

Initial Environmental Examination

April 2013

PRC: Yunnan Sustainable Road Maintenance (Sector) Project

CURRENCY EQUIVALENTS

(as of 23 April 2013)

Currency unit	–	Yuan (CNY)
CNY1.00	=	\$0.1616
\$1.00	=	CNY6.1871

ABBREVIATIONS

ADB	–	Asian Development Bank
ADB SPS	–	Asian Development Bank Safeguard Policy Statement 2009
CEWP	–	Construction Environmental Work Plan
CIEE	–	Consolidated Initial Environmental Examination(i.e. many subprojects addressed in one IEE)
dBA	–	A measure of audible (the ear) noise
EARF	–	Environmental Assessment and Review Framework
EIA	–	Environmental Impact Assessment
EMP	–	Environmental Management Plan
ESSU	–	Environment, Social and Safety Unit (established within YHAB)
GRM	–	Grievance Redress Mechanism
IEE	–	Initial Environmental Examination
masl	–	metres above sea level
PMO	–	Project Management Office
PPTA	–	Project Preparation Technical Assistance
PRC	–	People's Republic of China
RP	–	Resettlement Plan
RoW	–	Right of Way
SDAP	–	Social Development Action Plan
SPS 2009	–	ADB's 2009 Safeguard Policy Statement
subIDForm	–	Sub-identification form, provided in the project's Operations Manual summarizing all features for a subproject
vpd	–	Vehicles per day
YEPD	–	Yunnan Environmental Protection Department
YHAB	–	Yunnan Highway Administration Bureau
YHDIC	–	Yunnan Highway Development and Investment Co. Ltd
YPDOT	–	Yunnan Provincial Department of Transportation
YSRI	–	Yunnan Science and Technology Research Institute of Highways
YTPRDI	–	Yunnan Transport Planning Research and Design Institute

WEIGHTS AND MEASURES

CO	–	Carbon monoxide
kph	–	Kilometers per hour
mu	–	Land measurement unit = 520m ²
NO ₂	–	Nitrate or Nitrogen Dioxide
SO ₂	–	Sulphur dioxide
TPM	–	Suspended particulate matter, with particles ≥ 10 microns in size, and a danger to lungs. Also referred to as PM ₁₀

NOTE

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

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Endorsement by EA

YUNNAN PROVINCIAL DEPARTMENT OF TRANSPORT
IFI-FINANCED PROJECT OFFICE

FACSIMILE

To:	Mr. Tyrrell Duncan Director EATC Asian Development Bank	
Fax No.:	(632)636-2426	Page one of: 1
Date:	April 1, 2013	

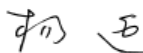
Dear Mr. Tyrrel Duncan:

Subject: Endorsement to IEE

The Initial Environmental Examination (hereinafter referred to as IEE) for Yunnan Sustainable Roads Maintenance (Sector) Project is prepared and compiled in accordance with relevant involuntary resettlement safeguards requirements as per ADB's Safeguard Policy Statement (2009) and relevant laws and legislations of the People's Republic of China Government. During implementation of the Project, we will strictly abide by this IEE.

Sincerely yours,

Yang Yan



Deputy Director General

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Acknowledgements

The team that prepared this report consisted of international and national environmental specialists, as well as two YHAB specialists being trained on the job to undertake field surveys and complete future environmental assessments for maintenance projects. Provincial, prefecture and county staff of YHAB and YSRI devoted considerable time and effort to consultation and information collection for this study. Local citizens along the road section right of ways were consulted to identify their environmental concerns and provided many valuable inputs which were very much appreciated. Many of their comments are reflected in this report. The ADB project environmental specialist and project officer both participated in the completion of this report, and their inputs are acknowledged.

EXECUTIVE SUMMARY

The Yunnan Sustainable Road Maintenance (Sector) Project (the Project) is located in Yunnan Province in the People's Republic of China. The Yunnan Department of Transport (YPDOT) is the executing agency and the Yunnan Highway Administration Bureau (YHAB) the implementing agency. The latter manages non-tolled national highways, provincial roads and important county roads in the province. Condition of the network has been deteriorating resulting in a reduced level of service and safety, increased transport costs and environmental degradation.

The Project includes four outputs: maintenance of 850 km of national, provincial and county roads (Output 1); pilot of performance-based maintenance contracts (Output 2); development of a road asset management system (Output 3); and institutional development to enhance the performance and sustainability of YHAB road maintenance (Output 4). Maintenance activities will be implemented over five years in four Phases.

The outcome of the Project will be more sustainable management of the local road network in Yunnan. The project aims to: (i) improve the condition of the YHAB road network; (ii) increase the proportion of the YHAB road network receiving maintenance; (iii) strengthen YHAB's capacity and operational performance; and, (iv) reduce the gap between estimated maintenance needs and available resources.

The Project is classified as environment Category B since there will be limited, generally site-specific impacts that are largely reversible and that can be readily addressed through mitigation measures. This Initial Environmental Examination (IEE) and Environmental Management Plan (EMP) have been prepared for maintenance works which will be implemented in the first year of the project, in accordance with ADB Safeguard Policy Statement 2009. The first year maintenance works cover 10 road sections, associated with nine subprojects in six prefectures, of a total length of 276 km. Maps showing the location of the subprojects and types of maintenance proposed are provided in Annex A. ADB refers to this type of IEE, which applies to a number of subprojects, as a consolidated IEE or CIEE.

The planned first year maintenance work is expected to have generally minor, localised negative impacts that are temporary in nature. The work will be confined to the existing road right-of-way (RoW), and will be undertaken on fully operating roads with traffic volumes ranging from several thousand to over fifteen thousand vehicles per day.

The impacts will include short episodes of increased noise and dust pollution during a few concentrated activities, such as the operation of the pavement milling machine on G320b. The Ruili River bridge deck improvement will involve work over water, but will be restricted to repair of the bridge deck. All culvert work will be less than 500 m, so surface water contamination is not considered significant, provided that methods defined in the EMP are applied. There may be minor surface drainage channel alterations (e.g. county road X214) during the work, but these will be fully restored to prevent erosion or flooding. There will be no drilling or blasting, and no known groundwater recharge areas will be affected; therefore, groundwater aquifers will not be impacted.

As the work will be confined to the RoW of operating national, provincial and county roads, no environmentally sensitive or culturally significant areas will be disturbed. There are no ecologically sensitive areas within 2 km of any of the first year roads.

A method for screening the environmental impacts and risks associated with proposed maintenance subprojects was developed. This method was used to screen the nine proposed subprojects. Roads S211 and X214 are considered to have environmental impacts and risks commensurate with ADB environment Category B. Due to lack of previous maintenance and intensive use by heavy vehicles, road reconstruction, including three major concrete culverts will be needed. The EMP included in Annex B will be fully applied to these two subprojects. The

other seven subprojects are considered to have environmental impacts and risks commensurate with ADB environment Category C. For these subprojects, the general EMP measures that apply to all subprojects will apply, as well as any other relevant specific measures, as indicated in the EMP in Annex B. Environmental clauses based on the templates provided in the Environmental Assessment and Review Framework will be included in contracts for first year works to ensure that Contractors are aware of and committed to implementing environmental requirements associated with the works.

Prior to loan effectiveness, YHAB will set up a new Environment, Social and Safety Unit (ESSU) under its maintenance division, with support of consultants, funded by ADB. This unit will provide training and guidance on environmental, social and road safety assessment, management and monitoring for YHAB periodic, maintenance and rehabilitation works. Training will help improve the environmental capacity of YHAB and its contractors. Further, this training should ensure that the risk of environmental impacts during the proposed maintenance works is minimised and opportunities for environmental benefits maximised.

The maintenance work will have a number of important benefits, as expressed by roadside residents during the public consultation program, including: reduced travel time to markets and services; improved public transport due to the attraction of providers to an improved road network; and significant reduction of road dust, resulting in less crop damage and fewer respiratory problems. With a significant road safety program targeting roads and communities¹, improved safety on subproject roads passing through urban areas is anticipated.

This IEE and EMP provides YHAB with a comprehensive assessment of environmental impacts associated with all 10 subproject roads proposed during the first year and sets out all necessary environmental management measures for design and implementation. No further surveys or studies will be required for first year subprojects as long as there are no major changes in the type and location of maintenance activities proposed.

¹ Based on the consultant's studies and implementation procedures found in the 2012 Road Safety Operational Manual prepared for YHAB as part of this project.

I. Introduction

A. Background to Project

1. The Yunnan Sustainable Road Maintenance (Sector) Project (the Project) is located in Yunnan Province in the People's Republic of China (PRC). The Yunnan Department of Transport (YPDOT) is the executing agency and the Yunnan Highway Administration Bureau (YHAB) the implementing agency. YHAB manages non-tolled national highways, provincial roads and important county roads in the province. Given the strong focus on expressway network expansion in recent years, funding available for local road improvement and maintenance has been limited and condition of the network has deteriorated.

2. The Project includes four outputs: maintenance of 850 km of national, provincial and county roads (Output 1); pilot of performance-based maintenance contracts (Output 2); development of a road asset management system (Output 3); and institutional development to enhance the performance and sustainability of YHAB's road maintenance (Output 4). Maintenance activities will be implemented over five years in four Phases.

3. Prior to loan effectiveness, YHAB will set up a new Environment, Social and Safety Unit (ESSU) under its maintenance division to provide training and guidance on environmental, social and road safety assessment, management and monitoring for YHAB periodic, maintenance and rehabilitation works.

B. Need for Project

4. Yunnan Province has a high incidence of poverty well above the national average, 60% of the population are dependent on agriculture. The local road network provides rural communities with accessibility to markets, essential facilities and services. The current poor condition of the network severely reduces level of service and safety; raises transport costs and results in environmental degradation.

5. The outcome of the Project will be more sustainable management of the local road network in Yunnan. The project aims to: (i) improve the condition of the YHAB road network; (ii) increase the proportion of the YHAB road network receiving maintenance; (iii) strengthen YHAB's capacity and operational performance; and, (iv) reduce the gap between estimated maintenance needs and available resources.

C. Environmental Classification of Project

6. The Project is classified as environment Category B as it is considered that there will be limited, generally site-specific and reversible impacts and that can be readily addressed through mitigation measures. The proposed activities will be confined to the existing road right-of-way (RoW), and will be undertaken on fully operating roads with traffic volumes ranging from several thousand to over fifteen thousand vehicles per day.

7. During project preparation, the financing modality was changed from a project to a sector loan. In line with ADB Safeguard Policy Statement (SPS) 2009 requirements for this modality, a consolidated Initial Environmental Examination (CIEE) and Environmental Management Plan (EMP) have been prepared for the subprojects that have already been identified. These include the seven subprojects identified for rehabilitation during Phase I (Output 1) and two performance-based road maintenance pilot projects (Output 2). The 10 road sections associated with these nine subprojects are shown in Table 1.

8. A method for screening the environmental impacts and risks associated with proposed maintenance subprojects was developed. This method was used to screen the nine proposed

subprojects. Roads S211 and X214 are considered to have environmental impacts and risks commensurate with ADB environment Category B. The other seven subprojects are considered to have environmental impacts and risks commensurate with ADB environment Category C.

9. Project components for subsequent years (Phases II-IV) will be prioritised on an annual basis, based on road condition, traffic surveys and asset management software. An Environmental Assessment Review Framework (EARF) has been prepared to guide the preparation and implementation of subprojects that will be identified between 2013 and 2016 (Phases II-IV). The EARF includes a range of templates and tools, including an: (i) environmental screening method for future subprojects; (ii) generic EMP that identifies all anticipated impacts, mitigation and monitoring measures for the full range of maintenance activities that may be carried out; (iii) template for a compliance monitoring checklist to be used by the ESSU; (iv) sample environmental clauses for inclusion in contract documents for subprojects; (v) template for public consultation and guidance on information disclosure; (vi) template excel spreadsheet for costing environmental mitigation and monitoring; and (vii) template for Contractor Construction Environmental Work Plan.

10. The legal agreements for this Project loan will include covenants on the obligation of the borrower (YPDOT) to implement the ADB SPS, the IEE, EMP and the EARF.

II. Policy, Legal, and Administrative Framework

11. PRC has established a complete legal system to regulate environmental management. The Environmental Protection Law of PRC (1989) defines general principles for environmental protection, institutions for environmental management and supervision, requirements for protection and improvement, prevention and mitigation of pollutions and liabilities. To supplement the basic law and set supporting laws, ordinances, ministry decrees, governmental regulations, norms, and standards, are in place and in use across the country.

12. In PRC, National People's Congress (NPC) and its standing committee are the empowered national legislation institutions. Under NPC, the State Council (the cabinet of the central government) is entitled to issue environmental ordinances. The Ministry of Environmental Protection (MEP) plays a leading role in general environmental management, preparing environmental legislation, and encouraging the enforcement of environmental statutes. MEP also publishes specific ministry decrees to regulate environmental issues. Other ministries or administration agencies directly under the State Council are responsible for sectoral environmental management in related fields. They also issue ministry decrees related to environmental protection and conservation of natural resources. Some of the more prominent agencies are the State Forestry Administration which manages most nature reserves, and the Ministry of Housing and Urban-Rural Development which has authority over designated scenic regions.

13. PRC's EIA legal system is applicable to only commercial or industrial development planning and construction projects. For the proposed road maintenance and rehabilitation works associated with this project, PRC's Environmental Assessment Law does not apply; however, the following legislation does:

- (i) The Environmental Protection Law of PRC (1989), fundamental law;
- (ii) Management Directory of EIA Classification for Construction Project (MEP, 2008),
- (iii) Regulations on Review and Approval of EIAs for Construction Project (MEP, 2009),
- (iv) Regulation on Hierarchical Review and Approval of EIAs for Construction Project in Yunnan Province (2010), covering management of the whole EIA process;
- (v) Environmental Protection Management Ordinance for Construction Project (1998),
- (vi) Environmental Protection Management Regulation for Transport Construction Project (MOT, 2003),
- (vii) Environmental Protection Ordinance of Yunnan Province (2004),

- (viii) Notice on Enforcement of Environmental Supervision in Transport Construction Project (MOT, 2004), covering environmental management for the life cycle of the transport construction project;
- (ix) Water Pollution Prevention Law of PRC (2008) and relevant regulations, mandatory requirements for water pollution prevention and mitigation;
- (x) Air Pollution Prevention Law of PRC (2000) and relevant regulations, mandatory requirements for air pollution prevention and mitigation;
- (xi) Environmental Noise Pollution Control Law of PRC (1996) and relevant regulations, mandatory requirements for noise pollution prevention and mitigation;
- (xii) Solid Waste Pollution Control Law of PRC (2005) and relevant regulations, mandatory requirements for solid wastes pollution control and recycling;
- (xiii) Water and Soil Conservation Law of PRC (2010) and relevant regulations, mandatory requirements for soil erosion control;
- (xiv) Land Management Law of PRC (2004),
- (xv) Highway Safety Ordinance of PRC (2011),
- (xvi) Quota for Land Use of Highway Construction Project (Ministry of Construction combined with Ministry of Land and Resources, 1999), regulatory requirements for land acquisition of the highways;
- (xvii) Nature Reserve Ordinance of PRC (1994), Ordinance for Scenic Resorts and Historic Sites of PRC (2006),
- (xviii) Ordinance for Management of Nature Reserves in Yunnan Province (1998), mandatory requirements for conservation of the protected areas.
- (xix) Ordinance for Redress of Public Complaints (the State Council, 2005), Interim Procedures for Public Consultation in EIA (SEPA, 2006), and Environmental Complaints Management Regulation (SEPA, 2006), requirements for EIA public consultation and environmental grievance redress;
- (xx) Notice on Strengthening EIA Management to Control Environmental Risks (SEPA, 2003)
- (xxi) Interim Management Regulation for Contingency Plan of Environmental Incidents (MEP, 2010), management requirements for environmental risks control, preparation and implementation of environmental contingency plan;
- (xxii) Environmental standards and guidelines, including environmental quality standards for surface water, air, and ambient noise; emission standards for polluting sources of wastewater, air pollutants, and noise; as well as EIA guidelines such as Technical Guideline on EIA published by MEP.
- (xxiii) PRC guideline HJ/T169-2004, National Inventory of Hazardous Goods & MEP Dec.1, 2008.

14. Yunnan has a large number of international, national, provincial and local protected areas. For each Phase, determination of the location of any designated sites in relation to the roads to be maintained will be necessary.

III. Description of the Project

A. Project Location

15. Yunnan is in the south-west of the People's Republic of China (PRC), located in the area bounded by 21°08' N and 29°15' N, and 97°31' E and 106°11' E. The province has an area of 394,000 sq km (4.1% of the nation's total area), with a span west to east span of 865 km and south to north of 980 km. Yunnan borders Guangxi and Guizhou to the east, Sichuan to the north, and Tibet to the northwest. It shares an international border with Myanmar to the west, Laos to the south, and Vietnam to the south-east.

B. Project Scope and Boundaries

16. During the first year, maintenance is proposed for 10 road sections in six prefectures in Yunnan province. This includes seven subprojects identified for Phase I rehabilitation (Output 1) and two performance-based road maintenance pilot subprojects (Output 2). The first pilot covers the rehabilitation and maintenance of a 57 km segment of G323 highway in Wenshan prefecture. The second pilot covers the periodic and routine maintenance of a network of paved roads within the Ruili county of Dehong prefecture (total 107 km). All road sections associated with Output 1 and Output 2 that will be subject to works during the first year have been assessed in this CIEE as indicated in Table 1. Maps showing the location of the subprojects and types of maintenance proposed are provided in Annex A.

17. The proposed work will be confined to maintenance activities within existing RoWs. Figure 1 shows typical cross sections of Class II, III and IV roads cross sections and RoWs. YHAB have defined five categories of maintenance and 86 types of activities which may be applied, as described in Annex C.

18. Much of the work will be minor, such as replacement of guard rails, painting of road markings, and repair of potholes. Most roads will have sections of pavement replaced and their horizontal alignments raised to reduce flooding. There will also be some larger-scale slope stabilization work and bridge deck repair (but no bridge replacements or structural work). All construction earthworks materials used, including aggregate, quarry rock, concrete, and asphalt will be purchased from existing licensed operations located as close as possible to the work areas. No new facilities or access roads will be necessary.

19. All first year works are expected to commence in early 2013 and take about five years to complete, with contractors being mobilized simultaneously along all project roads. Table 1 provides details of road sections where maintenance is proposed during first year associated with Output 1 and 2, the responsible YHAB General Section, types of maintenance proposed and sub-project environmental classification.

