response to emergency

Entity	Responsibilities
	situations. - Maintain good communication lines with the EERT to ensure prompt help response & adequate protection, by keeping them informed of Subproject progress.

43. The ERT will be led by the contractor's senior engineer (designated ERTL) on site with a suitably trained foreman or junior engineer as deputy. Trained first-aiders and security crew will be the core members of the ERT.

44. The Contractor will ensure that ERT members are physically, technically and psychologically fit for their emergency response roles and responsibilities.

45. Prior to the mobilization of civil works, the Contractor, through its Construction Manager, ERTL, in coordination with the PCU/PIU, will meet with the ultimate response institutions to discuss the overall construction process, including, but not limited to:

i) Subproject sites;
ii) construction time frame and phasing;
iii) any special construction techniques and equipment that will be used;
iv) any hazardous materials that will be brought to and stored in the construction premise and details on their applications and handling/management system;
v) the Contractor's Emergency Management Plan
vi) names and contact details of the ERT members

46. The objective of this meeting is to provide the ultimate response institutions the context for:

i) their comments on the adequacy of the respective Emergency Management Plans
ii) their own assessment of what types, likely magnitude and likely incidence rate of potential hazards are anticipated; and
iii) arrangements for coordination and collaboration.

47. To ensure effective emergency response, prior to mobilization of civil works, the Contractor will:

i) set up the ERT;
ii) set up all support equipment and facilities in working condition
iii) made arrangements with the EERT;
iv) conducted proper training of ERT members, and encouraged and trained volunteers from the work force; v) conducted orientation to all construction workers on the emergency response procedures and facilities, particularly evacuation procedures, evacuation routes, evacuation assembly points, and self-first response, among others; and vi) conducted drills for different possible situations.

48. To sustain effective emergency response throughout subproject implementation an adequate budget shall be provided to sustain the capabilities and efficiency of the emergency response mechanism, the emergency response equipment, tools, facilities and supplies. Drills and reminders will take place regularly, the former at least every two months and the latter at least every month.

A. Alert Procedures

49. Means of communicating, reporting and alerting an emergency situation may be any combination of the following: (i) audible alarm (siren, bell or gong); (ii) visual alarm

(blinking/rotating red light or orange safety flag); (iii) telephone (landline); (iv) mobile phone; (v) two-way radio; and (vi) public address system/loud speakers. Some rules relative to communicating/alerting will be:

(i) Whoever detects an emergency situation first shall immediately :
- call the attention of other people in the emergency site,
- sound the nearest alarm, and/or
- report/communicate the emergency situation to the ERT.

(ii) Only the ERTL and, if ERTL is not available, the Deputy ERTL are authorized to communicate with the EERT. Exceptional cases to this rule may be necessary and should be defined in the Emergency Management Plans.

(iii) When communicating/alerting an emergency to the EERT, it is important to provide them with at least: i) the type of emergency situation; ii) correct location of the emergency; ii) estimated magnitude of the situation; iii) estimated persons harmed; iv) time it happened; v) in case of a spill, which hazardous substance spilled; and vi) in case of fire and explosion, what caused it. Such details would allow the EERT to prepare for the appropriate response actions.

For an effective reporting/alerting of an emergency situation:

(i) The names and contact details of the relevant persons and institutions should be readily available in, or near to, all forms of communication equipment, and strategically posted (at legible size) in all Subproject sites and vehicles:
- Most relevant construction/operations staffs namely, the ERTL, Deputy ERTL, first-aiders, supervising engineers, foremen
- EERT institutions/organizations
- Concerned village authority/ies
- PIU Office, SS

(ii) All Subproject sites should have good access to any combination of audible and visual alarms, landline phones, mobile phones and two-way radio communication at all times.

(iii) Contractor's construction vehicles should also be equipped with the appropriate communication facilities.

B. Emergency Response Situations

The following tables suggest general procedures that will be refined in the final EMP during detailed design, and described in more detail in the Emergency Management Plans of the Contractor.

Table 10: Evacuation Procedure

Procedure	Remarks
• Move out as quickly as possible as a group, but avoid panic.	• All workers/staff, sub-contractors, site visitors to move out, guided by the ERT.
• Evacuate through the directed evacuation route.	• The safe evacuation shall have been determined fast by the ERTL/Deputy ERTL & immediately communicated to ERT members.
• Keep moving until everyone is safely away from the emergency site and its influence area.	• A restricted area must be established outside the emergency site, all to stay beyond the restricted area.
• Once outside, conduct head counts.	• Foremen to do head counts of their sub-groups; ERTL/Deputy ERTL of the ERT.
• Report missing persons to EERT immediately.	• ERTL/Deputy ERTL to communicate with the EERT.
• Assist the injured in evacuation & hand them over to the ERT first-aiders or EERT medical group	• ERT to manage injured persons to ensure proper handling.

Procedure	Remarks
• If injury warrants special care, DO NOT MOVE them, unless necessary & instructed/directed by the EERT.	• ERTL/Deputy ERTL communicates with EERT to get instructions/directions in handling the injured.

Table 11: Response Procedure during Medical Emergency

Procedure	Remarks
• Administer First Aid regardless of severity immediately.	• Fundamentals when giving First Aid: - Safety first of both the rescuer and the victim. - Do not move an injured person unless: - victim is exposed to more danger when left where they are, e.g., during fire, chemical spill - it would be impossible for EERT to aid victims in their locations, e.g., under a collapsed structure - instructed or directed by the EERT. • First AID to be conducted only by a person who has been properly trained in giving First Aid.
• Call the EERT emergency medical services &/or nearest hospital.	• ERTL/Deputy ERTL or authorized on-site emergency communicator
• Facilitate leading the EERT to the emergency site.	• ERTL/Deputy ERTL to instruct: - an ERT member on- site to meet EERT in access road/strategic location. He/she shall hold orange safety flag to get their attention & lead them to site. - Other ERT members to clear access road for smooth passage of the EERT.
• If applicable, vacate site & influence area at once, restrict site, suspend work until further notice.	• Follow evacuation procedure.