Table 1. Road Sections Proposed for Maintenance during the First Year of the Project

Road No.	Sect. No.	YHAB Local Area Office	Prefecture	Road Class	Section	Tot. Length (Km)	Rehab Length (Km)	Chainage Start (Km)	Chainage End (Km)	Type of Maintenance: Major (Mj), Medium (Md), Minor (Mi) (%)	Subproject Environmental Classification
Phase 1 - Maintenance Projects (Output 1)											
G108	1	Kunming General Section	Kunming	2	Kunming-Luqian	46.00	46.00	3290 3325	3303 3358	Mj (70), Md(30)	C
G213	2	Kunming General Section -a	Kunming	3	Jinning	46.00	46.00	2118.25	2163.89	Mj(26), Md(74)	C
	3	Yuxi General Section-b	Yuxi	3	Yuxi	15.00	15.00	2163.89	2178.00	Mj (92), Md (8)	C
G320	4	Dali General Section-a	Dali	3	Xianyun	17.00	17.00	3063 3183	3069 3194	Mj (100)	C
S211	5	Kunming general section: Yangxian	Kunming	2(4km), 3(18)	Yangxian Line	31.00	31.00	98.286 (K34)	129.286 (K3)	Mj (100)	B
X214	6	Dehong General Section	Dehong	3	Changcheng Line	16.10	16.10	10.60	26.70	Mj (100)	B
S321	7	Lincang General Section	Lincang	4	Yongdi	22.00	22.00	71 185	85 193	Mj (100)	C
Phase 1 - Pilot Projects (Output 2)											
G320	1	Dehong general section (Pilot)-b	Dehong	2	Ruili-Section	50.00	27.80	3585	3635	Md (100)	C
S234	2	Dehong General Section (Pilot)	Dehong	2	Baoshan-Ruili	56.80	28.00	8.2 190.00	37.00 218.00	Md(100)	C
G323	3	Wenshan General Sect.(Pilot)	Wenshan	3	Luocunkou-Yanshan	90.00	57.00	1622	1712	Mj (86), Md(14)	C

Source: YHAB database

20. As maintenance activities are associated with operating roads, effects will be difficult to distinguish from existing impacts from daily traffic volumes (see Table 2). The project area of influence will in general be 50m either side of a road centreline. For noise, it will be the distance to

the nearest sensitive receptor, such as schools, hospitals and retirement centres. Any protected natural habitat within 2 km of a subproject RoW is considered within the project area of influence.

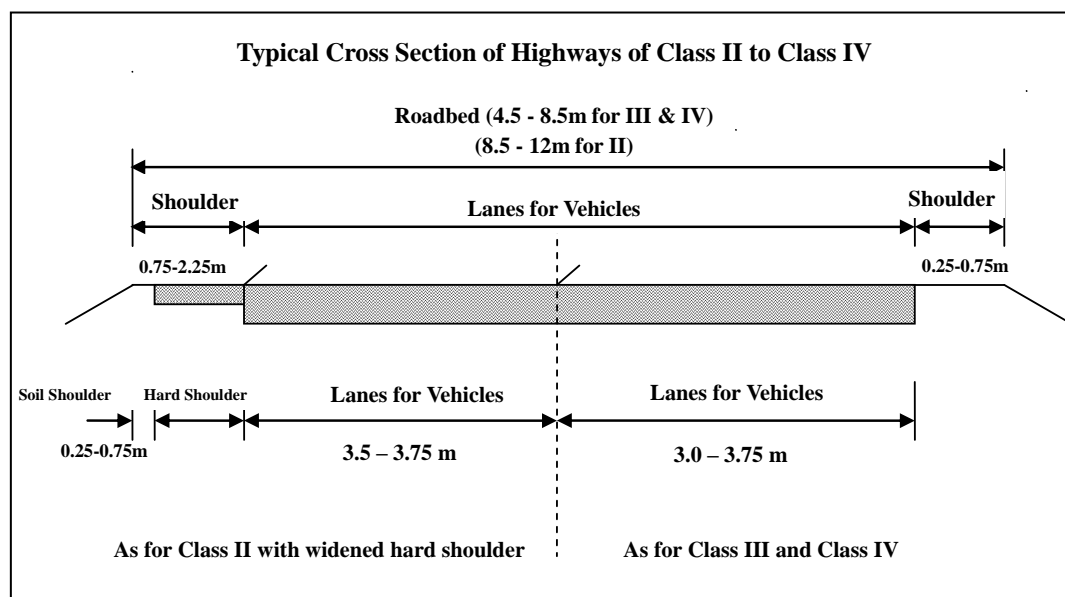


Figure 1. Typical PRC Class II-IV road cross sections and right of way (≥ 1 m safety zone on each side not shown)

C. Project Schedule

21. **Figure 2** shows key environmental and project milestones. IEE review and approval by ADB and YHAB/YPDOT will take place in March 2013. Bid documents, incorporating environmental clauses as defined in the EARF and as specified in the EMP, will be prepared in September 2013. Contractors will be selected by December 2013, and mobilized in February 2014. The establishment of an Environment, Social and Safety Unit (ESSU) within YHAB, as recommended in the EARF, is expected to take place between March and July 2013 prior to loan effectiveness.

22. The initial proposed five-day training for government staff and the two-day session for contractors will take place in June 2013, immediately after the contractors are mobilized (see **Figure 2**). Aside from the ESSU establishment task, the cycle shown in **Figure 2** will begin for Phase II in September 2013 and repeated each subsequent year for Phases III and IV.

23.

	2013											2014			
	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	
Task															
IEE approval by YHAB															
Establishment of Environmental and Social Safeguards Unit within YHAB															
Detailed Design and Quantities completed by design team															
Bid documents written by design consultant, incorporating environmental clauses, etc. from IEE															
Contractor bid submission															
Contractor Selection															
Contractor Mobilization															

32. **G320b (Dehong):** The maintenance work on this part of G320 is under the management of Dehong General Section, and involves six short sections of a total of 30 km. This part of G320 is a Class II road with a total RoW width of around 14 m. Most of the subsections are in gently sloping terrain, have forested roadsides, a small amount of agriculture and some small industrial operations. Traffic volume varies considerably, from 4,036 vpd to almost 14,000 vpd. No sensitive environmental receptors were noted.

33. Due to truck overloading, ruts have developed in several of the subsections. These will be repaired. The work will involve intermittent asphalt concrete replacement using a milling machine, and raising the horizontal alignment by 9-50 cm. The Ruili River bridge deck will be partially resurfaced. Structural work will not be required. Curbs and pavement joints will be repaired and road cracks will be filled.

34. **G323 (Wenshan):** Maintenance along this Class III road will take place within five subsections, totalling 30 km. All of the road subsections pass through low mountainous and gently sloping terrain. The road elevations range from 300 metres above sea level (masl) to 650 masl, and there are more than thirty sharp switchback turns. The existing carriageway width is between 7 and 7.5 m and has an average traffic volume of 4,894 vpd (2011). Due to lack of maintenance, these subsections require repair of major pavement failure, pavement resurfacing, subgrade refilling, and curb rebuilding. The horizontal alignment of some subsections of the carriageway will be elevated by about 30 cm. One small bridge at Km 1637 will need to be resurfaced, and two culverts will be lengthened and repaired at Km 1639 and Km 1674, respectively. Finally, some minor slope stabilisation and repair to a rock fall zone will be necessary at Km 1663.

35. From Km 1622 to 1623 and about 300-500 m from the edge of the RoW, the Tuoniang River parallels G323. There are no drainage channels crossing the road and maintenance work is not considered likely to have any negative effect on the river. The area between the river and the road is heavily vegetated, further reducing the chances of any construction related runoff into the river.

36. The vegetation along the road is mainly subtropical evergreen broadleaf forest. Typical plants are subtropical coniferous and broad-leaved trees. No sensitive environmental receptors were noted.

37. Construction materials, including aggregate, concrete, and asphalt, will be trucked in from the General Section's existing facilities located around 40 km away. Aggregate will need to be transported from commercial enterprises located about 140 km away.

38. **S211 (Kunming):** S211 is a mixture of Class II and Class III road, with the entire length of 21 km requiring major repairs and maintenance. Much of the road serves as a haul road for the seven rock, aggregate and sand processing facilities along its length. The road is also used by coal trucks supplying a local power plant. Average annual daily traffic for 2011 was 6,040 vpd, but traffic flow reached as high as 10,800 vpd. Chronic truck overloading has degraded not only the road, but most of the 12 large concrete three-sided culverts as well. Major work will include subgrade replacement and resurfacing with asphalt concrete. Other work will include rebuilding of curbs, clearing and repair of side ditches, reinforcement of slope protection and retaining walls, and repairing damaged culverts. To reduce the risk of slope failures and long road closures, at least two major slope stabilization works will be required. A series of retaining walls will also be needed. The horizontal alignment will be raised by 50-60 cm.

39. Heavy truck traffic has degraded the asphalt for more than 65% of the total length of the section, resulting in serious dust pollution and related health and safety issues. Of the total 21 km, an estimated 16 to 20 km will have to be reconstructed. This reconstruction will involve significant access restrictions and will require traffic management.

40. S211 traverses low grade sedimentary mountain terrain, with altitudes of 1800-2250 masl. Roadside slopes are unstable and highly erosion-prone. A number of houses are scattered along the road and agricultural areas are located mostly between Km 111 and Km 129. The main crops include rice, corn, and potato. Eucalyptus, fig, camphor, tung, cypress, willow, and Japanese cedar trees are found along the roadsides. No sensitive environmental receptors were noted, although the highly unstable slopes are of concern, with landslides having already buried some hillside agricultural areas. One major landslide site was rehabilitated between 2010 and 2011.

41. **X214 (Dehong):** This is currently a county-level Class III road, mostly under 8 m wide, although a few stretches are up to 12 m wide. The RoW is 14 m wide. The General Section has indicated that the intention is to upgrade this road to a Class III provincial road by providing a fully paved surface, drainage structures, and proper culverts to prevent regular flooding. Since X214 will remain an improved Class III road, traffic volumes are not expected to rise. The estimated 2011 traffic volume was 5,800 vpd. The road passes through open farmland, crops include sugarcane, tobacco, and paddy, and over at least 40 small irrigation canals. Work around these structures will require special coordination between the contractor and the local landowners, since they will need to be temporarily blocked during reconstruction. There are no bridges along this road section.

42. Along at least two short sections of the road, 250-300 years old broadleaf fig trees are found, and are of cultural significance to local communities. These trees are located at the edges of the RoW and do not need to be disturbed. Although the trees are not protected nationally or provincially, local communities informed the survey team of their importance. The roadsides also have large planted eucalyptus trees; many of these will need to be removed during the work, as they are located within the road shoulders.

43. The work on X214 will involve resurfacing the entire length, building up the subgrade by about 48 cm, and constructing curbs, ditches and hard shoulders. The work will require large volumes of rock, aggregate, concrete, and asphalt trucked in from existing sites and plants 25-45 km away. The work will require long periods of access restrictions for roadside communities in a relatively densely populated area.

44. **X212 (Dehong):** This is a 15 km-long feeder road intersecting with the G320 at the Ruili River bridge. It connects large aggregate and quarry operations and a town on the border with Myanmar. X212 is a smooth, well paved road with a 10 m-wide roadway, estimated annual average daily traffic volume in 2011 was 7,000 vpd. The terrain is flat, and the main issues are subsidence and rutting. The work will include reconstruction of some stretches, as well as intermittent rebuilding of curbs. A number of locations will require raising the carriageway by 9-50 cm. There are no bridges, and the culverts do not require maintenance other than checking for blockages.

45. This road passes through a mixture of roadside farming, heavy industry and commercial land uses. In the 5-6 km section from the Ruili River Bridge, the air was polluted with dust from major roadside aggregate processing and rock crushing facilities. During the field survey, significant accumulations of fine dust and larger fines from passing trucks were observed along the roadsides within a 3-4 km radius of these facilities.

46. Agricultural crops were mostly coffee and rubber, plus some sugar cane; all relatively hardy and located some distance from the edge of the RoW (10-30 m). There were also small subsistence gardens tended by local people living near the road; none were visible from the road, but were identified during consultations. During the field survey, no other sensitive environmental receptors were identified.

47. **S321 (Lincang):** S321 is a 193 km-long Class IV road, of which 22 km are scheduled for maintenance as part of this project. The two subsections, located almost 100 km apart, are 14 and

8 km long, respectively. Both sections are in mountainous terrain with steep drops on at least one side of the road. The carriageway is around 6 m wide, with a large number of roadside trees. Some of these trees are presently being cleared as a road safety measure mandated by the General and Maintenance Sections.

48. Maintenance on the 14 km-long section will be confined to intermittent resurfacing, shoulder protection, and rebuilding of a number of road curves (with no alignment alteration). One small bridge passing over a seasonal stream will require deck resurfacing. There are also several short sections requiring slope stabilization work. The horizontal alignment will be raised, intermittently along both subsection, by up to 30 cm. At least 2 km of the shorter section, S321 passes through a medium-sized village, where resurfacing will be needed through the downtown area.

49. Since the newly built Class II highway from Yang Touyan to Qing Shuihe (a port bordering Myanmar) was opened in 2011, most of the traffic on S321 has been diverted to that newer and better road, to the detriment of local economies. Currently, the traffic volume on S321 is very low, ranging between 2,640 and 4,590 vpd. The maintenance work on S321 should help to redistribute traffic.

50. Due to the excellent growing conditions, diverse agricultural crops are grown on the slopes and in the valleys along the road, including sugarcane, banana, walnut, coffee, and corn.

51. **S234 (Dehong):** The two sections of S234 where maintenance will take place are Km 206-235 and Km 168-196, for a total of about 56 km. The first section passes through open agricultural land, and a large irrigation channel (3-4 m wide) runs parallel to the road. The roadsides outside the RoW boundary are densely populated. The RoW width is about 25 m, with the carriageway and shoulders measuring between 10 and 12 m wide.

52. The second section has secondary forest and scrub vegetation on both sides of the RoW.

53. Based on public consultation (attended by 14 people, records provided in Annex E) and discussions with the General and Maintenance Section, no special road-related issues such as flooding, erosion, or slope instability were noted. Two schools and a kindergarten are located about 100 m from the edge of the RoW.

54. The proposed work will involve mostly minor and medium maintenance such as repairs to roadside drainage, pavement cracks and shoulders, as well as some resurfacing. There are five medium bridges, five small bridges, and 182 culverts within the sections proposed for maintenance, however none require any work.

IV. Description of the Environment

A. Methodology and Environmental Classification

55. A two-week field survey covering all first year roads was completed between June and August 2012, including the preparation of maps and a photo record of significant environmental features. The survey involved driving the roads and noting down (referenced by chainage markings) observations on land use, environmental features, location of culverts and bridges and water courses, and sensitive roadside cultural features. These survey notes, plus any other relevant observations, were recorded in a summary document for each road; these documents are available on request from YHAB and ADB.

56. A method for screening the environmental impacts and risks associated with proposed maintenance subprojects was developed. Each project road was given an environmental classification based on the sensitivity of environmental and social receptors and the anticipated impacts of proposed maintenance activities. When several maintenance activities will be

undertaken at the same time, the classification was based on the most sensitive receptors and/or most significant impacts. This screening method was designed in line with the ADB method for the environmental classification of projects. All references to Category A, B and C in relation to particular activities or subprojects are on the assumption that potential associated environmental impacts and risks are commensurate with ADB environment categories A, B and C.

57. Using past experience with similar types of work undertaken in a wide range of regions and countries, the likely environmental assessment category that any one of the 86 listed maintenance activities could trigger was also defined (see Annex C) to provide a guide for future phases. These secondary classification tables provide a cross-reference for the subproject screening process. Both the existing environmental conditions and the maintenance activities proposed contribute to the final classification.

58. The Operational Manual developed for YHAB as part of this project contains ‘subIDForms’, one for each first year subproject. The subIDForm summarizes engineering, planning, financial, social and environmental conditions as well as the work to be performed for each subproject. The Environment section of the form has 16 items referred to as classification triggers. The triggers that best define the environmental sensitivity of the subproject were checked off, thereby defining the most likely environmental assessment classification for that subproject.

59. The triggers as presented in the subIDForm are shown in Figure 3:

D Environmental Assessment-G108			
General Comments	Environment Categorization Checklist	Env. Cat.	Next steps
Mainly farm land. Some environmentally sensitive features along this road. Mostly medium maintenance planned: resurfacing of 1 medium and 2 small bridge decks.	<input type="checkbox"/> Potential loss or damage to Cultural heritage site <input type="checkbox"/> Encroachment into buffer or core of protected natural area <input type="checkbox"/> Encroachment onto significant wetland providing important habitat <input type="checkbox"/> Damage to Old-growth forest <input type="checkbox"/> Permanent loss of important biodiversity	Category A Triggers	
	<input type="checkbox"/> Works in densely populated district e.g. urban zone, village, town or <input type="checkbox"/> Establishment of a new quarry or placement of new asphalt plant <input type="checkbox"/> Slope stabilization works > 50m <input type="checkbox"/> Replacement of more than 5 irrigation canals <input type="checkbox"/> Bridge replacement, river bed training >30m or more than 2 in-water pier reinforcement <input type="checkbox"/> Resettlement of >= 50 vulnerable people, >= 100 ethnic minority people, or >= 200 unclassified <input type="checkbox"/> Temporary bypass at maintenance site > 50 m, road closure of more than 24 hours <input type="checkbox"/> Continuous pavement works > 15 km	Category B Triggers	EMP
	<input type="checkbox"/> Other specific impact: <input checked="" type="checkbox"/> Check Table 8, IEE Annex C to confirm Category		C

Figure 3 Environmental Section of YHAB Operational Manual SubIDForm – Example showing the environmental triggers, classification and next steps for subproject G108

60. The environmental section of the SubIDForm as shown in Figure 3 was designed to display the environmental classification as well as the follow up actions required. For example, for subproject G108, classified as Category C, the general ‘for all subproject’ EMP mitigation and monitoring measures and associated environmental contract clauses would apply.

B. Climate

61. The climate of Yunnan province varies across regions, and features low-latitude monsoon, and mountain plateau characteristics. Seven regional climatic zones are recognized; from south to north, these are: north tropics, south subtropics, middle subtropics, north subtropics, south

temperate, middle temperate, and plateau. The differentiation of regional climatic zones is heavily influenced by variation in latitude and elevation. Generally, temperatures decline from south to north, as elevations rise along with latitudes, the exceptions being high mountains and deep valleys, where sharp temperature gradients are often observed. High mountains surround the province to the west, north, and east, protecting it from cold fronts moving in from the north. The warm front coming up from South Asia also helps counter the cold wind in winter. Thus the province enjoys a mild spring-like climate year round.

62. Rainfall distribution is uneven both geographically and seasonally. Annual precipitation varies from up to 1,500 mm in the southern regions to 500-700 mm in the Jinshajiang River valley on the northern face of the plateau. Sixty percent or more of annual precipitation occurs in the rainy season from May to October. During the long dry season from November to April, serious drought is common in large areas of the province. Most parts of Yunnan province have long frost free periods of more than 300 days.

63. **G108, G213, S211 (Kunming):** These road sections are located in the north subtropics and plateau climatic zones, which feature ample sunshine, distinct wet and dry seasons, and mild spring-like weather year round. Annual average temperature ranges from 14.7°C to 15.9°C, and the annual precipitation from 900 mm to 1,000 mm. More than 75% of the annual rainfall occurs between June and October.

64. **G323 (Wenshan):** This road section is in the south subtropical zone. The local climate is mainly controlled by the warm and moist air flows from the Bay of Bengal and Gulf of Tonkin, although dry, cold air flowing from the northwest predominates during the dry season. The temperature varies insignificantly over the year, but sharply on a daily basis. The annual average temperature is 19.3°C and the annual average precipitation is about 1,200 mm. Rainfall is unevenly distributed throughout the prefecture, but in general more than 80% falls during the monsoon season, from May to October.

65. **G320, S234, X214 (Dehong Prefecture):** The south subtropical climate in the project area encompassing these road sections is mainly controlled by the southwest monsoon from the Indian Ocean. The area benefits from high precipitation, ranging from 1,400 mm to 1,600 mm per year, and ample sunshine of 2,300 to 2,600 hours per year. The rainy season normally lasts from June to October. Annual average temperature varies from 19°C to 21°C.

66. **S321 (Lincang):** This road section is located in mountainous terrain in the middle subtropical zone, and is influenced by the monsoon. The area experiences abundant rainfall and sunshine, with mild seasonal variations. Annual temperatures average between 16.5°C and 17.5°C, and annual precipitation averages between 1,300 and 1,500 mm. About 80% of the rainfall occurs during the rainy season, which is from May to October.

67. **G320a (Dali):** This road section falls within the north subtropical and plateau climatic zones. In Xiangyun County, annual average temperatures are around 15°C, and annual rainfall averages about 810 mm. In recent years, the area has suffered from severe drought and significant crop failures.

C. Air Quality and Noise

68. Since YPDOT has not yet established its own environmental monitoring capacity, there are no air quality and traffic noise monitoring data available for existing roads in Yunnan. To get an approximate estimation of air pollution and noise levels from motor vehicles on the project roads, alternative approaches based on traffic volume and composition (for air quality) and modelling (for

noise) also based on traffic volumes were used² (see Table 2). Where appropriate, the benchmark concentrations of air quality indicators were compared to work done on other road project environmental impact assessments (EIAs) undertaken in Yunnan.³

69. To fully take into account the baseline data, factors such as landforms, meteorological attributes, traffic flow composition, and road conditions were assumed to be constant.⁴

Table 2. Annual average daily traffic volumes (AADT) in 2011 for first year roads

Road Number	Segment Chainage	Traffic Volume (vehicles per day)
G108	K3295 - K3304	8,338
	K3358 - K3359	11,707
G213	K2147 - K2163	13,066
	K2115 - K2117	14,738
G320a	K3262 - K3264	2,348
	K3063 - K3264	5,264
G320b	K3523 - K3624.7	4,036
	K3558 - K3564	13,979
X212	K0 - K15.5	10,613
X214	K10.6 - K26.7	2,756
G323	K1622	885
	K1694	2,721
S211	K21 - K23 (K109.286 - K111.286)	4,167
	K3 (=K129.286)	10,852
S321	K71 - K85	2,640
	K185 - K193	4,593
S234	Km 206.1-235	6,709

Source: YSRI database, 2011. The traffic volume data are in vehicles/day and are further broken down into ten vehicle classes in the YHAB dataset.

70. **Air Quality:** The main indicative air pollutants coming from motor vehicles are carbon monoxide (CO) and nitrogen dioxide (NO₂). Both of these key pollutants' daily average concentrations were estimated for each road segment (see Table 3). None of the estimates exceeded PRC standards. Further, the estimates were in line with benchmark environmental assessment calculations.

Table 3. Air pollution within 100 m of RoW, using existing Phase 1 traffic data

Road Number	CO (mg/m ³) Daily Avg.	NO ₂ (mg/m ³) Daily Avg.	PRC Ambient Air Quality Standard GB3095-1996 and Revision Addendum			Assessed Against Category II**
			Standards apply to all subprojects			
			Category I	Category II	Category III	

² The PRC methodological standards followed were (1) Specifications for Environmental Impact Assessment of Highways (JTG B03-2006), published by the Ministry of Transport; and (2) Technical Guidelines for Noise Impact Assessment (HJ2.4-2009), published by the Ministry of Environmental Protection.

³ For instance, the EIA Report for Upgrading Project of Kunming–Yuxi Section of G213 (2012, China Merchants Chongqing Communications Research & Design Institute Co., Ltd).

⁴ The vehicle emissions data conform to the methods set out in GB18325.3-2005 and GB17691-2005, which are commonly accepted as a balanced computational approach, albeit one that slightly underestimates actual emissions.

Road Number	CO (mg/m³) Daily Avg.	NO ₂ (mg/m³) Daily Avg.	PRC Ambient Air Quality Standard GB3095-1996 and Revision Addendum			Assessed Against Category II**
			Standards apply to all subprojects			
			Category I	Category II	Category III	
G108	0.033	0.052- 0.054				In compliance
G213	0.036- 0.045	0.034- 0.037				In compliance
G320a	0.011- 0.023	0.015- 0.020				In compliance
G320b	0.014- 0.025	0.013- 0.015				In compliance
X212	0.010	0.010	CO – 4.0	CO – 4.0	CO – 6.0	In compliance
X214	0.002	0.009	NO ₂ – 0.8	NO ₂ – 0.12	NO ₂ – 0.12	In compliance
G323	0.003- 0.010	0.012- 0.014				In compliance
S211	0.015- 0.040	0.049- 0.058				In compliance
S321	0.005- 0.006	0.009				In compliance
S234	0.011- 0.023	0.015- 0.020				In compliance

Source: Calculated by the consultant.

** GB3095-1996, Category II applies to dwelling, commercial, transport, general industries, and rural areas.

71. Unfortunately, levels of total particulate matter (TPM), another important indicator of vehicle emissions, are not measured in rural areas. However, as levels of CO and NO₂ recorded are well within standards, TPM levels are unlikely to present a serious issue, except in localised areas, such as along S211 and X214 where the road passes large rock crushing and aggregate processing facilities that are major sources of dust.

72. **Noise:** Existing noise levels were estimated using the numerical models prescribed by PRC guideline HJ2.4-2009 (see Table 4).

Table 4. Estimated existing noise levels*: first year subprojects (Leq, dBA), GB3096-2008 Methods

Dist. From Carriageway	10m		50m		100m	
Time Period	Daytime	Night time	Daytime	Night time	Daytime	Night time
G108: K3295-K3304	69	66	62	59	59	56
G108: K3358-K3359	69	66	62	59	59	56
G213: K2147-K2163	70	67	63	60	60	57
G213: K2115-K2117	70	67	63	60	60	57
G320a: K3262-K3264	62	59	55	52	52	49
G320a: K3063-K3264	65	62	58	55	55	52
G320b: K3523-K3624	64	61	57	54	54	51
G320b: K3558-K3564	68	65	61	58	58	55
X212: K0-K15.5	67	64	60	57	57	54
X214: K10.6-K26.7	57	54	50	47	47	44
G323: K1622	58	55	51	48	48	45
G323: K1694	62	59	55	52	52	49
S211: K21-K23	61	58	54	51	51	48
S211: K3	66	63	59	56	56	53

Dist. From Carriageway	10m		50m		100m	
Time Period	Daytime	Night time	Daytime	Night time	Daytime	Night time
S321: K71-K85	60	57	53	50	50	47
S321: K185-K193	61	58	54	51	51	48
S234:	62	59	55	52	52	49
GB3096-'08:Category 2 Limits (>25m)	60	50	60	50	60	50
GB3096-'08:Category 4 Limits (1 st 25m)	70	55	60	50	60	50

Source: Calculated by the consultant, 2012.

* To calculate noise levels, the traffic volume was normalized to three categories, namely large vehicles, medium vehicles, and small vehicles.

73. The project roads fall into noise category 4 (70 dBA day, 55 dBA night) and category 2 (60 dBA day, 50 dBA night) based on the noise guidelines defined in PRC's GB3906-'08. Category 4 applies to the zone, normally about 50 m wide along the edge of Class I and Class II highways RoWs and light rail corridors passing through urban areas. Category 2 limits apply to areas of mixed land use, including commercial, residential, and light industrial, as well as some residential areas. Category 4 limits apply to G108, X212, S234, G320b (Dehong) and a 4-km section of S211⁵. Category 2 limits apply to all other first year road sections.

74. For all project roads, existing noise levels at 100 m from the carriageway was within Category 2 limits for both daytime and night time noise. Noise levels along G108 were 62 dBA during the day. While this exceeds the 60 dBA limit, the 2 dBA difference is not audible to the human ear. Some of the road corridors parallel to Class I expressways had average noise levels greater than 75 dBA, which would mask nearly all noise generated by the construction activity.

D. Topography, Geology, Soils and Existing Erosion

75. Yunnan province is located in the southern zone of the Qinghai-Tibet plateau. The terrain is hilly and mountainous, and slopes generally from the northwest to the southeast. The average elevation of the province is above 2,000 masl. Moving from northwest to southeast, three scarped terraces are encountered; these are the Diqing Plateau (peaks over 5,000 masl), the Central Plateau (general altitude about 2,000 masl), and the Southern Plateau (altitude under 1,000 masl).

76. Divided by the Yuanjiang River valley and a broad ravine between the southern ridges of the Yunling Mountains, the eastern part of the province is dominated by medium-depth valleys and various karst landforms. The west is mostly mountainous, with steep slopes and deep valleys in the north and a more gentle landscape in the south. Mountainous areas comprise 84% of the province's area, with plateau and hilly areas (10%) and broad valleys (6%) making up the rest.

77. With laterite soils⁶ in the north and sedimentary and alluvial formations in the south and east, the entire project area is highly erosion prone.⁷ Consequently, extreme care must be taken whenever vegetative cover is disturbed during construction.

⁵ Methods defined in the Technical Specifications to Determine the Suitable Areas for Environmental Noise of Urban Area (PRC's GB/T 15190-94) were used to determine the width of roadside noise belts.

⁶ soil types rich in iron and aluminium, formed in hot and wet tropical areas; rust coloured.

⁷ The EIA Report for Yunnan Provincial Highway Network (2005, China Academy of Transportation Science) and the EIA Report for Upgrading Project of Kunming-Yuxi Section of G213 (2012, China Merchants Chongqing Communications Research & Design Institute Co., Ltd) were referred to as respective environmental baseline information sources.

E. Hydrology and Surface Water Quality

78. There are about 10,000 rivers and creeks in Yunnan, of which more than 600 have year-round flow. These watercourses are tributaries of the Irrawaddy, Nujiang, Langsang, Honghe, and Zhujiang Rivers. The Jinshajiang River (the upstream portion of the Yangtze River) and Nanpanjiang River (the upstream portion of the Zhujiang River) also run through Yunnan.

79. With the exception of G320b, none of the first year road sections cross any significant rivers or come closer than 500 m to a natural surface water body. G320b crosses the Ruili River via a large existing bridge. Some small creeks or seasonal streams are crossed by the proposed road sections, but none of these are potable water sources, and most are significantly polluted and in fact cannot be used, even for irrigation. For example, the creeks that pass beneath Congde medium bridge and Miyou Village medium bridge on G108 are only conveyances for sewage.⁸ For these minor water bodies, no water quality monitoring data are available.

80. S234 is parallel to a large, recently constructed concrete and brick irrigation canal from Km 206 to 235; the canal is situated within the highway RoW.

81. G320 crosses the Ruili River at Km 3,615 via a large bridge (the Gazhong Bridge). Near the crossing, the river is 100-200 m wide. The Ruili River (known as the Shweli River in Myanmar) is an important transboundary watercourse in western Yunnan. It flows east for 53 km into Myanmar, where it eventually drains into the Irrawaddy River. Annual average monitoring data for 2011 shows that the Ruili River at Gazhong Bridge is minimally polluted (see Table 5), and fully satisfies the PRC's Category II (GB3838-2002) designation for surface water, as shown in Table 5. The maintenance work proposed for G320 is not expected to impact on water quality of the river.

Table 5. Water quality for the Ruili River at Gazhong Section (2011)

Indicator	DO	COD	BOD	TP	Oil
GB3838-2002, II	≥6.0	≤15.0	≤3.0	≤0.1	≤0.05
Monitoring Data	6.8	6.0	2.0	0.05	0.029

Source: Dehong Prefecture Environmental Monitoring Station. 2011

F. Groundwater

82. None of the maintenance activities will require interference with groundwater aquifers or withdrawal of significant volumes of groundwater. Unless more invasive maintenance activities are added to the list provided by YHAB, groundwater resources will not be affected by this project. However, for the sake of completeness, a general summary is provided.

83. The complex geological structures and diverse climate types in Yunnan make groundwater distribution very uneven, both spatially and seasonally. Most of the groundwater (about 70%) is impounded in sedimentary rock beds. The groundwater has hydrological linkages to the surface water, being replenished by precipitation and runoff via recharge areas, supplemented by glacier and snowmelt runoff from the high mountain areas. The groundwater distribution is similar to that for surface water; that is, the western and southern parts of Yunnan have richer reserves than do the eastern and northern regions of the province.⁹

84. Table 6 provides a summary of groundwater types, water bearing strata, and groundwater abundance in relation to the First year roads. Given the strong link between surface water and

⁸ Based on consultant's observations, May 2012.

⁹ Dai Xinglan. Space-Time Distribution of Groundwater Resource in Yunnan Province [J]. Yunnan Water Power. Vol. 23, No.1, (2007).

groundwater, as well as the generally limited abundance (Table 6), it is critical that any groundwater recharge areas remain off limits to any construction work.

Table 6. Groundwater type and abundance in the area of the First year roads

Road Number & Prefecture	Groundwater Type and Aquiclude** Strata	Abundance
G108, S211 Kunming Prefecture	Crevice Water in Carbonatite*** Rock	Moderate
G213 - Kunming and Yuxi Prefecture	Crevice Water in Clastic* Rocks	Moderate
	Interstitial Water in Loose Rocks	Moderate
S321 Lincang Prefecture	Crevice Water in Magmatite****	Moderate to Poor
	Interstitial Water in Clastic Rocks	Poor
G320, X212 Dehong Prefecture	Crevice Water in Metamorphic Rocks	Moderate
	Crevice Water in Clastic Rocks	To Poor
	Interstitial Water in Loose Rocks	Moderate
X214,S234 Dehong Prefecture	Crevice Water in Clastic Rocks	Moderate to Poor
G323 Wenshan Prefecture	Crevice Water in Clastic Rocks	Rich
G320 Dali Prefecture	Crevice Water in Clastic Rocks	Poor

Source: Hydrogeological Mapping Report of Yunnan Province 2005.

* rock made up of conglomerations of older rock pieces; ** a layer of mostly impermeable material separating the unconfined upper aquifer from the deeper groundwater, with low water abundance.

*** igneous rock with >50% carbonate materials, ****oxide or iron

85. No known recharge areas or wells are anywhere near the proposed project roads.

G. Flora and Fauna

86. **Flora and Habitats:** Yunnan province has the third largest forest cover in the PRC. The Province is considered an ecological hotspot but it also has a large number of species under threat due to conversion of natural habitats to agriculture. Forest covers 238,000 km², or 60.4% of the total provincial area, of which, 44.3% is natural, albeit secondary growth.

87. **G108, G213, S211 (Kunming/Yuxi):** The project areas in Kunming and Yuxi Prefectures where G108, G213, and S211 are located are considered part of the north subtropical evergreen broad-leaved forest region.¹⁰ Stands of Yunnan evergreen oak, chinquapin oak, Yunnan pine, Yunnan youshan, and silky acacia predominate. Exotic planted ornamental species typical of the area include eucalyptus, fig, camphor, cedar, China fir, cypress, tree of heaven, and bougainvillea.

88. **G323 (Wenshan):** This road section is located in Funing County of Wenshan Prefecture, amid the south subtropical monsoon forest region,¹¹ which is characterized by subtropical coniferous and broad-leaved trees. Burma pine, cedar, star anise, tung tree, lacquer tree, sweet gum, birch, camphor, kapok, camellia, and bamboo are typical non-native species planted along the roadsides.

¹⁰ The main reference for this is the EIA report for Upgrading Project of Kunming –Yuxi Section of G213. (2012, China Merchants Chongqing Communications Research & Design Institute Co., Ltd)

¹¹ Chen Sheng-guo. An Investigation and Suggestion on the Recovery of Degenerating Vegetation in Karsting Area in Wenshan. Ford Foundation (1015-0281) and Yunnan Provincial Foundation (2002C004) funded project. April, 2009.

89. **S321 (Lincang):** This road section in Lincang Prefecture extends from the east to the west, passing first through tropical seasonal rainforest dominated by kasai, Asian almond, and false hemp tree, and later through subtropical mountainous monsoon evergreen broad-leaved forest and broad-leaved forest composed of beech, *Euphorbiaceae*, magnolia, laurel, and pine.

90. **G320b, X212, S234-Pilot road, X214 (Dehong):** These road sections in Dehong Prefecture pass through tropical rainforest, south subtropical monsoon broad-leaved forest, subtropical mountainous deciduous broad-leaved forest, coniferous forest, and bamboo groves.¹² Forest coverage is about 55%. Rubber tree, tree of heaven, eucalyptus, broadleaf fig, Chinese banyan, bamboo, cotton tree, jackfruit, teakwood, and bougainvillea are commonly planted along the road segments.

91. **G320a (Dali):** In Dali Prefecture, G320a passes through north subtropical evergreen broad-leaved forest, deciduous broad-leaved forest, coniferous forest, and bamboo groves. Most roadside vegetation is planted. Typical plant communities in this area include blue and red eucalyptus, Chinese walnut, juniper, lacquer tree, Chinese hackberry, Chinese evergreen magnolia, yucca, rhododendron, tree of heaven, and bougainvillea. None of the tree cover is to be removed for any of the work proposed along G320a.

92. **Fauna:**¹³ Yunnan's varied climate and topography supports a diverse flora and fauna. The combination of tropical, subtropical, temperate, and alpine zones has resulted in a very rich fauna, with 1,737 vertebrate species (59% of the national inventory) and more than 10,000 species of insects (40% or more of national total). Much of Yunnan was never glaciated, and thus its species, communities, and ecosystems have enjoyed long periods of uninterrupted evolution.

93. Most of the project areas have been heavily influenced by human habitation, with only the hardiest species such as small rodents, small omnivores and herbivores, amphibians, and birds recorded alongside the road alignment. Many of these species, such as mice and rats, are considered pests.

94. All project roads have been in existence for many years and the proposed works are considered unlikely to have significant effects.