Table 12: Response Procedure in Case of Fire

Procedure	Remarks
• Alert a fire situation.	• Whoever detects the fire shall immediately: - call the attention of other people in the site, - sound the nearest alarm, and/or - Foreman or any ERT member among the construction sub-group contacts the fire department (in this case it should be agreed on that it is alright for any ERT member in the sub-group to alert the fire department) - report/communicate the emergency situation to the ERTL/Deputy ERTL.
• Stop all activities/operations and evacuate.	• All (non-ERT) workers/staff sub-contractors, site visitors and concerned public to move out to safe grounds following the evacuation procedure.
• Activate ERT to contain fire/control fire from spreading.	• Guided by the training they undertook, ERT members assigned to mitigate the fire shall assess their own safety situation first before attempting to control fire spread.
• Call the nearest fire & police stations &, if applicable, emergency medical services.	• When alerting the EERT, ERTL will give the location, cause of fire, estimated fire alarm rating, any injuries.
• Facilitate leading the EERT to the emergency	• ERTL/Deputy ERTL to instruct:

Procedure	Remarks
site.	- an ERT member to meet the EERT in the access road or strategic location and lead them to the site. He/she shall hold the orange safety flag to get their attention and lead them to the site. - some ERT members to stop traffic in, & clear, the access road to facilitate passage of the EERT.
• ERT to vacate the site as soon as their safety is assessed as in danger.	• Follow appropriate evacuation procedure.

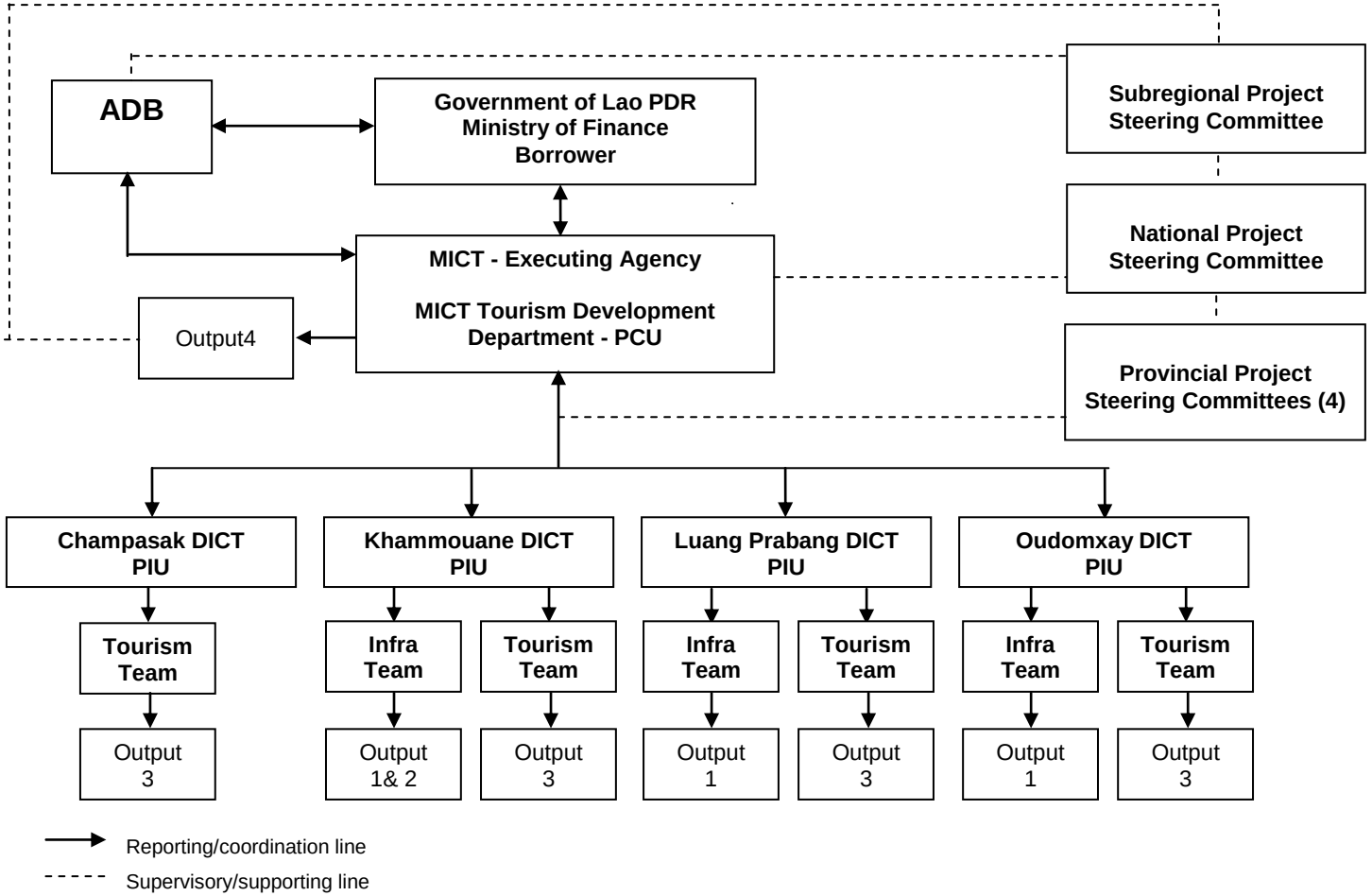
IX. INSTITUTIONAL CAPACITY REVIEW AND NEEDS

50. Currently there is little experience and capacity for environmental assessment and management amongst national counterparts responsible for the implementation of the EMP. i.e., DICT/PIU, and DPWT in Khammouane province. No dedicated environmental staff exist in the DICT and thus the PIU. The DDSC with assistance from the designated SS/PIU will develop and deliver training courses to the DICT/PIU staff responsible for the implementation of the subproject. The purpose of the course(s) is to strengthen the ability of the PIU/SS to oversee implementation of the EMP by construction contractors, and EMC

51. The SS who is a full-time environmental member of the PIU as well as the EO of the contractor should attend training courses as required. Costs for training should be included with costs for implementation of the EMP.

52. Training on the implementation of an EMP should address two thematic areas. The first area should be principles environmental management focused on the potential impacts of subproject activities on the natural and social environment. The second area should be environmental safeguard requirements of the ADB and GoL with specific reference to the EMP.

ANNEX 1: PROJECT MANAGEMENT ORGANIZATION IN LAO PDR



ADB = Asian Development Bank; DICT= Department of Information, Culture and Tourism; Infra = infrastructure; MICT = Ministry of Information, Culture and Tourism; PCU = project coordination unit; PIU = project implementation unit.

ANNEX 2: INDICATIVE RESPONSIBILITIES OF KEY MANAGEMENT UNITS OF EMP

EMP Implementation organizations	Roles and Responsibilities
Executing agency (EA) (MICT)	➢ Overall responsibility for the execution of the project ➢ Reviews the project implementation progress ➢ Reviews and endorses any proposed change in the project scope or implementation arrangements ➢ Supervises compliance with loan covenants
Project Coordination Unit (PCU), inside MICT	➢ Project preparation, including the setting up of financial and management systems and procedures, and the procuring of PCU office equipment ➢ Consultant recruitment and supervision ➢ Review and approval of goods and civil works contracts, including bid documents ➢ Coordination between the concerned agencies at the national and provincial levels ➢ Coordination of activities of the PIUs and the inputs of concerned stakeholders ➢ Coordination of all reporting aspects of the project ➢ Coordination of institutional strengthening measures ➢ Ensuring compliance with ADB Loan covenants, assurances and safeguard requirements, as well as with national and provincial policies and regulations ➢ Provision of administrative and technical support to the PIUs ➢ Preparation of consolidated Project accounts to be forwarded to ADB ➢ Advice to PIUs on revenue-enhancing activities related to the recovery of costs of constructing, operating, and maintaining Project facilities and equipment; ➢ Coordination of project audits ➢ All specified monitoring, evaluation and reporting activities ➢ Communication of Project's outcomes, outputs, and activities to all stakeholders ➢ Provide coordination for safeguards and monitoring for PIU
Provincial Project Steering Committee (PPSC)	➢ Ensuring that concerns of all stakeholders are adequately reflected in the project ➢ Coordination of project implementation between the concerned agencies ➢ Confirming compliance with local regulations and provincial policies ➢ Overseeing budgeting and disbursement of counterpart funds ➢ Overseeing implementation of resettlement plans, compensation schemes and all other project safeguard procedures
Project Implementation Units (PIUs) inside DICT	➢ Coordination and supervision of consultants' inputs on the appraisal of feasibility studies, and conceptual and detailed designs construction ➢ Procurement of goods and civil works contracts, including the preparation of bid documents and bid evaluations ➢ Approving payments to contractors and maintaining disbursement records ➢ Ensuring that institutional-strengthening and capacity-building initiatives involving DMOs, private partners, SMEs and CBTOs are implemented in line with agreed Project designs, schedules and budgets ➢ Ensuring compliance with loan covenants and assurances in respect of all sub projects, including updating of IEEs, EMPs, IPPs, GAPs, resettlement plans

EMP Implementation organizations	Roles and Responsibilities
	➢ Oversee implementation of EMP by contractor EO, and EMC ➢ Prepare quarterly reports on EMP implementation for PCU ➢ Coordinate with DDSC to design and deliver capacity development & training. ➢ Coordinating the process of establishing appropriate cost-recovery mechanisms ➢ Coordinating the implementation of identified Public-Private Partnership (PPP) initiatives; ➢ Meetings with all concerned stakeholders ➢ Quarterly progress and monitoring-and-evaluation reporting to the PCU
Detailed Design & Supervision Consultant (DDSC)	➢ Completes detailed designs of subprojects with PIU ➢ Update EMP to meet final detailed designs of subprojects ➢ Supervises and assists PIU with contractor management ➢ Provides technical advice and support when needed to PIU and EMC ➢ Designs and oversees delivery of all training and capacity development of PIU for construction and operation of completed subprojects including EMP. ➢ Provides advisory role for implementation of EMP by PIU and EMC
Environmental Monitoring Consultant (EMC)	➢ Implements environmental sampling for EMP ➢ Conducts laboratory analyses of environmental quality samples from field sampling ➢ Prepares periodic monitoring reports for PIU
Environmental Officer (EO) of Contractor	➢ Implements the CEMP for the construction phase ➢ Maintains a daily log of environmental issues at the construction sites ➢ Prepares brief monthly summaries of mitigation activities and environmental issues at constructions site to PIU.
ADB	➢ Assists PCU through timely guidance at each stage of project implementation following agreed implementation arrangements ➢ Review all documents that require ADB approval ➢ Review of monitoring reports on EMP implementation to ensure EMP meets SPS (2009) ➢ Approval of procurement activities ➢ Periodic project review missions, a mid-term review and a completion mission for the project ➢ Ensuring compliance of all loan covenants ➢ Timely processing of withdrawal applications and release of eligible funds ➢ Ensuring compliance of financial audit recommendations ➢ Regularly updates project information disclosure on the ADB website