95. **G108, G213, S211 (Kunming/Yuxi):** The project areas in Kunming and Yuxi prefectures where G108, G213, and S211 are located have been extensively altered by habitation and agricultural activities. Roadsides are either in commercial and industrial use, or are devoted to very intensive agriculture, including large greenhouse operations. The proposed maintenance work will thus not degrade wildlife habitat.

96. **S321 (Lincang):** Lincang Prefecture, through which S321 passes, has remote areas with valuable natural habitats and species, however, along the road corridor, forests are degraded and for the most part converted to agricultural production.¹⁴ As a result, the S321 corridor is not considered important with respect to biodiversity.

97. **G323 (Wenshan):** In Wenshan Prefecture, G323 passes within 30-50 km of some natural habitat supporting a number of valuable species. Given the distance between the road corridor and these habitats and existing human activities adjacent to the road, none of the proposed maintenance work is considered to have impacts on valuable natural habitats or species.

¹² <http://qy.cctv.com/tuwencate/201303/019ef692-a9a4-4eaa-b921-2c76b2d2ccaf/1.htm>.

¹³ <http://baike.baidu.com>

¹⁴ LI Yongjie. Human Impacts on Wild Animal Resources in Lincang Prefecture [J]. Ecological Economy. Vol. 3, 1999.

98. **S234 (Dehong):** From Km 206 to Km 235, S234 passes through sparsely wooded open farmland on rolling terrain, in subtropical conditions. The second subsection of the road segment is flanked on both sides of the carriageway by woodlands, comprised of deciduous broad-leaved trees, bamboo groves, eucalyptus and broadleaf fig. No trees or roadside habitat outside the RoW will be disturbed by the proposed work.

99. **G320b (Dehong):** In Dehong Prefecture, G320b passes through a disturbed tropical rainforest, making the roadsides attractive habitat for certain species, such as common rodents and birds such as magpies, minah and bulbul that prefer forest edges. However, in common with other project areas, this is an existing road corridor, where wildlife has already been reduced, and where the main species observed are small rodents, reptiles, and common birds.¹⁵

100. G320b crosses the Ruili River, which is home to about 60 fish species, including 26 species of minnow, 11 species of Asian catfish, and other common species. Generally, fish communities in the Ruili River are a mixture of temperate Qinghai-Tibetan species and tropical fishes. Since only short duration bridge deck surface repairs are proposed, no impact on the river or its fish is expected; provided the EMP is implemented effectively.

H. Environmentally Sensitive Areas, Rare and Endangered Species

101. **Environmentally Sensitive Areas:** Yunnan province has rich flora and fauna resources with high biodiversity; unfortunately, these are in rapid decline. The province has established numerous protected areas of varied types and levels of protection, with the intention of ensuring protection of 80% of the remaining old-growth forest and 90% of its species.¹⁶ According to the Yunnan Provincial Forest Department, the province has set up 158 nature reserves with a total area of 29,574 sq km, or 7.5% of the total provincial land area.¹⁷ A number of roads originally considered for the project passed near or through protected areas, but for this reason were removed from consideration. ADB is currently supporting the Yunnan Environmental Protection Department in the development of a Biodiversity Strategy and Action Plan for Yunnan Province and will consider any relevant recommendations made through that study during the planning of future Phases.

102. **Rare and Endangered Species:** There are many rare and endangered species in Yunnan province that are afforded national or provincial protection. According to PRC's Flora Red Book and Directory of National Key Protected Wild Plants, the province has 191 species of rare and endangered plants.¹⁸

103. The Directory of Rare and Protected Wild Animals in Yunnan Province¹⁹ lists 193 wildlife species as nationally or provincially protected. Due to major human impacts along all project road corridors, most rare and endangered species have been driven into more remote forest areas. During the field surveys, local people noted a few cases where rare species such as silver pheasant and pangolin had been seen, but such sightings all occurred far from the road alignments.

¹⁵ During the field surveys, only common bird species such as common egrets and mynah birds were observed.

¹⁶ http://www.forestpest.org/senfang/News/lyxw/2011-06-28/Article_2532.shtml.

¹⁷ http://yn.yunnan.cn/html/2011-12/22/content_1967416.htm.

¹⁸ Ouyang Zhiqin, Yang Suo. Current Situation and Countermeasures of the Rare and Endangered Plants Protection in Yunnan [J]. Environmental Science Guide. 29(5). 2010.

¹⁹ Published By Yunnan Provincial Government, 1990.

I. Agricultural and Mineral Development

104. **Agriculture:** Yunnan has more than 6.2 million hectares under cultivation, of which 55% are sloping farmlands with steep grades of 15 degrees or more;²⁰ farming on such steep slopes is generally discouraged by the Department of Agriculture and YEPD. There are about 1.4 million hectares of high quality farmland in the province.²¹ Generally, Yunnan has not been self-sufficient in terms of food production. Staple agricultural products of Yunnan include corn, potato, rice, rape, garden vegetables, sugarcane, tobacco, rubber, tea, and flowers. By both planting area and outputs, Yunnan is ranked first in the country in tobacco and flowers, and second in sugarcane and rubber.²²

105. Most of the lands bordering the project road corridors are under agricultural cultivation. Kunming and Yuxi Prefectures (G108, G213, and S211) are main producing areas for vegetables, fresh flowers, and fruits. Dali Prefecture (G320a) is famous as the granary of the province; Dehong Prefecture (G320b, X212, S234, and X214) produces tropical fruits, rubber, sugarcane and rice. Lincang Prefecture (S321) is a tea growing area; corn, rice, sugarcane, and potato are also grown here. Wenshan Prefecture (G323) mainly produces rice, corn, rape, potato, vegetables, and medicinal crops.

106. Many of these agricultural crops grow in close proximity to the road RoW boundary.

107. **Mineral Development:** Kunming and Yuxi Prefectures are rich in deposits of coal, iron, phosphorous, copper, and manganese. Dehong Prefecture mines a number of minerals, including tin, lead, zinc, copper, coal, and mica. Wenshan has nonferrous minerals such as antimony, tin, alumina, and manganese. The prefecture also possesses plentiful coal, tungsten, and nickel deposits. Mines in Lincang Prefecture extract diatomite, antimony, germanium, and grammite. Dali Prefecture is rich in coal, barium carbonate, gold, silver, quartz sandstone, limestone, clay, and kaolin.²³

108. Some of the project roads (e.g., S211) are used to haul some of these mineral resources, primarily coal and aggregate. Severe overloading of mineral-hauling trucks has led to serious damage to carriageways and bridges.

J. Economic, Cultural, and Social Development

109. **Infrastructure and facilities:** In general, rural public facilities in Yunnan are insufficient to meet people's livelihood and development needs. Provincial data suggest that the rural population has good access to primary education, but the roads leading to these schools are very poor. Half of rural households have access only to earth-surfaced roads, which are often impassable in the rainy season. Most of the persons affected by the First year works are rural or live in small villages. Access to basic infrastructure and social services, such as schools, tap water, and hard surfaced roads by rural people is lacking in many respects (Table 7), and the proposed road improvement is much needed.²⁴

²⁰ http://paper.ce.cn/jjrb/html/2011-09/12/content_168302.htm.

²¹ Yunnan Provincial Government. Circular on Strengthening Protection of Cultivated Lands and Promoting Sustainable Development of Urbanization in Yunnan Province. August, 30, 2011.

²² <http://www.ynagri.gov.cn/news8307/20100819/529305.shtml>

²³ <http://wenku.baidu.com>

²⁴ As identified during the consultations with roadside communities and local officials

Table 7. Infrastructure and facilities in areas along the project roads (2010)

Children in primary schools	HH* access to tap water	HH access to cement/asphalt roads	HH access to stone/sand/gravel roads	HH access to other materials roads
98%	63%	39%	13%	48%

Source: Yunnan Statistics Year Book 2010.

*HH = household

110. **Land Use:** Agriculture is the dominant land use in the project areas, particularly in Wenshan and Lincang Prefectures, where agriculture makes up about 90% of the roadside land use.

111. There are four main types of cultivation in the surveyed areas: paddy land, dry land vegetables, orchards, and plantation forest. Paddy land is used for growing rice and wheat. Per capita the paddy land parcel size is 0.78 mu (405.6m²). The paddy land with easy access to roads is increasingly being converted to cash crops such as sugarcane, flowers and vegetables.

112. **Employment and Livelihood:** All but a few kilometres of the proposed road maintenance work passes through intensively cultivated agricultural areas. The people are principally farmers, or workers in larger farming and greenhouse agribusiness operations.

113. If one includes subsistence farming, employment is nearly 100%, with the average annual income around RMB 3,900. More than 82% of the people are either self-employed or work in the agricultural sector. The living space for a family of four to five is currently 29 m², an increase of 3 m² over the past six years.

114. **Population and Communities:** The population in Yunnan is characterized by multiple ethnic minority groups and a large proportion of rural residents. In 2010, Yunnan Province had 46.02 million people, accounting for 3.4% of China's total population and ranking the province twelfth among China's 31 provinces and regions. Of the total population of Yunnan, 51.8% are male and 48.2% female; 66.6% are Han people and 33.4% are members of an ethnic minority; 83% make their living in agriculture and 17% in other areas. Average household size is four people. The population density is 115.3 people per square km.

115. Based on the surveyed households (see Social and Poverty Analysis Report, MMM Consultant, 2012), 54.2% of the three to four-member households include a husband, wife and two children, and 24.9% of five to six member households included a husband, wife, two children, and grandparents. Heads of household are dominated by men, accounting for 86.6% of those surveyed. The percentage of ethnic minority headed households is 46.8%. The household survey indicated that 22% of respondents have not attended school, 40% completed their primary school (six education years), and 30% completed junior middle school (nine education years). Only 2% of respondents obtained higher education (over twelve years).

116. Among adults aged 16-60, 67% of respondents reported that they are farmers working on the land. The other occupations reported were 11% migrant labourers (both long-term and seasonal), 7% private enterprise owners, 6% students, 5.6% small business managers, and 3.4% working in either government or government enterprises.

117. **Socioeconomic Profile:** Cash crops, long term and seasonal migrant labour earnings make up 70% of total household incomes. Traditional livestock raising makes up only 6.4% of the household income. Income from providing collective informal transportation services is close behind at 5.9% of household income. The household survey showed that demand for more cash among rural households has led to a need for greater mobility, which translates to a need for better roads and public transport services.

118. Among project counties, five were listed by the province as priority counties for poverty reduction since per capita annual incomes in 2010 were lower than the provincial average. Farmers in Fuming and Longchuan Counties, for example, had annual per capita incomes below RMB 3,000, which is considered a poverty income.

119. Household consumption comprised 53.1% of all expenditures, followed by investments and house construction (34.6%) and agriculture inputs such as seed, fertilizer and pesticide. Household consumption consists of food (36%), social and cultural activities (28%), health care (13.8%), education (11%), travel cost (8%), and domestic use of water and electricity (3.2%).

K. Human Settlement in the RoW

120. None of the projects within Phase I will require any resettlement or land acquisition.

L. Community Safety

121. During the public consultation meetings (records provided in Annex E) community safety, particularly where roads passed through urban areas, was raised as an issue. Participants indicated that some roads, such as S231 and S211 and X214 which have stretches through towns were unsafe for children as there were no sidewalks and speeds were excessive. It is evident that improved safety is a key priority.

M. Archaeological, Historical Treasures and Scenic Areas

122. No archaeological historical or cultural resources of particular significance are associated with any of the road corridor areas, nor for 200 m either side of the road RoWs.

123. S321 has exceptional scenic vistas. Since these will not be impacted by the work no additional information was collected.

V. Impacts and Mitigation Measures

A. Introduction

124. Environmental impacts and associated preventative mitigation and monitoring measures are identified in the EMP Mitigation Measures Table and EMP Monitoring Measures Table in Annex B. Each mitigation measure has been assigned a number for easy reference and has a corresponding monitoring measure of the same number.

125. Table 8 summarises the maintenance activities associated with each subproject, which EMP mitigation and monitoring measures apply and the subproject environment category. For subprojects X214 and S211 all EMP measures are applied. For other subprojects, G108, G213, G320a, G320b, G323, X212, S321 and S234, generic mitigation measures for “*all subprojects*” are applied along with other relevant specific measures, as indicated.

B. Pre-Construction Period: Project Location and Design

126. Many impacts can be avoided or minimised through the integration of environmental and social considerations in the assessment, design and planning of subprojects. Improving the environmental capacity of YHAB will be key in influencing these important early stages and improving overall project environmental performance. Consulting and disclosing information to affected persons in advance of works is also important.

Table 8. First year subproject environmental assessment categories and mitigation and monitoring major mitigation and monitoring actions

Subproject	Maintenance Activities Proposed*	Most Relevant EMP Mitigation & Monitoring Measures	Subproject Environment Category
X214 (16.1km)	Replacement of entire pavement layer for ≥ 10 km, including subgrade and raising horizontal alignment.	Apply Complete EMP	B
	Culvert replacement and repositioning		
	Localized shoulder reinforcement		
S211 (31km)	Replacement of entire pavement layer for ≥ 10 km, including subgrade and raising horizontal alignment.	Apply Complete EMP	B (marginal)
	Culvert replacement and repositioning		
	Clearing long stretches of ditches, drainage canals and paved ditches		
	Comprehensive repair of landslide-damaged area		
	Full replacement of curbs along the entire road section		
G108 (21.6km)	Curb repairs and whitewashed stone	1, 2.1.1, 2.3, 2.7.3	C
	Dust, sanding and anti-skid application	1, 2.1.1, 2.5.1	
	Only pavement layer replacement	1, 2.1.1, 2.2.2, 2.3.1, 2.2.5, 2.7.2, 2.8	
	Comprehensive repair of retaining walls, slope protection, road shoulders, drainage ditches.	1, 2.1.1, 2.2.1-6, 2.7.2	
	Clearing long stretches of ditches and drainage canals		
G213 (41 km)	Only pavement layer replacement	1, 2.1.1, 2.2.2, 2.3.1, 2.2.5, 2.7.2, 2.8	C

Subproject	Maintenance Activities Proposed*	Most Relevant EMP Mitigation & Monitoring Measures	Subproject Environment Category
	Full replacement of curbs along the entire road section	1,2.1.1, 2.2.1-4, 2.6.1, 2.7.2 2.8	
	Apply sealcoat	1, 2.1.1, 2.3.2, 2.3.3	
	Localized shoulder repair	1., 2.1.1, 2.2, 2.3, some of 2.8	
G320a Dali (17km)	Pavement strengthening, including some widening within RoW, any distance	1, 2.1.1, 2.2.1, 2.2.4,2.2.5,, 2.4,2.5.2, 2.7.2	C
	Concrete pavement partial repair of the pavement surface	1, 2.1.1, 2.2.1, 2.2.4,2.2.5,, 2.4,2.5.2, 2.7.2, 2.8	
	Full replacement of curbs along the entire road section	1,2.1.1, 2.2.1-4, 2.6.1, 2.8	
G320b Ruili (30 km)	Concrete pavement partial repair of the pavement surface	1, 2.1.1, 2.2.1, 2.2.4,2.2.5,, 2.3, 2.4,2.5.2, 2.8	C
	Apply seal coat	1, 2.1.1, 2.3	
	Pavement joint repair	1, 2.1.1, 2.3.2,	
	Sand road evenness, repair rutting (road grading)	1, 2.1.1, 2.3, 2.4	
G323 (35km)	Concrete pavement partial repair of the pavement surface	1, 2.1.1, 2.2.1, 2.2.4,2.2.5,, 2.3, 2.4,2.5.2, 2.8	C
	Replacement of entire pavement layer for ≥10km, some widening within RoW	1, 2.1.1, 2.2.2, 2.3.1, 2.2.5, 2.3, 2.4, 2.7.2, 2.8	
	Comprehensive repair of landslide-damaged area	1, 2.1.1,2.2.1-5 & 2.2.7, 2.3, 2.4.2, 2.8	
	Bridge deck pavement replacement but not full replacement to deck girders. No increase in bridge capacity.	1, 2.1.1, 2.2.1, 2.2.5, 2.3.1-3, 2.4.2-3, 2.7.3	
	Other minor maintenance	2.3	
X212 (15.5km)	Replacement of entire pavement layer for ≥10km	1, 2.1.1, 2.2.2, 2.3.1, 2.2.5, 2.7.2, 2.8	C
	Other minor maintenance tasks	2.3	
S321(22.0km)	Pavement strengthening, including some widening within RoW, any distance	1, 2.1.1, 2.2.2, 2.3.1, 2.2.5, 2.3, 2.4, 2.7.2, 2.8	C
	Local shoulder reinforcement	1., 2.1.1, 2.2, 2.3, some of 2.8	
	Full replacement of curbs along the entire road section	1,2.1.1, 2.2.1-4, 2.6.1, 2.8	

Subproject	Maintenance Activities Proposed*	Most Relevant EMP Mitigation & Monitoring Measures	Subproject Environment Category
	Comprehensive repair of retaining walls, slope protection, road shoulders, drainage ditches	1, 2.1.1, 2.2, 2.3, 2.4, 2.7.3, 2.8	
S234(25km)	Localized shoulder repair; Daily application of clear seam to concrete asphalt cracks as required; Concrete pavement partial repair of the pavement surface	1, 2.1.1, 2.2.1, 2.2.4, 2.2.5,, 2.3, 2.4, 2.5.2, 2.8	C

C. Construction Period Environmental Effects and Proposed Mitigation

(1) Air Quality and Noise

127. **G108, G213 (Kunming):** The maintenance work on these roads will involve raising the horizontal alignments of sections by 40 to 50 cm, clearing ditches, repairing shoulders and filling cracks in the pavement. This will mean use of trucks to haul subgrade and new asphalt materials to the work sites. YHAB plans to purchase these materials from suppliers located within 10-30 km of work sites, and this will result in emissions. These trucks will not be part of YHAB's fleet and thus will not be under its control, but proper maintenance of any observed polluting vehicles will be requested of the haulers and overloading and exceeding vehicle operating specifications, which typically lead to increased emissions, will be discouraged by the construction inspectors (EMP measures 2.3.4 and 2.5.1).

128. The heavy equipment used to prepare the sections where the horizontal alignments will be raised will include backhoes, bulldozers, and compaction machines. As there will likely be no more than two of each machine used at any one work site, only a relatively small volume of emissions is expected from this source.

129. Although no field data are available, sulphur dioxide (SO₂) and TPM levels derived from daily operation of construction equipment are expected to be well within PRC Category II standards, based on studies carried out for other projects. Such emissions will marginally degrade air quality for short periods of time with localised effects, however, existing traffic is likely to have a more significant impact.

130. The work will generate dust, and suppression measures, including prevention of fines spillage from trucks hauling materials, road sweeping, application of water, and use of calcium chloride have been recommended to reduce dust to an acceptable level (EMP measure 2.5.1).

131. Noise levels reaching 70 dBA at roadsides will result from the operation of the heavy equipment, however, machinery noise will be heard only during the daytime, and will represent temporary spikes in the otherwise noisy roadside environment.

132. **G320a (Dali):** This 17 km section of G320 passes close to Dali City, where traffic volumes in 2011 ranged between 11,000 and 20,000 vpd. Work will be completed in four small sections rather than one continuous stretch, and will consist of resurfacing some sections, rebuilding curbs, repairing side ditches, repairing some culverts, and raising the horizontal alignment of at least one 2-3 km section by 40-50 cm. Existing asphalt will be taken down with a milling machine, which will generate dust and possibly silica dust. Dust will be mitigated with water spray suppression on the milling machine. Operators and support crews will be required to wear dust masks (EMP measure 2.5.2). In comparison to the emissions from the existing traffic, the work by a few heavy machines working for a number of weeks will result in minimal air emissions, and barely measureable changes. By applying the 'for all subprojects' EMP measures and ensuring that machinery and vehicles are properly maintained and operated (not overloaded, and travelling within designated speed limits), emissions will be minimised (EMP measure 2.5.1).

133. Local officials reported that this road experiences extensive traffic congestion due to the poor condition of the road, planned improvements should significantly reduce this and associated levels of air pollution.

134. With existing traffic volume of between 11,000 and 20,000 vpd, the noise associated with the maintenance work will be negligible and indistinguishable from that generated by the traffic.

135. **G320b (Dehong):** This southernmost section of G320 includes four segments that are 1 km, 3 km, 3 km, and 20 km in length, respectively. All sections are in rural, slightly hilly, and marginally populated areas. With 2011 traffic volumes ranging between 4,000 and 14,000 vpd, the road is well travelled. Estimates for CO and NO₂ (Table 3) suggest full compliance with PRC Category II emission standards. No other data were available, but observations and comments by local people along the road during the consultations did not suggest any exceedences for TPM or SO₂.

136. As with G320a, a milling machine will be used to recover some of the old asphalt for use as subgrade material, and this will produce TPM and possibly silica dust. Dust will be mitigated with water spray and suppression of the milling machine. Operators and support crews will be required to wear dust masks (EMP measure 2.5.2). Given the considerable distance between sections to be milled, impacts will be localised and short-term. The work by a few heavy machines working for a number of weeks will result in low levels of air emissions, and barely measureable changes over normal levels derived from road traffic. By applying the 'for all subprojects' measures and ensuring that machinery and vehicles are properly maintained and operated (i.e., not overloaded, and travelling within designated speed limits), emissions will be minimised (EMP measure 2.5.1).

137. With existing traffic volume of between 4,000 and 14,000 vpd, the noise associated with the maintenance work will be negligible, indistinguishable from that generated by the traffic. Further, as all work sections are in agricultural, forested, or vacant lands, noise from construction work will not be audible in dense settlements. Work is to be restricted to regular daytime hours in accordance with PRC standards and as agreed with local communities (EMP measure 2.8.10).

138. **S211 (Kunming):** Due to the large volume of heavy (often overloaded) truck traffic, this road will require an almost total reconstruction. Most of the pavement, the culverts, and all roadside structures have been severely damaged. As S211 is environment Category B, the full set of mitigation and monitoring measures as defined in the EMP will be applied (see Annex B). This road is used mostly by trucks hauling aggregate, sand, and coal (traffic volume up to 11,000 vpd). Emissions (primarily of SO₂ and TPM) are, as a result, elevated and exceed PRC Category II standards.

139. A larger fleet of construction machinery will be used for this maintenance, and this will result in greater emissions, but as with G108 and G213, the machinery operating at the work site will emit less than existing truck traffic.

140. The road is presently very dusty, with dust clouds reaching as far as 100 m on both sides of the road. Since the dustiest parts are in sparsely populated hilly areas, the health effects are marginal.

141. Where roadside populations or businesses exist, dust suppression will be implemented and monitored according to the EMP (EMP measures 2.3.2 and 2.5.1).

142. Due to the constant truck traffic and heavy industry along many stretches, noise levels along S211 significantly exceed the PRC Category II daytime limit of 60 dBA. The proposed work will result in daytime noise spikes of up to 78 dBA from equipment operation. As the work will be limited to daylight hours, and will take place while the road remains fully operational, works are unlikely to result in perceptible elevation of noise levels. No environmentally sensitive receptors are located anywhere close to this road corridor.

143. **G323 (Wenshan):** This 30-km section will see some resurfacing of the pavement (less than 5 km), bridge deck repair, road sweeping, placement of new signs and road markings, and limited slope stabilization (approximately 30m long). No significant air quality-related construction period impacts are anticipated if the EMP measures are implemented.

144. Construction noise will intermittently exceed maximum daytime ambient levels of 62 dBA, as measured 10 m from the carriageway. Work will be done while G323 is fully operational, with traffic volume of up to 2,721 vpd. Given that the work is of short duration, it is unlikely that there will be a perceptible change in noise levels and much of the RoW is uninhabited. Where G323 passes through two small villages, only minor rehabilitation work, such as replanting of trees, patching potholes, and adding new signs will be undertaken.

145. **S234 (Dehong):** This section will see mostly minor repairs but also some heavier equipment will be required to prepare surfaces for strengthening and handling of materials. Shoulder repairs will be done mostly by hand, but could require a backhoe. Compaction equipment will also be used.

146. There will be some noise and dust produced, but these are expected to be barely perceptible from the noise and dust generated by this operating provincial road. Air quality degradation will be minor, localised and short-term.

147. During the works, the contractor will adhere to all mitigation measures identified in the EMP as needed (see Table 4), and will report compliance to the Maintenance Section and the ESSU.

148. **S321 (Lincang):** This 22 km maintenance section, split into two work areas (14 km and 8 km, respectively), will require some pavement resurfacing, shoulder repair, curb repair, and minor bridge resurfacing, as well as some slope protection work. The impact on air quality will be most noticeable along the road section which passes through the county capital of Yongda. Existing traffic (4,600 vpd) along this fully operating road will mask much of the construction emissions. By applying dust suppression measures as defined in the EMP, the conditions may improve. As soon as construction is complete, a significant improvement in this part of the road corridor is expected, since dust will be eliminated through resurfacing and noise will be less since vehicle acceleration and deceleration cycles will be greatly reduced (EMP measures 2.3.2 and 2.5.1).

149. Noise will not be an issue along the first section (Km 71-85), as it passes through agricultural fields and steep forested lands. Partway through the second section (Km 185-193), the road passes through the county capital of Yongda, and here the entire 1.5-km length will need to be repaired and resurfaced. At present, it is a dusty, dangerous, potholed roadway. The work is expected to transform it into a well-designed urban thoroughfare. Existing noise levels are around 61 dBA, slightly exceeding the maximum daytime permitted value of 60 dBA. The equipment proposed may generate noise spikes of up to 78 dBA but these will occur while the road is fully operational and should not be particularly noticeable.

150. **X212 (Dehong):** X212 is a fully paved county road over 8 m wide, and loops from where G320 crosses the Ruili River back to G320 about 17 km to the northeast. Much of the roadside land use is agricultural, including rubber and coffee plantations. Several kilometres of the road, are in a sparsely populated area and passes a large aggregate processing facility, which will need to be rebuilt due to subsidence resulting from heavy use from overloaded trucks. The horizontal alignment for parts of this section will be raised by up to 50 cm. Elevated TPM levels were observed along much of this road, due mostly to the loss of fine materials from the many trucks carrying sand and aggregate from the quarries located along the road. During the survey, fine dust and sand was observed along the road's shoulders. Since the construction activity will be at a very small scale and existing traffic volume is on average 10,600 vpd, additional air emissions associated with the work will not be noticeable. The contractor will be instructed to properly maintain all construction vehicles according to manufacturer specifications and to observe designated speed limits (EMP measure 2.5.1).

151. A milling machine will be used to recover some of the old asphalt for use as subgrade material, and this will produce TPM and possibly silica dust. Dust will be mitigated with water spray

suppression installed on the milling machine. If dust suppression methods defined in the EMP are not applied, operators and support crews will be required to wear dust masks (EMP measure 2.5.2). Compared to the emissions from the existing traffic, the work by a few heavy machines working for a number of weeks will produce barely perceptible change. By applying measures defined in the EMP and ensuring that machinery and vehicles are properly maintained and operated (not overloaded and travelling at designated speed limits), emissions will be minimized (EMP measures 2.3.4, 2.5.1 and 2.5.2).

152. The additional noise from the construction equipment is not expected to be an issue, given the high existing traffic volumes, including large numbers of heavy trucks.

153. **X214 (Dehong):** The need to fully rebuild this 16.1 km-long road passing through mixed agricultural and urban land use triggered a Category B environmental assessment. Estimated values for NO₂ and CO (see Table 3) are far below maximum permissible levels for PRC Category II standards.

154. Given the existing dusty conditions and poor quality of the road, and despite the concentrated construction work, air quality will likely be only marginally and temporarily degraded. To establish TPM, SO₂, and NO₂ levels at the edge of the RoW and to ensure they are maintained within acceptable levels, the Contractor will be required to undertake a monthly monitoring program (as per EMP measure 2.4.4). Once a month, two samples will be taken (one during the morning traffic peak, and one when construction has stopped for the day) at each of six stations along the road.

155. Noise levels from the work are expected to peak intermittently during the day when heavy equipment such as compactors are used. These peaks may, for short periods and in highly localized areas within the road RoW, up to 78-80 dBA. It is likely there will only be 6-8 pieces of heavy equipment used, operating only between 06:00 and 18:00. Thus the work will contribute only minimally to the daytime noise environment, and contribute not at all during the night. The contractor will be required to keep all equipment properly maintained, thereby minimizing machine noise (EMP measure 2.5.1). The Contractor will monitor noise monthly at the same time as air quality (as per EMP measure 2.5.3).

(2) Water Quality and Hazardous Materials

156. There are a number of important construction period impacts associated with road maintenance defined in the EMP that, while applicable to any road maintenance works, are especially pertinent in relation to S211 and X214, since they involve replacement and/or repair of a large number of culverts. The first of these impacts relates to the modification of surface drainage during culvert and bridge replacement, raising of horizontal road alignment, and slow revegetation of exposed slopes. In all cases where the work will be on ≥ 5% grade, there is a great risk of both severe and chronic erosion and attendant water quality degradation. Erosion prevention measures, coupled with better storage of materials to restrict the discharge of particulate matter into water courses, will be implemented (EMP measure 2.2).

157. A potentially significant impact could result from inadequate fuel storage and handling, resulting in leakage into surface waters and groundwater. This is expected to be a particular risk for larger construction operation sites such as for S211 and X214, where machinery must be serviced and fuelled on site. Siting on flat ground, using proper fuel dispensing equipment, applying waste lubricant recovery methods and recycling and disposal of used petroleum products will be required (EMP measure 2.3, 2.3.5 and 2.4.3).

158. Another potentially significant impact could be contaminated surface runoff degrading local water courses. This can occur when contaminated water draining off large road surface areas is

channelled into local watercourses (in this case, principally the small irrigation channels the road crosses). Immediate re-vegetation of exposed areas with grades exceeding 10% will be required, in order to slow runoff and thereby encourage slow percolation into the ground surface (EMP measures 2.2.2 and 2.6.1). This will apply to X214 and S211 which are most vulnerable to this impact. S323 and G320b have rivers nearby (about 800 m distance), but as works will be confined to the RoW, negative impacts are not anticipated. All road maintenance presently proposed will require the use of relatively small quantities of hazardous materials on site, namely fuel, lubricants, paints, and bitumen. The EMP specifies good practice material handling measures (EMP measures: 2.4.2 and 2.8.3). EMP measures 2.4.3 and 2.8.3 specify a general protocol for management of bitumen stored in metal drums.

159. S234 has a large concrete irrigation channel running parallel to it, about 3-4 m from the edge of the shoulder. The work in that section will be mostly shoulder repair, and care will be taken to keep all fuels and other petroleum products away from that side of the road.

160. Groundwater conditions vary across the ten roads (see Table 6), but no impacts on groundwater are expected to result from the road work, since no digging beyond 60-70 cm below the surface will take place, and no pile driving or other access to the water table is anticipated.

(3) Soil Loss, Slope Instability And Erosion

161. **G108, G213 (Kunming):** The field survey did not identify any existing erosion issues with the sections of the G108 proposed for works. As there will be no cutting into slopes, clearing of vegetated areas, or culvert replacements, no potentially significant erosion impact will arise. Sections of G108 will be raised by up to 50cm, requiring the placement of subgrade which, with a heavy rainfall during the work period, could result in localized erosion. By properly implementing EMP measures, which include covering and compacting subgrade material immediately after placement (EMP measure No. 2.2.2), the chances of erosion will be reduced.

162. Similarly, G213 has no significant erosion issues, other than one 150-m section near Km 2,163, where both the road and the toe of the 5-m-high cut slope have degraded. The road and slope toe will need rebuilding in order to eliminate ongoing erosion, as well as possible future slope destabilization and silt- and clay-laden runoff every time it rains. The use of preventative engineering planning and design as defined in the EMP will remediate erosion issues (EMP measures 1.2 and 1.4).

163. **S211 (Kunming):** This road has at least three major unstable hillsides which, if left unremediated, could easily slip and result in road blockage. In fact, this did occur at a fourth site, requiring the entire slope and road section affected to be rebuilt. The slide sent large volumes of material down the slope across the road, requiring further costly reconstruction and rehabilitation of fields and irrigation canals. The three unstable slopes will require major works, as they involve entire hillsides. Since this is one of two Category B roads, the EMP is fully applicable and includes erosion protection methods (EMP measures 2.2.2 and 2.2.3). All culverts will need attention, involving repair and replacement of the large concrete structures, outflow erosion protection, and channel clearing using back hoes. The size of the culverts will be checked against known drainage data to ensure that the size matches maximum flows. The EMP has detailed guidelines on culvert work (EMP measures 2.2 and 2.4).

164. **G320a (Dali):** The field survey did not identify any erosion issues in this section of G320, and the work proposed is not expected to create significant problems. The proposed EMP measure 2.2 will help to mitigate any construction related erosion. The addition of subgrade up to 50 cm deep will be done so as to avoid significant loss of materials, through immediate compaction and revegetation, including placement of grass sod if conditions warrant.

165. **G320b (Dehong):** The field survey did not identify any existing erosion issues in these four subsections, given the good ground cover along the RoW, no future problems are expected. The work will not require disturbance of any vegetated areas, but will involve the placement of subgrade material. As with G320a, the requirement that the contractor applies sound engineering, and refers to the good environmental practices outlined in the EMP should help avoid any serious erosion issues (EMP measures 1.1-1.5).

166. **G323 (Wenshan):** Two major culvert repairs at Km 1,639+100 and 1,674+10, respectively, will require careful work to prevent chronic down-slope erosion during periods of surface runoff. Sound engineering and implementation of the EMP measures should help avoid erosion issues (EMP measure 2.2).

167. The Maintenance Section reported that at Km 1,663+800 there are landslides and rock falls. This problem will be addressed through various measures, including the use of metal netting to prevent rock fall, and other slope stabilization measures routinely applied by YHAB (EMP measure 2.2.3).

168. The construction activity, confined as it is to the carriageway and shoulders, will not generate any potential erosion issues, except for the placement of additional subgrade material. This risk is easily minimized with sound construction practice, as defined in the generic EMP measures that apply to all subprojects.

169. **S234 (Dehong):** Based on the field survey and discussion with local authorities no erosion or slope instability issues were identified along the two sections of S234 proposed for maintenance.

170. **S321 (Lincang):** There were no existing erosion issues observed during the field survey. Despite both maintenance subsections being in mountainous terrain, erosion will not be a significant risk, since the construction work will be strictly confined to the carriageway and shoulders. Raising the horizontal alignment by 20-30 cm in some sections should also not be an issue, as contractors will be made fully aware of erosion potential and will implement the measures set out in the EMP measures 2.2.1 – 2.2.4.

171. Significant curb rebuilding will be undertaken. Since this will be done with close to 100% manual labour, disturbance will be minor and erosion kept well under control by complying with the measures defined in the EMP measures 2.2 and 2.4.

172. **X212 (Dehong):** Although major work will take place to repair and maintain this road, including raising the horizontal alignment and repaving much of the 16.1 km distance, little erosion is expected as much of this section is flat and comprehensive management measures have been identified in the EMP measures in 2.2.

173. **X214 (Dehong):** For X214, there is very little concern. The construction work is unlikely to trigger erosion and slope instability problems, since this wide alignment traverses very flat to gently sloping terrain, with ample shoulders on both sides of the road. The generic EMP measures that apply to all subprojects will apply.

174. **Bioengineering Methods to Control Erosion and Slope Instability:** To manage erosion issues, a range of methods are available that combine hard and soft-engineering approaches. In addition, to traditional methods as set out in the PRC technical highway standards, it recommended that bioengineering methods are considered, where appropriate for the local conditions. These methods tend to be far less costly than structural solutions, use local materials, have been tested and proven effective in conditions similar to those along the project roads. Once installed, they also cost less to maintain. The most common bioengineering approaches and their standard engineering solutions are listed in Table 9, further details are provided in Annex D and referenced in the EMP measures 2.2.2 – 2.2.4.

Table 9. The main engineering functions of structures, with examples of civil and bio-engineering techniques (Copied from Howell, 1999²⁷ Figure 1.2)

Function	Civil engineering technique	Bio-engineering technique	Combination of both
Catch	Catch walls Catch fences	Contour grass lines or brush layers Shrubs and large bamboo clumps	Catch wall with densely planted shrubs Catch wall with bamboo clumps planted above
Armour	Revetments Surface rendering	Mixed plant storeys giving complete cover Grass carpet	Vegetated stone pitching Jute netting with planted grass
Reinforce	Reinforced earth Soil nailing (sodding)	Densely rooting grasses, shrubs and trees Most vegetation structures	Wire bolster cylinders and planted shrubs or trees Jute netting with planted grass
Anchor	Rock anchors Soil anchors	Deeply rooting trees	Combination of soil anchors and deeply rooting trees
Support	Retaining walls Prop walls	Large trees and large bamboo clumps	Retaining wall with a line of large bamboo clumps planted above
Drain	Masonry surface drains Gabion and french drains	Downslope and diagonal vegetation lines Angled fascines or brush layers	Herringbone-pattern wire bolster cylinders and angled grass lines French drains and angled grass lines

(4) Natural Habitats, Flora and Fauna

175. Since all work is confined to the heavily disturbed existing road RoWs, and all earthworks and paving materials will be purchased from existing and licensed suppliers, no impact on local ecology is expected. Temporary haul roads and other temporary access roads will not be required for any of the road maintenance work.

176. Only X212 has potential issues with respect to flora and fauna, as several groves of giant ficus (banyan) trees, estimated to be more than 100 years old, are found within and close to the alignment. The consultations with local people highlighted the need to protect these groves (banyan trees can reach 300 years in age), revising the road design if needed (consultation records provided in Annex E). YHAB and its General and Maintenance Sections have agreed to instruct the contractors to place temporary fencing around the drip line²⁵ of these trees before work begins, in order to protect them from damage. ESSU inspectors will confirm that this mitigation measure (EMP measure 2.6.1) has been implemented.