ANNEX 3: INDICATIVE TOR FOR ENVIRONMENTAL SPECIALISTS OF DDSC

International Environmental Specialist. With assistance from the national environmental specialist the international consultant will be responsible for updating the provincial EMPs at detailed design, and assisting the PIU with overall environmental management of the implementation of the subprojects in LAO. The consultant will: (i) update environmental management plans (EMP) for subprojects in Oudomxay, Luang Prabang, & Khammouane to ensure that EMPs address the detailed designs and engineering of subprojects. Updates to EMPs include mitiation and monitoring plans, budget, and capacity development needs of executing agency (EA/PCU) and PIUs (DICT / DPWT); (ii) with national consultant design comprehenisve training plan for safeguards specialist/PIU and on principles of EIA, and the purpose, content, and roles and responsibilities for implementation of updated EMPs highlighting environmental issues of subprojects; (iii) ensure that all relevant safeguards of the EMPs are adequately addressed in the bidding documents (instruction to bidders), and in the evaluation criteria for awarding contracts; (iv) Coordinate and work with the PIUs to ensure that contractors finalize their respective site-specific CEMPs based on the updated EMPs and the actual site conditions; (v) oversee the implementation of all safeguards of the three EMPs relating to construction phase activities including handling of construction spoil and waste, water and air quality protection, public nuisance impacts (noise, dust, traffic, blocked access, workers, and camps), and public safety; (vi) Coordinate with the Department of Heritage in Luang Prabang to ensure UNESCO development guidelines are followed in Chomphet; (vii) coordinate with the three provincial Departments of Natural Resources & Environment (DONRE) on all relevant environmental regulatory compliance issues (e.g. noise and dust from construction sites, sanitation in workers campsite etc); (viii) prepare TOR(s) for the LAO UXO for the survey, detection, and removal of unexploded ordnance (UXO) at all civil works sites. Ensure that EA and/or PIUs consult LAO UXO and Government authorities to assist with ToR development and implementation; (ix) contact Asia Elephant Conservation to clarify road surface and walking space requirements for elephants at Ban Pak Ou and Ban Xang Hai in Luang Prabang; (x) with PIU/DPWTs, prepare TORs for the follow-up interviews and consultations with the same affected stakeholder and local residents contacted during the PPTA on issues and concerns arising during project construction. Of particular concern is upgrades to access roads; (xi) prepare TOR(s) for external national environment monitoring consultant (EMC) for conducting water and air quality sampling, and laboratory analyses for the monitoring plans for the provincial EMPs; (xii) coordinate with PWDTs to address vehicle traffic issues, respectively during road upgrades; (xiii) work with cave specialist as needed to identify least impact walkways and lighting inside Chom Ong Cave; (xiv) advise PIU/DPWTs on environment-related concerns arising during sub-projects construction, and recommend corrective measures; (xv) with PIU/DPWTs, ensure dissemination to stakeholders the results of environment quality monitoring and implementation of safeguards, especially among households or small businesses near the civil construction works areas; (xvi) assist EA and PIU/DPWTs prepare a table of contents for regular reports PIU must submit to the EA on implementation of EMPs, environmental, issues, and corrective actions; (xvii) assist PIU/DPWTs prepare simple report template for construction contractors to report monthly on mitigation activities, and environmental issues that occur during construction phase; and (xviii) prepare a quarterly status report on implementation of EMPs, environmental issues, and public safety protection to be submitted through the PIU and EA to the provincial DONREs and ADB. The consultant should have an advanced degree in environmental sciences, and at least 7 years experience implementing and managing environmental assessment of infrastructure projects in southeast Asia countries (preferably Lao PDR). Other requiremetns include: a) understanding of ADB and national environmental safeguard requirements; b) experience working with and supervising the activities of provincial and national environmental management agencies with envronmental safeguards; and c) designing and delivering training and capacity development programs to provincial environment, project implementing units.

National Environmental Specialist. Provide assistance to the international environmental specialist including acquisition of information new information to update the provincial EMPs at detailed design, and work with the PIU with overall environmental management of the

implementation of the subprojects in LAO. The national consultant will assist with: (i) updating environmental management plans (EMP) for subprojects in Oudomxay, Luang Prabang, & Khammouane to ensure that EMPs address the detailed designs and engineering of subprojects.; (ii) deliver initial training to M/DICT and DPWT on the purpose, content, and roles and responsibilities for implementation of updated EMPs; (iii) ensure relevant safeguards of the EMPs are addressed in the bidding documents in paccurate local language and in evaluation criteria for awarding contracts; (iv) help PIUs to ensure that contractors prepare their respective site-specific plans based on the updated EMPs and the actual site conditions; (v) help international consultant oversee the implementation of all safeguards of the three EMPs relating to construction phase activities including handling of construction spoil and waste, water and air quality protection, public nuisance impacts (noise, dust, traffic, blocked access, workers, and camps), and public safety; (vi) assist coordination with the three provincial Departments of Natural resources & Environment (DONRE) on all relevant environmental regulatory compliance issues (e.g. noise and dust from construction sites, sanitation in workers campsite etc); (vii) with PIU/DPWTs, prepare ToRs for the follow-up interviews and consultations with the same affected stakeholder and local residents contacted during the PPTA on issues and concerns arising during project construction. Of particar concern is upgrades to access roads; (viii) assist PWDTs to address vehicle traffic issues, respectively during road upgrades; (ix) with international consultant advise the PIU/DPWTs on environment-related concerns arising during sub-projects construction, and recommend corrective measures; (x) with PIU/DPWTs, ensure dissemination to stakeholders the results of environment quality monitoring and implementation of safeguards, especially among households or small businesses near the civil construction works areas; (xi) assist with all eporting for the EMP. The consultant should have a university degree in the environmental sciences and at least 5 years experience with environmental assessment of infrastructure projects in Lao PDR) including: a) understanding of ADB and national environmental safeguard requirements; b) experience working with international consultants; and c) delivering training and capacity development programs to provincial project implementing units.

ANNEX 4: REGULATORY FRAMEWORK FOR ENVIRONMENTAL PROTECTION

Law or Decree	Article	Relating To	Content
Constitution of the Lao People's Democratic Republic (1991, amended 2003)	17	Environment in general	"All organizations and citizens must protect the environment and natural resources: land, underground, forests, fauna, water sources and atmosphere."
Environmental Protection Law (1999)	5	Environment in general	Conservation takes priority over mitigation and restoration. Socio-economic development planning must include planning for environmental protection
Environmental Protection Law (1999)	8	EIA Process	MONRE is main agency to issue regulations for EIA. People affected by projects, mass organizations, and local administrations are to be involved in the EIA process
	10	Responsibility of those engaged in development works	Those engaged in development works must adhere to safeguards, and to standards and regulations issued by Government agencies
	14	Responsibility of those engaged in development works	Those engaged in development works must abide by laws on land, forests, water, etc.
	16	Responsibility toward cultural, historical, natural heritage sites	Those engaged in development works must abide by laws and regulations to protect such heritage sites
	22	Pollution control	All are responsible for control of pollution, and applying technologies appropriate to control such pollution
	23	Hazardous wastes / emissions	Restrictions to hazardous wastes and means to control such wastes and emissions
	28	Damage to environment	Those causing damage to environment are responsible for repair through appropriate Government agencies
	38, 39	Local environmental management and monitoring	Stipulates responsibilities of local administrations (provinces, municipalities, special districts, districts) to establish environmental management and monitoring units
	40	Local environmental responsibilities	Stipulates responsibilities of village administrations to follow environmental regulations