177. There was no observed wildlife or reports of wildlife along any of the project roads, other than common species such as white egrets, mynah birds, bulbuls, and the occasional flying fox along X212 in the far south of the province. No large mammals were reported anywhere along the roads.

²⁵the outermost circumference area of a tree canopy where rain water drips from the tree onto the ground

178. **Modified Habitats:** Close to 100% of the roadside habitat which could possibly be influenced by the maintenance work is modified habitat, i.e., agricultural, urban residential, small enterprise, and small commercial land uses. All works proposed will be contained within existing RoW so will not affect existing land uses.

179. **Natural Habitats:** Since all the work proposed is within the road RoW, no natural habitat will be lost, assuming effective implementation of the EMP and an appropriate level of supervision. Since aggregate and other road building materials will come from outside suppliers who operate licensed facilities²⁶, no significant impacts on natural habitats are anticipated.

180. **Critical Habitats:** No critical habitat was recorded during the field survey of the project roads. A further check with the Yunnan Environmental Protection Department (YEPD) did not yield any additional information. All work will be restricted to the road RoW, with most occurring directly within the carriageway boundaries.

181. **Invasive Alien Species:** Undoubtedly there are some invasive plant species along the roadsides which will be managed according to Yunnan practice defined by the Ministry of Agriculture and the Environmental Protection Bureaus. There are no invasive or alien species being introduced as a result of the project.

(5) Health And Safety

182. Health and safety impacts and corresponding mitigation and monitoring actions are defined in EMP Measures 2.7.3 - 2.8.9 (Annex B). These measures address environmental and occupational health and safety issues associated with the construction and post-construction phases of the first year subprojects, as summarised below.

183. **Provision and Use of Personal Safety Equipment:** Given that all roads will be fully operational while maintenance work is underway, maintenance of a safe working environment will be important. Workers will be provided with safety equipment such as high visibility safety vests hardhats and appropriate shoes. The contractor will be required to ensure that all workers have access to eye, ear and hand protection, as required. Refer to EMP measure 2.8.1.

184. **Management of worker safety on fully operating roads:** Adequate traffic management measures should be implemented, including safety cones and markings. The use of traffic control persons will be required for all roads during periods when traffic diversion to a single lane is required. Refer to EMP measure 2.8.5.

185. **Provision of basic sanitary conditions and potable water at worksites:** All maintenance work will involve labourers, equipment operators, and engineers being on site daily for several days to weeks at a time. Basic sanitary conditions, including hygienic toilet facilities comprised of either pit latrines (one per ten people) or portable chemical toilets, will be installed at every worksite where construction takes place for more than one day (in accordance with PRC standards). Immediately after the work is completed, the pit latrines and/or chemical toilets will be removed and disposed of in line with required standards. Any sewage pits will be pumped out, if needed, then filled in and completely revegetated. Refer to EMP measures 2.8.4 and 2.8.9.

186. Potable water, in clearly marked containers with drinking cups supplied, will be available at all times to all workers on work sites. Providing water will be the daily responsibility of the contractor's site supervisor, as instructed by the Maintenance Section management. Refer to EMP measure 2.8.9.

²⁶ Information provided by YHAB, July 2012.

187. **Access restrictions:** All first year roads will require some traffic control, and this will involve at least some traffic restrictions and temporary blockage of access for roadside residents and businesses. Prior to the start of any work requiring access restrictions, such as repaving, adding subgrade material, bridge deck repairs, or enlarging or repairing culverts, the contractor will be required to conduct a door-to-door consultation with all residents affected. Such communication will indicate the nature and timing of the proposed work, and record any urgent issues such as requirements for regular medical visits, daily travel to and from places of work, and requirement for livestock movements, as explained by those affected. Based on such discussions the contractor will prepare a closure schedule for those roads where no other option exists and distribute it to affected persons. Alternative routes should be provided, where possible. At the public consultations, the contractor will provide copies of the grievance redress mechanism, including contact telephone numbers and addresses to roadside residents and businesses (EMP measures 2.7.2, 2.7.5 and 2.8.1).

188. **Safety of Residents in Construction Zone:** Contractors will be required to have all necessary safety features on their equipment such as reverse alarms and to demarcate and control areas where heavy equipment is operating. Traffic control technicians or county police will be hired to direct traffic (EMP measure 2.8.1 and 2.7).

189. **Hazardous Materials Transport through the Construction Zone-** According to PRC regulation on the transport of hazardous materials by road and rail (HJ/T169-2004/2008 and Decree 591 The Regulations on Safe Management of Hazardous Chemicals, Dec. 2011), the transport of hazardous materials requires marked vehicles and for some materials, notification of the local highway department before a journey takes place. Depending on the type of maintenance to be undertaken traffic management will be either by the contractor's flagmen or the police, both trained in the safe control of traffic. If dangerous goods are transported, forms must be filed with local environment departments who monitor trans-shipment. If lanes are closed or if the work is in steep terrain, as with S321, flagmen will not let heavy vehicle pass until it is safe to do so (EMP measure 2.8.3).

190. **Utilities, Sewage and Conveyances:** All subprojects will be undertaken in existing and operating roads where the location of all utilities such as sewers, telephone lines and water pipelines are well known and identified on drawings held by the General and Maintenance Sections. The general approach of YHAB will be to prevent or avoid impact to these services. Mitigation options will be considered only if prevention is impossible. Prior to the start of a contract the General and Maintenance Sections will work with the contractor to locate any areas where possible conflicts could occur. A plan to prevent or mitigate any future damage will be developed, and if relevant discussed with local community leaders (EMP measures 2.3.1 and 2.4.2).

191. There is unlikely to be an impact on services since much of the work will be within the RoW and the location of utilities is known. Buried water pipes and communication cables will be considerably below the excavation depth of most subprojects. Utility poles may be moved but no power cuts for any significant length of time are anticipated.

D. Operating Period

192. The proposed maintenance will improve the road condition and traffic flow on existing operating roads but it will not result in increased capacity and is not considered to have any significant operational impacts on environmental conditions. In some cases, the proposed activities will improve local environmental conditions by alleviating issues associated with dust mobilisation and current poor road conditions that lead to congestion or inefficient driving practice that can result in higher levels of pollutant emissions.

193. A number of operational impacts are identified in the EMP (Annex B) Mitigation and Monitoring Measure Tables and are summarised below. Given the low level of predicted operational environmental impacts associated with the proposed project activities it is not considered that there is a need to mitigate or monitor impacts beyond what is discussed in the sections that follow and in the EMP.

194. **Increased Risk of Vehicle-Pedestrian Interaction:** For G108, S321, S211 and X214, the planned road improvements could lead to a faster average vehicle speed, thereby increasing the risk of accidents. This could become a significant concern in urban areas; for example, along S321, where the existing road is in such poor condition that average traffic speed is now only 20 kilometers/hour(kph) but will rise to 70 kph after improvements. To address this issue, this project includes a component on road and community safety, which will include various mitigation measures to control traffic speed, reduce hazards and to increase awareness of local communities.

195. Traffic calming, speed bumps, better road markings, speed limit signage, and marked and signalled pedestrian crossings have been proposed. In locations where the safety survey recorded high traffic incidence statistics community awareness training will be delivered. Community involvement in road safety management will be encouraged.

196. Road safety issues were raised by the consultant during the public consultations but were not viewed as significant by local residents (records of consultation provided in Annex E) . Generally, it was considered that the benefits of road maintenance far outweigh the drawbacks.

197. **Degradation Of Local Air Quality Due To Increases In Traffic Along Alignments:** In general, traffic volumes are not expected to increase once the maintenance work on these roads is complete. Air quality should improve, since a smoother road requires fewer stops and starts, reduce the level of congestion and associated emissions.

198. It is likely that over time, due to normal traffic volume growth, unrelated to the work, air quality along the roads will deteriorate. However, this could be mitigated by strategic improvements and progress made in the transport sector, such as enforcement of higher emission standards, cleaner fuel and advances in vehicle technology.²⁷

199. **Noise and Vibration Disturbance Due To Increases In Traffic:** A perceptible (audible to the human ear) increase in noise requires a doubling of traffic volume, which will not take place on any of the roads. Following improvement of two subsections of G213 parallel to an express toll road, it is likely that traffic will divert back to the G213 as a free alternative to the toll road. If this were to happen, there would be a marked increase in traffic volume and an associated rise in noise, air pollution and local ground vibration along G213. The newly completed pavement would rapidly degrade. To combat this, YHAB will erect a height barrier at two locations along G213 to prevent large trucks, which exceed the design capacity of the road, from using the road (EMP measure 3.2).

E. Other Impacts

200. **Irreversible and Irretrievable Impacts:** This project will not generate any irreversible effects since it only involves repairing and resurfacing existing roads, without any widening or realignment and EMP measures will be applied to all works to minimise environmental impacts. Construction-related pollution will only have localised and short-term effects and disturbed areas will be rehabilitated by the contractor. Inspection by the ESSU will ensure that this takes place.

²⁷ Much of the PRC's urban motorbike fleet, which in the past was a major contributor to urban air quality pollution, is now electric only. Most urban areas prohibit the use of petrol powered motorbikes. Other measures are slowly gaining favour across the PRC.

201. **Indirect and Induced Impacts:** There are no significant negative indirect environmental impacts associated with the maintenance activities proposed for this project. Improved roads can lead to increased average vehicle speeds and increased safety risk. Various traffic calming methods, as well as the installation of signs and markings, are proposed for encouraging safe traffic speeds in both urban and rural settings. This will be combined with a community road safety awareness programme.

202. **Cumulative Impacts:** The proposed maintenance work, which will take place within the existing road RoW corridors, is unlikely to trigger any cumulative impacts. The ESSU will, however, examine the timing of other major construction work taking place near the road works (e.g., the gas pipeline construction paralleling the maintenance on G320 and S234 in Ruili) which is currently underway.

203. **Management and Use of Renewable Natural Resources:** Renewable resources used will be mostly aggregate and rock materials plus cement and bitumen for the production of road pavement and related surface treatments. The environmental management of these resources is defined in the EMP. Petroleum products will also be managed according to standards defined by PRC regulations. Refer to EMP measures 2.3.1-2.3.3 and 2.4.2-2.4.3).

F. Environmental Benefits and Enhancements

204. The road maintenance activities proposed will result in benefits for road users and local residents, with the greatest benefits coming from:

- reduced travel times on all project roads;
- dust suppression and better air quality in the road corridor of S211, X214 and short stretches of S321 once all roads and shoulders are paved;
- less flooding due to repair of culverts and drains on G108, G213, S211, and X214;
- reduced vehicle operating costs, reduced congestion and vehicle wear and tear on all project roads;
- safer roads and reduced accidents, due to improved signage, markings, and traffic calming, on all project roads; and
- improvements in public transportation services, which should arise as the quality of roads improves (on at least X214 and S211).

205. A number of support measures are planned (see Appendix 10 of Social Development Action Plan MMM Consultants Ltd, 2012) including community involvement in road safety programs and road safety monitoring. In addition, private transport outfits looking to start services on the improved roads will be given tax waivers and local permit waivers for a fixed period in exchange for a new transport service. Refer to EMP measure 3.3.

206. YHAB will monitor X214 and S211 to assess changes in the provision of public transportation, vehicle operating costs as a result of improved roads and other benefits. The ESSU will complete this survey within the subproject's first operating year. Refer to EMP measures 3.1 and 3.3.

G. Social Sector Impacts

207. **Social Assessment:** Since work periods will be short, only limited direct employment benefits for roadside residents are anticipated. There will be a few unskilled labourer jobs available, and some materials, including food, will be purchased locally. Cooperation between the contractors and local people will be required to minimise access restriction issues.

208. In general, the positive impacts will outweigh the negative ones, since all of the first year roads need improvement. The planned work will reduce travel time and transportation costs, and in

time will lead to better public transport, as operators will be willing to establish expanded service on the improved roads.

209. For further details on social impacts and benefits, please consult Volume C, Social Development Guidelines (MMM, 2012) prepared for this project.

210. **Poverty Impact:** Most of the project roads pass through low income counties (see social survey completed as part of this work). There is a danger that economic hardships could arise in the event of access road closure as this could result in loss of perishable products, missed market days, or make it difficult for workers to get to their places of employment. These people lack access to alternative modes to reach markets and employment or facilities to store goods in the event of road closure.

211. To help minimise this risk, YHAB will hold a meeting with local communities along all the roads where access restrictions, road lane restrictions and/or traffic rerouting is anticipated. They will also post advance warning signs at both ends of the work and also in each settlement area. Signs will define the work, including its boundaries and timetable, as specified in Measure 1.5 of the EMP. Contractors will be required to provide a method statement for minimising access restrictions and dealing with access issues raised by local communities. This document will be submitted to the local community heads, the Maintenance Section in charge, and the ESSU at least one week before work is due to commence. During the works, an inspector will be required to examine this issue daily, and adjust the mitigation measures and inform local residents of any changes, as needed. Refer to EMP measures 1.5 and 2.73. The project performance indicators include an indicator that will assess the effectiveness of access management.

212. As indicated above, the impact on poverty should be positive, since the improved roads will stimulate better public transportation services and reduce travel times.

213. Finally, the contractors will be encouraged to hire at least 50% of their unskilled labour locally, and also purchase food locally whenever possible. Refer to EMP measure 2.7.6.

214. **Resettlement:** Based on the social study completed in July 2012, none of the first year road maintenance will involve any resettlement, or the temporary or permanent acquisition of any land outside existing RoWs.

VI. Environmental Grievance Redress Mechanism

215. YHAB has developed an environmental Grievance Redress Mechanism (GRM),²⁸ which will be readily accessible to affected persons and will be applied to every maintenance project. The GRM has been scaled to the potential risks and adverse impacts of the project. It addresses affected persons' concerns and complaints promptly, using an easily comprehensible and transparent process. The GRM will be provided, at no cost and without fear of retribution, to the affected people. Given the minor nature of the maintenance work, significant grievances are not expected. The GRM process is shown in Figure 4).²⁹

216. YHAB will make certain that the GRM is accessible to varied community members, including vulnerable people such as single mothers, the very poor, the elderly, and youth. YHAB will post their contact information, including addresses, postal codes, emails, hotline numbers and websites at General and Maintenance Section offices located in the capital city or town of each prefecture. They will also consult with affected village committees prior to works to inform them of the GRM, relevant contacts and methods of resolution to maximise accessible to potentially affected persons.

²⁸ The GRM is fully compliant with the PRC's Public Complaints Decree No. 431(01- 2005), and the State Environmental Protection Agency (SEPA) Environmental Complaints Management Regulation (Decree No. 34),

²⁹ This process has been coordinated with the social sector work and is fully compatible

217. The basic grievance redress steps are described below. The ESSU will be responsible for facilitating, tracking and reporting grievance resolution at each step:

Step 1: The affected person should first try to resolve the issue of concern directly with the contractor and the local village committee. A solution must be presented within five days. If successful, no further follow-up is required.

Step 2: If there is no resolution the person can file the grievance with the county office of YHAB, the Maintenance Section or the Prefecture level Office of the General Section. A resolution must be reached within two weeks

Step 3: If no resolution is found the complainant can take the next step and contact the county or prefecture government offices where resolution will be required within two weeks.

218. During loan implementation, all complaints received will be tracked and their resolution fully documented and reported to ADB by the ESSU. The process of documenting the operation of the GRM will include the following elements:

- (i) tracking forms and procedures for gathering information from the contractor/highway section and complainant(s);
- (ii) updating the complaints database routinely;
- (iii) identifying grievance patterns and causes, promoting transparency and information disclosure, and periodically evaluating effectiveness of the environmental GRM, environmental controls, and their implementation; and
- (iv) collecting and submitting input to the quarterly reports from General and Maintenance Sections for inclusion in progress reports for ADB.

219. To ensure that the GRM is effective and accessible, the people living in the project corridor will be made aware of how to use it by the contractor and/or the ESSU.

220. GRM steps and relevant contact details will be distributed to each village head, in the relevant local languages, for posting in the village office.

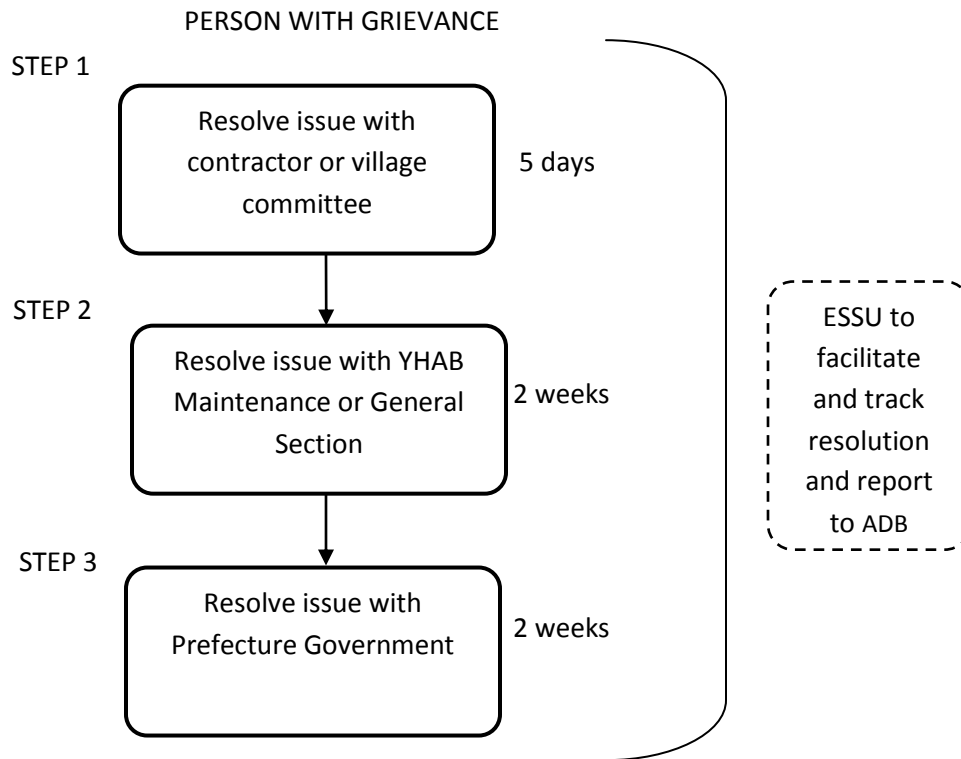


Figure 4. Steps of environmental grievance redress mechanism

VII. Information Disclosure, Consultation, and Public Participation

221. Since all maintenance activities will take place within existing road RoW and eight of the subprojects are considered to be commensurate with ADB environment Category C, the public consultations were scaled down to a less rigorous and more informal interview format. This involved consultation with affected persons along each road during the course of the environmental surveys. These sessions focused on explaining the proposed work and its boundaries and general timing, as well as discussion with roadside residents about potential impacts and benefits. These sessions were led by the consultant, but with participation from representatives of the General Section, Maintenance Section, and local communities. Summaries of the maintenance work to be done and possible impacts were presented orally, and feedbacks were recorded. This approach worked well, as participants were more spontaneous and had little time to provide formulaic answers. Depending on the length of the road section, one to three consultations were completed along each road, each involving 10 to 20 people. The full records of stakeholder and public consultations carried out for each subproject is included in Annex E.