Law or Decree	Article	Relating To	Content
Water and Water Resources Law (1996)	4	Rights to use water resources	Defines rights, obligations, and procedures to gain approval for use of water resources
	18	Permission for use	Stipulates that medium and large scale uses require feasibility studies, EIAs, and mitigation plans, before permission is granted for use of the resource
	22	Principles in water resource development management	Stipulates that water resource development must be consistent with national and sector plans, must ensure preservation of the natural beauty of the resources, and must protect against harmful effects of water
Water and Water Resources Law (1996)	25	Promotion of Watershed and Water Resource Protection for Hydropower Development	Stipulates that 'hydropower projects must be developed with due concern for environmental protection, flood protection, water supply, irrigation, navigation, fisheries and others."
	29	Water and water resource protection	Requires that water resources be protected from becoming spoilt, polluted, or drying up, and that forest and land resources be protected to help protect the water resources
Lao Forestry Law (amended 2007)	5	Policy on forest and forest land	The GOVERNMENT has the policy to preserve, regenerate, and develop forests and forest land to help preserve the environment, water resources, biodiversity, and people's livelihoods.
	9 to 13	Forest types	Classify the various types of forests according to use, including forests for village use
	26	Preservation of water resources in forest zones	Stipulates the preservation of water resources in forest zones for those areas where waterways originate and flow, including strict management and regulations to control logging, shifting cultivation, and destructive forest uses
	70	Conversion of forestland	Stipulates that forestland can be converted to other land type if it brings a high level of benefits to the nation and to livelihoods of the people, and is included in the national development plan
	71	Types of converted forestland	Stipulates that for uses such as dam construction, the timber and forest resources to be harvested in those areas are property of the State

Law or Decree	Article	Relating To	Content
Wildlife and Aquatic Law (2007)	31	Use for Household purposes	Allows use by village households of wildlife and aquatic species in the common and general category list in particular seasons or permitted areas, using tools or equipment that do not adversely affect habitats or compromise the species population.
	32	Customary Use	Allows use of wildlife or aquatic species in the common and general category list by village households for “necessary cultural beliefs.”
	52	Prohibitions	Prohibits taking of wildlife, including parts of the animals, from their habitats; tormenting wildlife and aquatics; illegal catching, hunting, trading and possession; catching aquatic and hunting in conservation zones, in breeding season, or when pregnant; devastation of habitats and feeding zones.
Land Law (2003)	6	Protection of Land and Environment	Declares that all individuals and organizations are obliged to protect the land from degradation,
	14	Changes in Land Category	Land use can be changed if it does not cause social or environmental harm and if prior approval is obtained from the authorities.
Decree on Land Lease or Concession (2009)	39	Obligation of Person or Legal Entity Who Leases or Obtains Concession	The person or legal entity that leases land or obtains a concession is obligated, among other things, “not to cause any damage to the quality of land and negative impact to the natural environment and the society.”
Road Law (1999)	15	Public Road Construction	Construction of public roads must include protection of the environment
Prime Ministerial Decree No. 112/PM on Environmental Impact Assessment (2010)		Stipulates the need for Environmental Impact Assessment	Stipulates rights of those affected by projects, and need for participation. Outlines the process of conducting the EIA, preparing environmental management and monitoring plans, social management and monitoring plans, issuing environmental compliance certificates, monitoring compliance with the various plans, establishing the institutional framework including grievance procedures.
Decree on Compensation and Resettlement of People Affected by Development Projects (2006)		Establish the procedures for compensation and resettlement for project affected people	Defines the principles, rules, and measures to mitigate adverse impacts and to compensate for damages that may result from involuntary acquisition or repossession of land and of fixed or movable assets, including changes in land use and restrictions to access of community or natural resources

ANNEX 5: ENVIRONMENTAL STANDARDS

Water Resources and Environment Administration No 2734 / PMO.WREA (now MONRE) Vientiane, 7 Dec 2009

Agreement on the National Environmental Standards

Based on the Environmental Protection Law No. 02/99/NA, dated 3 April 1999.
Based on decree on mandate of Water Resources and Environmental Administration dated 149/PM, dated 10 May 2007.

Surface water quality standards in Lao PDR

No	Substances	Symbol	Unit	Standard Value	Method of Measurement
1	Color, Odor and Taste	-	-	N	-
2	Temperature	t	°C	N'	Thermometer
3	Potential of Hydrogen	pH	-	5-9	Electronic pH Meter
4	Dissolved Oxygen	DO	mg/l	6	Azide Modification
5	COD	COD	ml/l	5	Potassium permanganate
6	BOD_5	BOD_5	mg/l	1,5	Azide Modification at 20 degree C, 5 days
7	Total Coliform Bacteria	Coliform Bacteria	MPN/100 ml	5000	Multiple Tube Fermentation
8	Fecal Coliform Bacteria	Fecal Coliform	MPN/ 100 ml	1000	
9	Nitrate-Nitrogen	NO_3-N	mg/l	<5.0	Cadmium Reduction
10	Ammonia-Nitrogen	NH_3-N	mg/l	0.2	Distillation Nesslerization
11	Phenols	C_6H_3-OH	mg/l	0.005	Distillation, 4-Amin anti-pyrenne
12	Copper	Cu	mg/l	0.1	Atomic Absorption Direct Aspiration
13	Nickel	Ni	mg/l	0.1	
14	Manganese	Mn	mg/l	1.0	
15	Zinc	Zn	mg/l	1.0	
16	Cadmium	Cd	mg/l	0.005	
17	Chromium, Hexavalent	Cr^{6+}	mg/l	0.05	
18	Lead	Pb	mg/l	0.05	
19	Mercury	Hg	mg/l	0.002	Atomic Absorption Cold Vapor
20	Arsenic	As	mg/l	0.01	Atomic Absorption Direct Aspiration
21	Cyanide	CN^-	mg/l	0.005	Pyridine-Barbituric
22	Alpha ¬Radioactive	α	Becquere l/l	0.1	Counting machine
23	Beta ¬ Radioactive	β	Becquere l/l	1.0	
24	Total Organochlorine	-	mg/l	0.05	Gas Chromatography
25	DDT	$C_{14}H_9Cl_5$	mg/l	1.0	
26	Alpha -BHC	αBHC	mg/l	0.02	
27	Dieldrin	$C_{12}H_8Cl_6O$	mg/l	0.1	
28	Aldrin	-	mg/l	0.1	
29	Heptachlor and Heptachlor Epoxide	-	mg/l	0.2	
30	Endrin	-	mg/l	None	

Drinking Water Quality Standards

Bacteriological Parameters

Parameters	Units	Concentration
Fecal Coliform	MPN/100ml	0
Total Coliform	MPN/100ml	<2.2
Entero virus	MPN/100ml	0

Physical -Chemical Parameters

No.	Parameters	Symbol	Unit	Concentration	
				Minimum	Maximum
1	Aluminum	Al	mg/l	0.1	0.2
2	Ammonia	NH_3	mg/l	0.5	1.5
3	Chloride	Cl^-	mg/l	200	250
4	Copper	Cu	mg/l	1.0	2.0
5	Iron	Fe	mg/l	0.3	<1
6	Manganese	Mn	mg/l	0.1	0.5
7	Sodium	Na	mg/l	200	250
8	Sulphate	SO_4^{2-}	mg/l	200	250
9	Hydrogen Sulphide	H_2S	mg/l	0.05	0.1
10	Conductivity	Ec	µs/cm	-	<1,000
11	Total dissolved solids	TDS	mg/l	500	600
12	Sodium Chloride	NaCl	mg/l	100	300-350
13	Potential of Hydrogen	pH	-	6.5	8.5
14	Temperature	T	^0C	25	35
15	Hardness	-	mg/l	50	300
16	Turbidity	-	NTU	-	<10
17	Taste and Odor	-	-	-	Acceptable
18	Color	-	TCU	-	5
19	Residual Chloride (if Chlorine disinfection is used)	Cl_2	mg/l	-	<0.2

Health Significant Chemical Parameters

No.	Parameters	Symbol	Unit	Maximum Concentration
1	Antimony	Sb	mg/l	0.005
2	Arsenic	As	mg/l	0.01-0.05
3	Barium	Ba	mg/l	0.7
4	Boron	B	mg/l	0.50
5	Cadmium	Cd	mg/l	0.003
6	Chromium	Cr	mg/l	0.05
7	Cyanide	CN^-	mg/l	0.07
8	Fluoride	F^-	mg/l	1.5
9	Lead	Pb	mg/l	0.01
10	Mercury	Hg	mg/l	0.001
11	Nitrate	NO_3^-	mg/l	50
12	Nitrite	NO_2^-	mg/l	3
13	Selenium	Se	mg/l	0.01

Priority Parameters

No.	Parameters	Symbol	Unit	Maximum Concentration
1	Iron	Fe	mg/l	<1
2	Manganese	Mn	mg/l	<0.5
3	Arsenic	As	mg/l	<0.05
4	Fluoride	F^-	mg/l	<1.5
5	Nitrate	NO_3^-	mg/l	50
6	Nitrite	NO_2^-	mg/l	3
7	Nitrite Nitrogen	NO_2^-N	mg/l	1
8	Potential of Hydrogen	pH	-	6.5-8.5
9	Coliform	-	MPN/100ml	0
10	Conductivity	Ec	µs/cm	1000
11	Residual Chloride (if Chlorine disinfection is used)	Cl_2	mg/l	0.2
12	Total Hardness	-	mg/l	<300
13	Turbidity	-	NTU	<10
14	Taste and Odor	-	-	Acceptable

Groundwater Standards for Drinking Purposes

Characteristics	Parameters	Symbol	Unit	Permitted Standard Value	
				Suitable	Maximum
Physical	1. Color	-	Platinum-Cobalt (Pt- Co)	5	15
	2. Turbidity	-	JTU	5	20
	3. Potential of Hydrogen	pH	-	7.0-8.5	6.5-9.2
Chemical	4. Iron	Fe	mg/l	≤0.5	1
	5. Manganese	Mn	mg/l	≤0.3	0.5
	6. Copper	Cu	mg/l	≤1.0	1.5
	7. Zinc	Zn	mg/l	≤5.0	15
	8. Sulphate	SO_4^{2-}	mg/l	≤200	250
	9. Chloride	Cl^-	mg/l	≤250	600
	10. Fluoride	F^-	mg/l	≤0.7	1
	11.Nitrate	NO_3^-	mg/l	≤15	45
	12. Total Hardness as	Total $CaCO_3$	mg/l	≤300	500
	$CaCO_3$				
	13.Non-carbonate hardness as $CaCO_3$	Non $CaCO_3$	mg/l	≤200	250
Toxic chemical substances	14. Total solids	TS	mg/l	≤600	1,200
	15. Arsenic	As	mg/l	None	0.05
	16. Cyanide	CN^-	mg/l	None	0.1
	17. Lead	Pb	mg/l	None	0.05
	18. Mercury	Hg	mg/l	None	0.001
	19. Cadmium	Cd	mg/l	None	0.01
	20. Selenium	Se	mg/l	None	0.01
Bacteria	21. Coliform bacteria	Coliform	MPN/100 ml	<2.2	<2.2
	22. E. coli bacteria	E. coli	-	None	None
	23. Standard plate count	-	Colonies/ml	≤500	-

Soil Quality Standards for Residential and Agriculture

No.	Substances	Symbol	Unit	Standard Value	Method of Measurement
I. Volatile Organic Compound					
1	Benzene	C_6H_6	mg/kg	0.5	Gas Chromatography or Gas Chromatography/. Mass Spectrometry (GC/MS) or other methods approved by DONRE
2	CarbonTetrachloride	CCl_4	mg/kg	89	
3	1,2 Dichloroethane	CH_2Cl-CH_2Cl	mg/kg	230	
4	1,1 Dichloroethylene	$CCl_2=CH_2$	mg/kg	1,700	
5	Cis 1,2 Dichloroethylene	CHCl=CHCl	mg/kg	57	
6	Trans-1.2-Dichloroethylene	CHCl=CHCl	mg/kg	520	
7	Dichloromethane	CH_2Cl_2	mg/kg	28	
8	Ethly benzene	lC_2ClC-CH_3	mg/kg	630	
9	Styrene	C_6H_5-$CH=CH_2$	mg/kg	8.4	
10	Tetrachloroethylene	C_2Cl_4	mg/kg	210	
11	Toluene	C_6H_5-CH_3	mg/kg	6.5	
12	Trichloroethylene	$Cl_2C=CHCl$	mg/kg	2.5	
13	1.1.1 Trichloroethane	Cl_3C-CH_3	mg/kg	3.5	
14	1.1.2 Trichloroethane	Cl_2CH-CH_2Cl	mg/kg	43	
15	Total Xylenes	(CH_3-C_6H_4-CH_3)	mg/kg	63	
II. Heavy Metals					
1	Arsenic	As	mg/kg	3.9	Inductively Coupled Plasma-Atomic Emission Spectrometry or Inductively Coupled Plasma-Mass Spectrometry or Atomic Absorption, Gaseous Hydride or Atomic Absorption, Borohydride Reduction or other Methods Approved by DONRE
2	Cadmium and its compounds	Cd	mg/kg	37	
3	Hexavalent Chromium	Cr^{+6}	mg/kg	300	Coprecipitation or Colorimetric or Chelation/ Extraction or other Methods Approved by DONRE
4	Lead	Pb	mg/kg	400	Inductively Coupled Plasma-Atomic Emission Spectrometry or Inductively Coupled Plasma-Mass Spectrometry or Atomic Absorption, Direct Aspiration or Atomic Absorption, Furnace Techniques or other Methods Approved by
5	Manganese and its compounds	Mn	mg/kg	1,800	