A. Summary of Consultations

222. All those interviewed expressed great enthusiasm, even after hearing the PPTA consultants define the potential adverse impacts that might arise from the proposed activities. The local communities along the highways foresaw the potential of the improved highway leading to a better local economy, promoting people's welfare, living standard, and providing potential short-term employment and income-generating opportunities. Having suffered poor road conditions for a long time, the people living along S211, S321, and X214 in particular indicated strong support for the planned rehabilitation. They believe that the negative impact of the construction activities will be of

a minor nature and of short duration, without any unacceptable environmental consequences. The full record of the consultation meetings is available from YHAB or ADB, on request.

223. The most common concerns identified by the local residents about the potential impacts of the road maintenance are detailed below.

224. **Traffic:** Roadside residents voiced concern that access on the project road could be restricted or temporarily halted while construction is taking place, and that no alternatives would be provided. Generally, the more remote the community was, the more it depended on a road, and the more important this issue was. The traffic management planning, as defined in the EMP measures 2.7.3 and 2.7.5, will address this concern adequately.

225. **Safety:** Some of those interviewed were concerned that operation of heavy vehicles and traffic congestion during construction would threaten the safety of the local people, especially children and the elderly. They suggested that the construction contractor should help relevant government authorities keep the traffic in order, and take special care close to schools, nurseries, and elders' homes. In addition, some roadside residents highlighted the need to strengthen traffic management during days when markets were scheduled, and that the contractor needed to consult with local authorities in order to better mitigate construction period traffic problems. YHAB will ensure that the contractor implements these suggestions through EMP measures 1.5, 2.7.2, 2.7.3 and 2.7.5. The majority of the people asked indicated that they were willing to live with the greater road safety risk during construction, so long as a better road was in place soon and a road safety program is implemented.

226. **Duration of Maintenance Work:** Local residents requested that YHAB and its General and Maintenance Sections minimize the duration of work on any one site, by working longer hours every day until the work is done. EMP measures 2.2.5, 2.3.6 and 2.8.10 address this. Residents are willing to put up with noise at night to get the job done quickly. This should be considered where no alternative access or modes are available to local people and restrictions are likely to result in hardships. Early warning through the posting of signs will also be implemented, as described in the Social Sector Impact section.

227. **Protection of Assets:** Nearly all people consulted expressed concerns about damage to their assets located adjacent to the RoW, including structures, orchards, trees, growing crops, irrigation canals, and water supplies. They felt that great care is needed, and that work area boundaries need to be clearly marked, especially when valuable assets exist at the boundary of the RoW. To that end, the contractors will be required to mark the work areas boundaries with tape and ensure they are maintained and enforced. Refer to EMP measures 2.7.2, 2.7.3 and 2.7.5.

228. **Benefits Transfer:** Many of the people interviewed requested that local income-generating benefits like buying locally or hiring local labour are prioritised by YHAB's prefecture and county offices. YHAB will encourage contractors to hire as large a percentage of unskilled labour locally as possible, and, when possible, to buy food and materials locally as per EMP measure 2.7.6.

229. **Pollution Abatement:** Due to limited environmental awareness in local populations, little interest was expressed about potential impacts on the environment. The few roadside residents who voiced concerns requested that the contractors properly control dust, noise at night near sensitive areas such as residential schools, and manage sewage and solid waste. The orchard owners and flower growers along G108, G213, and S211 complained that heavy dust from the roads had harmed fruit trees and flowers and retarded growth. They predicted much worse conditions during the construction period, and asked that this be prevented. YHAB will address these concerns by enforcing dust suppression measures and implementing EMP measures 2.5.1, 2.5.3 and 2.8.5.

B. Use of Consultation Results

230. Other than the issues of noise and dust, few other environmental concerns were raised during the consultations. Local residents were more focused on health, safety, and economic impacts arising from the construction activity. Many based these concerns on poor past experiences. Taking all consultation comments into consideration, the consultant prepared the following list of actions for YHAB and its General and Maintenance Sections to include in the bid documentation. These measures are also found in the EMP, numbered references are provided. They are:

1. For work requiring the temporary closure or diversion of traffic, at least one lane will be kept open. If this approach is not possible, alternative access routes will be established and traffic will be directed along these routes. Refer to EMP measures 2.7.2 and 2.7.3.
1. Safety and traffic control flagmen will be assigned to busy places such as schools and market areas, to help keep traffic flowing and better protect the safety of vulnerable road users, such as pedestrians. Such 'busy places' will be identified by the Maintenance Sections, in cooperation with community officials. Refer to EMP measure 2.7.5.
2. Construction duration for any work will be compressed, requiring more intense activity over a shorter total time period, resulting in less overall disturbance to local communities. Refer to EMP measure 2.3.6.
3. Despite being confined to the road RoW, construction activities may, in rare instances, be necessary outside the RoW. Where this becomes necessary, the use of land outside the RoW must be planned and agreed with owners of the affected land and properties prior to the start of the construction. This would be coordinated by the ESSU's social sector specialist. Refer to EMP measure 2.7.7.
4. YHAB will encourage contractors to use at least 50% local unskilled labour. Contractors will also be encouraged to buy locally (as feasible, depending on relative costs) such materials as cement, aggregate, rock, and daily necessities for the construction workforce. Refer to EMP measure 2.7.6.

C. Follow-Up Program

231. In order to check the effectiveness of the actions proposed above and in the EMP, public consultation and information disclosure will be continued along S211, X214 and G321 during construction, and for at least six months into the operating period. The consultations will follow the same approach as defined in the EARF and tested in this IEE.

232. YHAB is assigning the implementation of the follow-up consultations and information disclosure to the ESSU,³⁰ as described in Table 10 and EMP measure 3.1.

³⁰ The ESSU was proposed in the project's EARF and will be implemented according to that design as the unit to plan and implement all safeguard issues for YHAB. Pending adequate funding, it will be operational prior to the start of Phase I construction.

Table 10. Future public consultation program for S211, X214 and G321

Organizer	Approaches	Times/Frequency	Subjects	Participants
Pre-Construction Period				
YSRI/ESSU	Questionnaires, interviews, workshops, hotline, e-mails, and website messages	After IEE is disclosed	Project portfolio, environmental effects, public comments and suggestions to the project implementation	Residents alongside the project roads, school teachers, Villager/neighborhood committee.
General and Maintenance Sections & ESSU	Posters, pamphlets, and consultation meetings	Prior to beginning of construction	Explanation of work, project boundaries, timing, and the GRM	
Construction Period				
General and Maintenance Sections assisted by YSRI/ESSU	Household visits and site visits	At least once during construction.	Comments and suggestions on construction impacts, adjustment of mitigation measures if necessary, focus on traffic management and access restriction issues.	Affected persons and Villager/neighborhood committee.
	Workshops and press conferences			
Operational Period				
YSRI/ESSU assisted by General and Maintenance Sections	Interviews, site visits and public satisfaction survey	Between 1 and 1.5 years after start of operating period.	Effectiveness of mitigation measures, comments and suggestions on operational impacts.	Representatives of affected communities and other stakeholders.

VIII. The Environmental Management Plan

233. The EMP is based on the likely impacts of proposed maintenance activities. It describes mitigation measures for the pre-construction, construction and operating period. The EMP covers all subproject roads.

234. The EMP is presented in Annex B, Mitigation Measures Table and Monitoring Measures Table. The third column 'applicable subproject' identifies which EMP measures are relevant to particular subprojects, based on environmental classification and proposed maintenance activities.

235. Each environmental issue and associated mitigation measure is identified by a unique number, which is cross-referenced with a monitoring measure. For example, measure 2.4.1 in the Mitigation Measures Table addresses modifications to surface drainage and is cross-referenced with a measure of the same number in the Monitoring Measures Table, where appropriate monitoring actions are specified. The EMP includes details on where and when actions are needed, as well as who implements and supervises this work.

236. The EMP will be implemented by YHAB, with execution responsibility assigned to the ESSU and a network of General and Maintenance Section staff that will be nominated by YHAB as environment, social and safety focal points. In this way, the ESSU will have local staff available as needed, to assist with co-ordination of environmental assessment work and EMP implementation.

A. Environmental Mitigation and Management

237. **Preconstruction Period.** The pre-construction period is the time to influence the design and establish good practice, thereby avoiding impacts. The value of the environmental assessment process can be undermined if information is not shared with or adopted by relevant parties during the design and bidding stages, a number of common issues are described in the EMP (measures 1.1-1.4).

238. During the planning phase, all environmental assessment documentation will be prepared, and the plan for implementation of environmental management actions defined. By knowing where and what environmentally sensitive receptors exist, and what issues are likely to arise in the future, YHAB will be able to avoid serious impacts by modifying a design, adjusting alignment or switching to more sustainable methods and/or materials.

239. In line with ADB SPS (2009), impacts and risks will be analysed in the context of the project's area of influence. For maintenance projects, this impact corridor is the road RoW, any haul routes established for the work, and any temporary storage areas, usually located within the RoW. All construction materials will be purchased from outside fully licensed suppliers, and no work camps are anticipated.

240. YHAB and the ESSU will ensure that the IEE, EMP, and the EARF are translated and made available to the General and Maintenance Sections. The ESSU will assist YHAB to integrate the EMP mitigation actions into the construction contract specifications. Template contract specifications have been provided in the EARF.

241. **Construction Period.** A major factor leading to serious construction environmental impacts is the lack of experience of contractors in implementing good environmental management practice. The provision of annual contractor environmental training in the use of EMPs and the preparation of a Construction Environmental Work Plan (CEWP) should help to address this problem. A CEWP will be prepared for each subproject, including all measures defined in the general EMP. It will identify mitigation and monitoring actions required in relation to particular construction activities. A template for a CEWP is provided in the EARF. The contractor, with advice from the ESSU will be mainly responsible for implementing the EMP.

242. **Operating Period.** All work proposed for this project will be on existing roads and confined to the existing RoW. All roads are already in operation, and none will see increases in design capacity as a result of the rehabilitation. There will be some increase in the speed of the traffic and potential road safety issues (e.g., G321, S211, and X214). Road and community safety programs will be initiated to address these issues, as previously described. The EMP focuses on mitigation measures related to operating period road safety and traffic diversion onto improved roads running parallel to toll roads.

243. The ESSU working with YHAB and their General and Maintenance Sections will be responsible for implementing the operational mitigation measures as set out in the EMP.

B. Monitoring and Reporting

244. **Environmental Monitoring.** The ESSU will be responsible for environmental monitoring. During pre-construction stages they will confirm that contractors have received environmental training and that all necessary documentation has been translated and distributed to key stakeholders. In particular, they will verify that the construction contract(s) have the requisite environmental clauses and/or references to the EMP included and that contractors have copies of the EMP(s). The ESSU will also be responsible for delivering and reporting progress on training programs for YHAB and their Contractors.

245. During construction, the ESSU will assist contractors with the preparation of a CEWP (see example in EARF Annex 8) for each subproject. The CEWP will be filled in monthly by the contractors to report progress on the implementation of the EMP. The ESSU will undertake quarterly compliance audits of YHAB and their Contractors using a monitoring checklist (see example in EARF Annex 3). The CEWPs and monitoring checklists will inform the quarterly project progress reports and the annual performance and sustainability assessment report that will be prepared for ADB.

246. The ESSU will conduct post-construction consultations to establish the effectiveness of EMP mitigation measures implemented. The issues raised during the IEE consultations will be the focus of these surveys. The results will be used to improve the effectiveness of mitigation measures on future projects, or on the same road if maintenance is repeated in the future.

247. **Project Monitoring.** Within 3 months of loan effectiveness, YHAB with support of the project management consultant will establish a project performance monitoring system which will monitor three levels of information:

- (i) **Project Progress.** The ADB Project Management Office (PMO) will annually monitor annually progress against the indicators and targets set in the project Design and Monitoring Framework. The indicators will be submitted as part of the Quarterly Progress Reports to ADB. They will provide information necessary to update ADB's project performance reporting system.
- (ii) **YHAB Performance and Sustainability.** The PMO will monitor the performance and sustainability of YHAB's road maintenance program. YHAB will carry out annually road network condition surveys. ADB Project Office will collect data and information necessary to prepare an Annual YHAB Performance and Sustainability Report. This will include setting up of new targets for the following year. The report monitors the effectiveness, efficiency, management performance of the program, as well as its social and environmental sustainability.
- (iii) **Subproject Progress.** Information on the progress of each subproject under Outputs 1 and 2 will be monitored by the field offices and reported to the ADB Project Office; information includes: (a) baseline social data, (b) procurement, physical and financial progress, and (c) status of implementation of EMP, Resettlement Plan (RP) and Social Development Action Plan (SDAP). The PMO will update the information on a quarterly basis and report to ADB in the Quarterly Progress reports. Within six months after the completion of a subproject, the ADB Project Office will update social data, finalize physical and financial information, finalize information on the implementation of EMPs, RPs and SDAP, and re-evaluate economic benefits based on new traffic count results.

248. **Compliance Monitoring and Reporting.** Status of compliance with loan covenants will be monitored and reported to ADB in the quarterly project progress reports. This includes compliance with the project Results Agreement, which includes commitments by YHAB and YPDOT in financial, technical, managerial, safety, environment and road safety areas. Status of the implementation of the EMPs, RPs and SDAP will be integrated in the quarterly project progress reports and reviewed during ADB annual missions. In addition, an annual performance and sustainability assessment report will be prepared for ADB which will summarise progress made with capacity development and improved institutional arrangements for maintenance, including environmental assessment, management and training. It will also report on the effectiveness of YHAB and their Contractors in implementing the project including compliance with EMP mitigation and monitoring measures. The information for the quarterly and annual reports will be prepared by the ESSU for the PMO who will report to ADB. The ESSU will also prepare environmental inputs for the project completion report.

249. **Environmental Reporting.** Contractors will complete a Construction Environmental Workplan monthly to record progress with implementation of the EMP. The ESSU will undertake quarterly compliance audits of YHAB and their contractors, evaluate performance against project environmental indicators, and submit a quarterly monitoring report to YHAB. These environmental reports will be included as an appendix in the quarterly project progress report and will inform the annual performance and sustainability assessment report that will be submitted to ADB, as described in Section VIII, X of the PAM. The project team will review the environmental appendix

and disclose it on the ADB website within 14 calendar days of receipt from the Borrower in line with ADB Public Communications Policy (2011). Separate periodic environmental monitoring reports will not be required unless specific environmental issues are identified in the quarterly project progress reports, annual report or during review missions and subsequently requested by ADB. The effectiveness of this system of EMP reporting will be reviewed after the first annual performance and sustainability assessment report has been received and reviewed. The ESSU will prepare environmental inputs for the project completion report, this report will also be disclosed on the ADB website.

250. **Environmental Performance Indicators.** The ESSU will help measure environmental performance against project indicators. Table 11 lists proposed indicators and targets for 2012 and 2013. Targets for subsequent years will be set annually. The indicators will be used to assess the overall environmental performance of YHAB and the effectiveness of prescribed environmental mitigation and monitoring measures in controlling impacts associated with subprojects. A chart showing performance indicator scores for subprojects will be prepared by the ESSU and presented in each quarterly monitoring report submitted to ADB. In addition, YHAB environmental performance will be monitored annually and reported in the annual performance and sustainability report, as described above.

Table 11. Environmental Performance Indicators

Indicator	Units	2012: Target	2012 Actual	2013 Target	Score (%)
Indicators to Monitor YHAB Environmental Performance					
Number of environmental specialists in YHAB ESSU.	#	0	0	1	
% of Medium and Major maintenance works which are classified as Category B works and have EMPs being implemented by Contractor(s).	%	50	0	100	
% of Medium and Major maintenance work with completed Environmental Screening documents.	%	50	25	100	
% of all Contractor(s) working on project with completed CEWPs and/or being effectively implemented.	%	25	0	50	
% of maintenance activities implemented following the Environmental Procedures defined in the EARF.	%	50	25	100	
% of medium and major maintenance works, recycling/ reusing construction materials such as pavement, old concrete, etc.: Recycling 76-100% Recycling 50-75% Recycling <50%	%	50	25	75	
% contractors operating low emission heavy equipment, as defined by manufacturer's specification	%	25	?	75	
% contractors with verifiable environmental safeguards expertise provided on the job as needed	%	100	0	100	
% of completed construction monitoring checklists showing that actual implementation of mitigation and monitoring is more or less in step with what was planned	%	100	?		
Number of Trainees at each annual training session	No.	30			
INDICATORS TO MONITOR SUBPROJECT ENVIRONMENTAL PERFORMANCE					
%of beneficial environmental impacts stemming from maintenance action identified by IEE team and taking place	%				
Number of graduates of the contractor training session work on the subproject	No.	NA	NA	1	
Number of non-compliance occurrences recorded for contractor for subproject	No.	NA	NA	0	
Number of concerns /issues voiced concerning poor traffic management at subproject construction sites	No.	0	NA	0	
Number of occurrences of damage to assets that requires compensation during implementation	No.	0	NA		

IX. Institutional Capacity, Needs, and Proposed Strengthening

A. Existing Conditions

251. Aside from YPDOT's Environmental Unit³¹ in Kunming and the YSRI trainees participating in this PPTA, the technical capacity within YHAB to plan, prepare and implement environmental assessments and EMPs is limited. At the prefecture and county levels, where the work will be done, there is no technical capacity, even in the implementation of PRC environmental assessment requirements. Contractors have little knowledge of environmental safeguard procedures, or experience interpreting and applying EMPs.

252. Since all maintenance work is exempt from environmental assessment under domestic legislation, YHAB has not seen the need to establish in-house expertise until now. The YEPD has this capacity, but there is no established link between YEPD, YHAB, YPDOT, and the General and Maintenance Sections. The problem is compounded by a lack of even the most basic monitoring equipment.

253. At present, YHAB contracts out all its environmental assessment work. YPDOT presently issues EIA work to four consulting firms, who are certified under PRC law to conduct environmental assessments. These firms are:

- Yunnan Institute of Environmental Science, Kunming;
- Environmental Protection Centre of the Ministry of Transport, Beijing;
- Highway Scientific Research Institute of the Ministry of Transport, Beijing;
- and
- China Merchants Chongqing Communications Research & Design Institute Co., Ltd.