					DONRE
6	Mercury and its compounds	Hg	mg/kg	23	Cold-Vapor Technique or other Methods Approved by DONRE
7	Nickel, soluble salts	Ni	mg/kg	1,600	Inductively Coupled Plasma-Atomic Emission Spectrometry or Inductively Coupled Plasma-Mass Spectrometry or Atomic Absorption, Direct Aspiration or Atomic Absorption, Furnace Techniques or other Methods Approved by DONRE
8	Selenium	Se	mg/kg	390	
III. Pesticides					
1	Atrazine	$C_8H_{14}ClN_5$	mg/kg	22	Gas Chromatography or other Methods Approved by DONRE
2	Chlordane	-	mg/kg	16	Gas Chromatography/ Mass Spectrometry (GC/MS) or other Methods Approved by DONRE
3	2,4 D	-	mg/kg	690	Gas Chromatography or High Performance Liquid Chromatography/ Thermal Extraction/ Gas Chromatography/Mass Spectrometry (TE/GC/MS) or other Methods Approved by DONRE
4	DDT	DDT	mg/kg	17	Gas Chromatography or Gas Chromatography/ Mass Spectrometry (GC/MS) or other Methods Approved by DONRE
5	Dieldrin	$C_{12}H_8Cl_6O$	mg/kg	0.3	
6	Heptachlor	Cl_7	mg/kg	1.1	
7	Heptachlor Epoxide	-	mg/kg	0.5	
8	Lindane	-	mg/kg	4.4	
IV. Others					
1	Benzo(a)pyrene	-	mg/kg	0.6	Gas Chromatography/ Mass Spectrometry (GC/MS) or Thermal Extraction Gas Chromatography/ Mass Spectrometry (TE/GC/MS) Chromatography/ Fourier Transform Infrared (GC/FT-IR) Spectrometry or other Methods Approved by DONRE
2	Cyanide and its compounds	CN^-	mg/kg	11	Total and Amenable Cyanide: Distillation, or Total Amenable Cyanide (Automated Colorimetric, with off-

					line Distillation), or Cyanide Extraction Procedure for Solids and Oils or other Methods Approved by DONRE
3	PCBs	-	mg/kg	2.2	Gas Chromatography or other Methods Approved by DONRE
4	Vinyl Chloride		mg/kg	1.5	Gas Chromatography or Gas Chromatography/ Mass Spectrometry (GC/MS) or other Methods Approved by DONRE

Ambient Air Quality Standard

Parameters	Symbol	Average Time Unit: mg/m3					Method of Measurement
		Hours			1 month	1 year	
		1 hr	8 hr	24 hr			
Carbon monoxide	CO	30	10.26	-	-	-	Non dispersive infrared detection
Nitrogen dioxide	NO_2	0.32	-	-	-	-	Chemilumine scene method
Sulphur dioxide	SO_2	0.78	-	0.30	-	0.10	UV Fluorescence (1hr, 24hr, 1yr) or Pararosaniline (1hr,4hr)
Total Suspended Particulate	TSP	-	-	0.33	-	0.10	Gravimetric
Particulate Matter less than 10 microns	PM-10	-	-	0.12	-	0.05	Gravimetric or Beta Ray or Taper Element Oscillating Microbalance or Dichotomous
Ozone	O_3	0.20	-	-	-	-	Chemiluminescence or UV Absorption Phoptometry
Lead	Pb	-	-	-	1.5	-	Atomic Absorption Spectrometer

Noise Standard

Standards	Method of Measurement
Maximum Sound Level (L_{max}) should not exceed 115 dB(A)	Equivalent Sound Level (L_{eq}) from Fluctuating Noise
L_{eq} 24 hour not exceeding 70 dB(A)	Equivalent Sound Level (L_{eq}) from Steady Noise

Noise Standards for Other Places

Type of Area	Standard Value in dB(A)		
	6.00-18.00	18.00-22.00	22.00-6.00
Quiet areas: hospitals, libraries, treatment places, kindergarten and schools	50	45	40
Residential areas: hotels and houses	55	55	45
Commercial and service areas	70	70	50
Small industrial factories located in residential areas	70	70	50

General Industrial Wastewater Discharge Standards
Standards for General Industries

No.	Parameters	Symbols	Unit	Maximum Concentration
1	BOD_5	BOD_5	mg/l	40
2	Ammonia Nitrogen	NH_3-N	mg/l	4
3	Total Suspended Substances	TSS	mg/l	40
4	Potential of Hydrogen	pH	-	6-9.5
5	Total Dissolved Substances	TDS	mg/l	3,500
6	Phenols	C_6H_5OH	mg/l	0.3
7	Phosphorous	P	mg/l	1.0
8	Silver	Ag	mg/l	0.1
9	Zinc	Zn	mg/l	1.0
10	Sulphide	S	mg/l	1.0
11	Free Chlorine	Cl_2	mg/l	1.0
12	Chloride	Cl^-	mg/l	500
13	Iron	Fe	mg/l	2.0
14	Fluoride	F	mg/l	15
15	Cyanide	CN^-	mg/l	0.1
16	Copper	Cu	mg/l	0.5
17	Lead	Pb	mg/l	0.2
18	Oil and Grease	-	mg/l	5
19	Nickel	Ni	mg/l	0.2
20	Mercury	Hg	mg/l	0.005
21	Manganese	Mn	mg/l	1.0
22	Arsenic	As	mg/l	0.25
23	Barium	B	mg/l	1.0
24	Cadmium	Cd	mg/l	0.03
25	Chromium	Cr^{+6}	mg/l	0.1
26	Total Chromium	Total Cr	mg/l	0.5

Wastewater Discharge Standards from the Urban Area

No.	Parameters	Symbol	Standards				
			A	B	C	D	E
1.	Biochemical Oxygen Demand	BOD_5	Not more than (mg/l)				
			30	40	50	60	200
2.	Suspended Solids	SS	Not more than (mg/l)				
			30	40	50	50	60
3.	Settle able Solids	-	Not more than (mg/l)				
			0.5	0.5	0.5	0.5	-
4.	Total Dissolved Solids	TDS	Not more than (mg/l)				
			3000	2500	2000	1500	-
5.	Chemical Oxygen Demand	COD	Not more than (mg/l)				
			120	130	150	350	400
6.	Sulphide	S^{2-}	Not more than (mg/l)				
			1.0	1.0	3.0	4.0	-
7.	Total Kjeldahl Nitrogen	TKN	Not more than (mg/l)				
			35	35	40	40	-
8.	Fat Oil and Grease	-	Not more than (mg/l)				
			20	20	20	20	100
9.	Temperature	t	Not more than (degree Celsius)				
			40	40	40	40	40
10.	Potential of Hydrogen	pH	Not more than				
			6-9.5	6-9.5	6-9.5	6-9.5	6-9.5

ANNEC 6: COST NORMS FOR ENVIRONMENTAL MONITORING

LAO PEOPLE'S DEMOCRATIC REPUBLIC
Peace Independence Democracy Unity Prosperity

Prime Minister's Office-PMO
Water Resources and Environment Administration-WREA (now DONRE)
Water Resources and Environment Research Institute-WERI

QUOTATION

Customer

Name: .....
Address: .....
City: .....
Phone: .....

Date: .....
Order Date: .....
Rep: .....
FOB: .....

No	Description	Unit	Quantity	Unit Price US$
1	pH	Sample	01	$2.00
2	EC	Sample	01	$4.00
3	Total Hardness (as $CaCO_3$)	Sample	01	$6.00
4	Biochemical Oxygen Demand (BOD_5)	Sample	01	$8.00
5	Chemical Oxygen Demand (COD)	Sample	01	$8.00
6	Sulfate ion (SO_4^{2-})	Sample	01	$7.00
7	Total Dissolves Suspended (TDS)	Sample	01	$8.00
8	Total Solid Suspended (TSS)	Sample	01	$8.00
9	Dissolved Oxygen (DO)	Sample	01	$6.00
10	Phosphate (PO_4^{3-})	Sample	01	$12.00
11	Chloride (Cl^-)	Sample	01	$8.00
12	Nitrate	Sample	01	$7.00
13	Nitrite	Sample	01	$8.00
14	Magnesium (Mg)	Sample	01	$8.00
15	Potassium (K)	Sample	01	$8.00
16	Sodium (Na)	Sample	01	$8.00
17	Calcium (Ca)	Sample	01	$8.00
18	Ammonia	Sample	01	$8.00
19	Total Nitrogen (T-N)	Sample	01	$8.00
20	Total Phosphorus (T-P)	Sample	01	$8.00
21	Iron (Fe)	Sample	01	$12.00
22	Lead (Pb)	Sample	01	$12.00
23	Mercury (Hg)	Sample	01	$15.00
24	Arsenic (As)	Sample	01	$15.00
25	Zinc (Zn)	Sample	01	$12.00
26	Copper (Cu)	Sample	01	$12.00
27	Cyanide (CN)	Sample	01	$12.00
28	Cadmium (Cd)	Sample	01	$12.00
29	Chromium (Cr)	Sample	01	$12.00
30	Manganese (Mn)	Sample	01	$12.00
31	Selenium (Se)	Sample	01	$12.00
32	Nickel (Ni)	Sample	01	$12.00
33	Zinc (Zn)	Sample	01	$12.00
34	Antimony (Sb)	Sample	01	$12.00
35	Salinity	Sample	01	$6.00

Items	Unit	Q'ty	Unit Price (US$)	Amount (US$)
Environmental surveys				
(1) Water Quality (River water)	sample/parameter	400	18.00	7,200.00
(2) Water Quality (Groundwater/lake)	sample/parameter	400	18.00	7,200.00
(3) Sediment Quality	sample/parameter	36	18.00	648.00
(4) Soil Quality	sample/parameter	27	20.00	540.00
(5) Air Quality	sample	210	69.00	14,490.00
(6) Noise Survey	sample	42	230.00	9,660.00

Water Quality analytical parameters

Fecal Coliform, Total Coliform, Alminium (Al), Ammonia (NH3), Chloride (Cl), Copper (Cu), Iron (Fe), Manganese (Mn), Sodium (Na), Sulfate (SO4), Hydrogen Sulfide (H2S), Conductivity, Total dissolved solids (TDS), Salt (NaCl), Hardness, Turbidity, Color, Taste and Odour, pH, Temperature (water, atmosphere), Residual chloride (if chloride disinfection is used), Antimony (Sb), Arsenic (As), Barium (Ba), Boron (B), Cadmium (Cd), Chromium (Cr), Cyanide (CN), Fluoride (F), Lead (Pb), Mercury (Hg), Nitrate (NO3), Nitrite (NO2), Selenium (Se): (as stipulated in Drinking Water and Household Water Quality Standard, MOH(2005)),

BOD5 (at 20□), Suspended Solid (SS), Settable Solid, TDS increase from regular use, COD, Sulfide, Total Kjeldahl Nitrogen (TKN), Fat oil and grease: (as stipulated in Standard for Wastewater Discharge, STEA (1998)),

Phenol, Silver (Ag), Zinc (Zn), Nickel (Ni) (as stipulated in Provision on Discharge of Domestic Sewage and Wastewater from Industrial Factories, MOIC(2006)),

And, DO, total nitrogen, total phosphorous, total organic compounds.

Sediment and soil analytical parameters

Cadmium (Cd), Total Cyanide (CN), Lead (Pb), Chromium (Cr(VI)), Arsenic (As), Total Mercury (Hg), Selenium (Se), Fluoride (F), Boron (B)

Air quality

Air quality survey items: nitrogen dioxides (NO_2), sulfur dioxide (SO_2), carbon monoxide (CO), total suspended particle (TSP) and particle matter 10 (PM_{10})

Noise

Noise survey: $L_A$eq level in accordance with the related guidelines in Laos