254. All four entities have experience working with the PRC environmental assessment process, whilst Ministry of Transport (MOT) affiliated organisations have solid international donor experience, they are based in Beijing.

255. Interviews were conducted with Yunnan University and Kunming University of Science and Technology, and their capacity was found to be excellent, in both the science and application of environmental assessment and management.

256. YEPD in Kunming has the necessary expertise to conduct IEEs and EIAs, but personnel lack knowledge about the comprehensive and detailed EMPs required by ADB. The environmental bureaus at the prefecture level have little training in EIA. The fact that there is only very occasional communication between YPDOT, YHAB, and YEPD does not help in building better environmental awareness within the transportation organizations.

B. Training Required

257. To strengthen environmental safeguard capacity within YHAB, an annual environmental training program will be held annually focusing on the interpretation and implementation of mitigation and monitoring measures as defined in the EMP. The training will be delivered in Kunming and at the prefecture headquarters where first year roads are located. The focus will be

³¹ While this is referred to as an environmental unit it has yet to be confirmed that it has any environmental safeguards expertise.

on contractors and the implementing units of YHAB at the prefecture and county level³². The training will cover the following topic areas:

- i. Understanding and applying international style EMPs
 - The executing and implementing agencies
 - The contractor
 - Others
- ii. Compliance monitoring methods, needed equipment and its use
- iii. Compliance monitoring information analysis
- iv. Enforcement of environmental safeguards
- v. Reporting

258. The training should cover case studies involving the completion of the screening checklist for at least one sub-project road, as well as a field trip to undertake a reconnaissance survey to establish the presence of any sensitive environmental conditions along a road.

259. The training will consist of a number of modules, requiring two days of lectures, plus question and answer periods, a case study exercise, and ample time for discussion.

C. Trainees

260. **General and Maintenance Sections of YHAB, and Contractors:** With the detailed design completed the training will focus on the contractors and the General (Prefecture) and Maintenance (County) Sections of YHAB. Depending on the availability of funds, it may be possible to combine General Sections (e.g., Ruili and Dehong) for one training session at a mutually agreed to location.

D. Training Material and Trainers

261. An international environmental consultant will prepare the environmental training modules. A national environmental consultant will work with the international trainer to translate the modules into Mandarin and deliver the training for first year. The international consultant will provide support for subsequent phases, as needed.

E. Improving Institutional Capacity

262. **Environmental, Social and Safety Unit:** YHAB will set up a new Environment, Social and Safety Unit (ESSU) under its maintenance division, before loan effectiveness. During the Project, the ESSU will have full responsibility for environmental, social and safety aspects throughout the project cycle, they will: (i) develop procedures for road safety audits, consultations, and environmental and social assessment; procedures will apply to new periodic maintenance and rehabilitation works and be implemented by the ESSU; (ii) define standard health, environmental, and safety operating procedures for contractors, and monitoring requirements for supervision consultants; (iii) prepare road safety engineering guidelines; (iv) design and evaluate new safety engineering measures; and (v) routinely monitor its environmental, social and road safety performance.

263. The ESSU will work closely with the YSRI and YHAB design teams in order to maximise opportunities to design-out negative impacts and to design-in enhancements, where appropriate. The institutional framework for environmental management, including the ESSU, is shown in Figure 5 and described in the EARF.

264. The ESSU will at least be staffed by one Environmental Specialist, one Road Safety Specialist, and one Social Development Specialist, who will all be employed full time during project

³² By this time a more detailed training for YHAB and related government agencies will have been complete

implementation. The Environment Specialist will have at least 10 years of experience in environmental management for civil works with extensive experience in preparing environmental assessments and management plans, environmental supervision and delivery of training. The key responsibilities of the Environment Specialist will include: (a) carrying out environmental surveys and assessments of subprojects; (b) assisting in screening and categorizing subprojects; (c) preparing IEEs and EMPs; (d) ensuring that construction contracts include environmental management clauses and adhere to IEE and EMP; (e) advising supervision consultants and contractors on environmental compliance and reporting; (f) carrying out regular audits of civil works, (g) preparing guidelines and procedures for environmental management in YHAB, (h) monitoring against environmental indicators for reporting in the PPMS, (i) preparing and delivering environmental training, and (i) generally coordinating all aspects of the EARF, OM, and institutional development plan related to environment.

265. The ESSU will be fully outfitted with computer equipment (three laptop computers), basic software, a digital camera with Global Positioning System capability, a multifunction laser printer/scanner, and telecommunications equipment (mobile phones). YHAB will ensure that a collaborative working relationship between YPDOT's Environmental Management Centre and the ESSU is in place and designed to share data, technology, and equipment as required. YHAB will provide full-time access to a vehicle and driver, as well as funding for six trips per year per technical specialist to subproject sites to undertake monitoring tasks. YHAB will also formally assign responsibility for environmental, social and safety co-ordination to at least one person in each prefecture. The ESSU would then have a network of people to assist with field work and logistics. An action plan for the establishment of an ESSU, and a cost estimate, are presented in Tables 1 and 2 of the EARF.

266. Before becoming operational, the ESSU staff and prefecture-appointed persons, together with YPDOT, YHAB (including representatives from General and Maintenance Sections), and YSRI will receive training in environmental and social assessment (including resettlement planning and consultation), and in the implementation of mitigation and monitoring measures. The workshop will also address the provision of environmental and social training for contractors, which will take place once contracts are awarded. This will be held prior to the training for contractors. A full road safety training programme is also planned as described in the Road Safety Operational Manual prepared for YHAB as part of this Project.

267. The ESSU will take on the responsibility for updating training modules and delivering training for subsequent phases with support provided by the international environmental consultant, as needed.

F. Costs

268. **Training:** The preparation of the training materials for first year will require three weeks for the international trainer and two weeks for the national trainer. The delivery of the training will require one week each for the international and national trainer. The cost of training for first year is likely to be around USD 21,000 excluding expenses. Training for Phases II-IV will be delivered by the ESSU, with support from the trainers, as needed. The costs of any required trainer support will be covered by the loan under the Project Management Consultancy contract.

269. **Operation of ESSU:** The estimated cost for the establishment of the ESSU (see Table 12) will be USD 60,850, including first year operating and non-reoccurring expenses. For each additional operating year, total cost will be approximately USD 54,850 which will be borne by YHAB. This includes the assessment of subprojects for each subsequent phase (Phases II-IV), preparation of an annual CIEE and EMP for approval by ADB, compliance monitoring and reporting.

270. **Implementation of Pre-Construction and Operational Measures:** The ESSU will be responsible for ensuring that YHAB implement the pre-construction and operational environmental mitigation and monitoring measures, as defined in the EMP. They will be supported by an International Environment Consultant. Two months of support will be provided in the first year and one month of support in each subsequent year, for a total of five months, this is estimated to cost approximately USD 115,000, plus USD 46,700 expenses. An estimate of costs is provided in Table 13. All other costs associated with the implementation of pre-construction and operational measures are included within the estimates made for the annual operation of the ESSU.

Table 12. Estimated costs for ESSU establishment, CIEE preparation and annual operation.

Item	Unit cost	No Units	Estimated Ann. Budget (USD)	One-Time Cost
Non-Reoccurring Costs of Establishment*				
Computers & software	1000	3		3000
Data storage system*	400	1		400
Laser Printer/scanner	600	1		600
Digital camera and GPS facility	800	1		800
Telecommunications equipment	400	3		1200
Total Non-Reoccurring Costs:				6,000.00
Annual Reoccurring Costs*				
1. ESSU Staff 1	5800	1 Year	5800	
2. ESSU Staff 2	5800	1 Year	5800	
3. ESSU Staff 3	5800	1 Year	5800	
3. Administrative support (annual)			Provided by YHAB	
4. Office Operation/Consumables	3500	1 Year	3500	
5. Land transportation costs (fuel/tolls)	5000	1 Year	5000	
6. Field audit trip: airfares	275	18	4950	
7. Field audit trip: per diem	50	200	10000	
8. Driver	4000	1 Year	4000	
9. ESSU Vehicle (full time)	600	1 Year	10000	
Total Annual Reoccurring Costs per Phase			54,850.00	

* Costs estimated based on past experience, but to be verified by YHAB

271. **Construction Environmental Measures:** The Contractor will be responsible for implementing all construction environmental mitigation and monitoring measures as defined in the EMP. It has been assumed that civil works calculations will take into account any associated costs, as specified in the environmental contract clauses (Annex 4 of the EARF).

Table 13. Estimate of Costs for International Consultant Support for ESSU

Item	Unit	No. Units	Unit Price USD	Total Price
International Environmental Specialist	Person			
	Months	5	23,000	115,000
International Air Travel	Flights	5	4,000	20,000
Incidental expenses (visa/home travel)	Expenses	5	300	1,500
Field audit trip expenses; 3 airfares/year to 4 project prefectures plus land transport for one person	Domestic Flight	12	300	3,600
	Land Travel	12	250	3,000
Audit Per diems @USD 150/day	Day	120	150	18,000
Estimate of Cost				161,700

272. Social Development Programs and Resettlement

ent: At the time this IEE was prepared, data on social development costs were not available. They are presented in the social assessment report prepared as part of this project. There was no resettlement of any kind, and therefore no resettlement costs.

273. The ESSU's social staff will be responsible for social development assessment and resettlement and land acquisition planning for Phases II-IV.

X. Implementation Arrangements

A. Roles and Responsibilities

274. Figure 5 illustrates the institutional arrangements of the agencies and units involved in implementing the environmental requirements defined in this IEE and EMP. While the ESSU is several levels below YPDOT, the executing agency, YHAB intends to give it controlling function over environmental and social safeguard matters.

275. **YEPD and EPBs:** The EIA Classification Decree of the Ministry of Environmental Protection (2008) does not classify highway maintenance works as construction projects; hence they are not subject to PRC environmental assessment, management procedures, or approval by YEPD. During the assessment, the local EPBs, representatives of local communities, and other key stakeholders may be consulted through questionnaires and meetings. EPBs will be made aware of the project, the GRM procedures, and will be provided the contact information of the relevant persons to contact within YHAB in the event a complaint is received.

276. **YPDOT:** YPDOT is the executing agency, and has overall responsibility for compliance with ADB requirements, any loan covenants, and contract clauses. YPDOT serves as the leading authority, coordinating with all relevant parties to develop highway maintenance schemes to the required standards.

277. **YHAB:** YHAB is the implementing agency for the project. As such, YHAB will, with the cooperation of General and Maintenance Sections and design institutes, coordinate all follow-up work associated with first year environmental safeguards.

278. **YSRI:** Two professionals from the environmental division of YSRI joined the PPTA team during the environmental assessments of first year works and the preparation of the IEE, EMP, and EARF in order to gain experience and capability to assist with the first year environmental assessment and the implementation of environmental safeguard measures defined in the IEE.

279. **ESSU:** The ESSU will be established to manage all Phases. The ESSU's environmental specialist will lead the environmental assessment and management activities for further first year work. The ESSU and the designated YHAB prefecture focal points, in co-ordination with provincial offices of YHAB and YSRI, will undertake the preparatory works and undertake or coordinate all other work necessary to implement environmental requirements as set out in the EARF, IEE and EMP. The ESSU, in co-ordination with the General and Maintenance Sections, will monitor the day-to-day environmental mitigation and monitoring tasks undertaken by the contractor and contribute to quarterly project progress reports.

280. Design changes and adjustments to methods proposed in the IEE to minimise environmental impacts will be reviewed and confirmed by YPDOT/YHAB³³ and ADB. Standardized environmental clauses (see Annex 5 of the EARF) will be added to construction contracts. The EMP has been priced so environmental costs can be added to the bill-of-quantities. That cost item

³³ The IEE is a YHAB document; the consultant facilitates its preparation. Once YPDOT/YHAB endorses the IEE, it becomes a binding agreement between YPDOT/YHAB and ADB.

will be withheld if non-compliance is reported. YHAB (through the ESSU) and the General and Maintenance Sections will encourage close cooperation of communities along the highway segment to encourage compliance with EMP requirements.

281. **Contractor:** For maintenance work, the success of environmental mitigation depends largely on the contractor doing what is specified in the EMP and/or the environmental clauses in the contract.

282. **ADB:** Once loan disbursement begins, the ADB will review implementation and assess performance against indicators (see Table 11 for proposed environmental indicators.) YHAB will submit quarterly project progress reports to ADB, these reports will be used as the basis for the periodic performance review, review missions, and special audits. Separate periodic environmental monitoring reports will not be required unless specific environmental issues arise and are subsequently requested by ADB. The ESSU will address compliance with the EMP and any other environmental clauses with support from the International Environment Consultant and ADB, as needed. If non-performance issues arise, ADB has the option to control loan disbursement.

B. Implementation

283. The ESSU, with close participation of the General and Maintenance Section staff assigned to help co-ordinate environmental, social and safety aspects, will play a central role in the implementation of environmental mitigation and monitoring actions.

284. The implementation of the EMP will begin as soon as the IEE document has been approved and the preparation of the bid documentation begins. The implementation and monitoring will continue throughout construction, and six to twelve months into the first operating year. Since maintenance work is not covered by PRC's environmental legislation, YEPD and its local units will be informed of projects but will not be directly involved unless invited, or if serious environmental impacts are brought to their attention and they investigate.

C. Approvals and Follow Up

285. After the IEE has been completed, it will be reviewed by YHAB, YPDOT and ADB. The document will then be revised by the PPTA consultant, and a final report completed. This final document will be endorsed by the government and ADB, and ADB will disclose the report on its website.

286. After the project IEE has been approved, the environmental training workshop will be conducted; this should significantly raise the environmental capacity in environmental assessment and management within YHAB and related organisations.

287. The template environmental clauses provided in the EARF will be used to write a relevant set of clauses for the bid documentation. The ESSU will help contractors to prepare CEWPs based on the clauses and/or the EMP.

288. Contractors will also attend training on the implementation of the EMP, the interpretation of the environmental clauses, completion of monitoring and reporting.

D. Adjustments and Feedback

289. If the ESSU and contractors are preparing the sub-project EMPs and new information comes to light or unforeseen changes are needed, adjustments to the defined mitigation and monitoring are possible. The ESSU needs to present the change and justification to YHAB and ADB for agreement. At the same time the IEE and EMP can be adjusted based on feedback received from residents or businesses in a subproject's corridor of impact, or interested government and community agencies. Such adjustments will be considered by YHAB and ADB based on a

justification statement. If some measures are not working or cannot be implemented, the contractors can also provide feedback on the effectiveness of the mitigation actions proposed and seek adjustments to their tasks with the ESSU and YHAB.

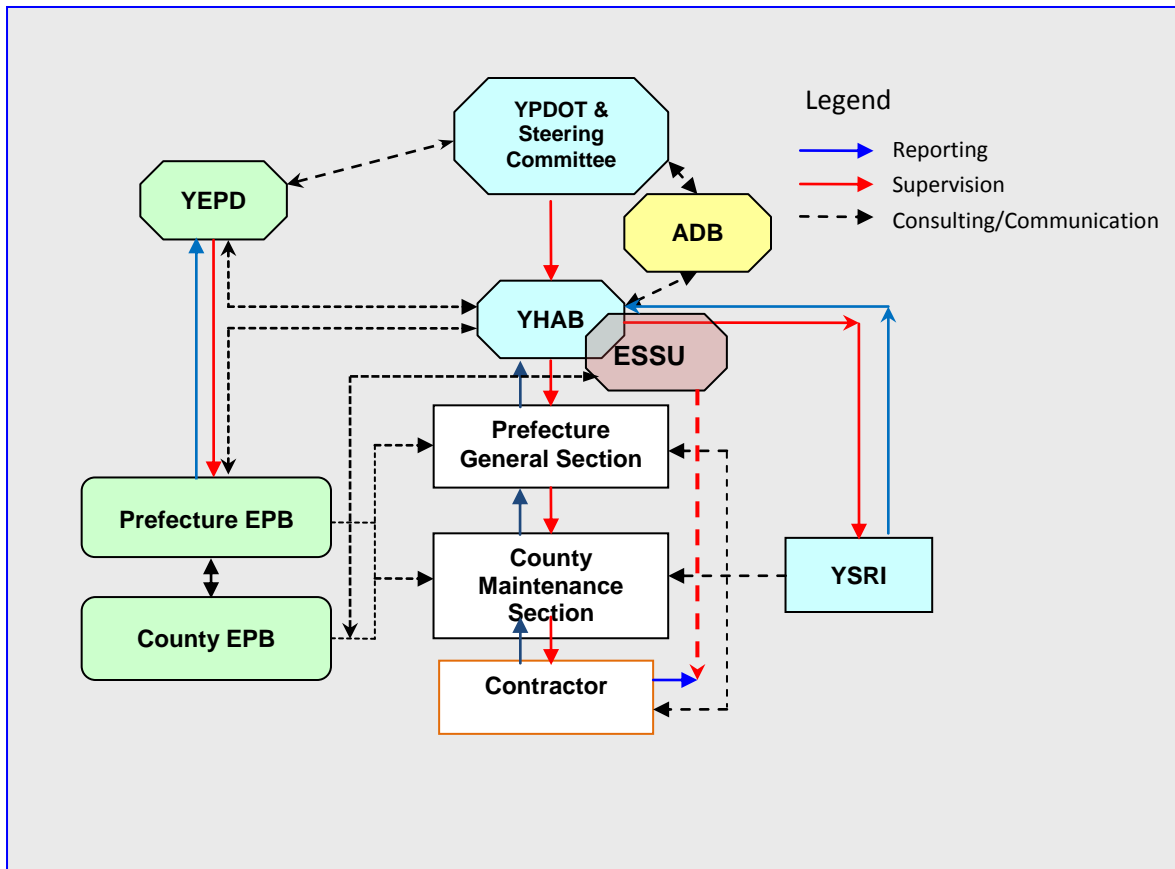


Figure 5: Institutional Arrangements for Environmental Management for Project

XI. Conclusions and Recommendations

290. The Project is classified as environment Category B since there will be limited, generally site-specific impacts that are largely reversible and that can be readily addressed through mitigation measures. This Initial Environmental Examination (IEE) and Environmental Management Plan (EMP) have been prepared for first year maintenance works. first year covers 10 road sections, associated with nine subprojects in six prefectures, of a total length of 276 km.

291. The first year works are expected to have generally minor, localised negative impacts that are temporary in nature. The work will be confined to the existing road RoW, and will be undertaken on fully operating roads with traffic volumes ranging from several thousand to over fifteen thousand vehicles per day.

292. The impacts will include short episodes of increased noise and dust pollution during a few concentrated activities, such as the operation of the pavement milling machine on G320b. The repair of the Ruili River bridge deck will be the only work over water. All culvert work will be no less than 500 m of any watercourse, so surface water contamination is not considered significant, provided that methods defined in the EMP are applied. There may be minor surface drainage channel alterations (e.g. X 214) during the work, but these will be fully restored to prevent erosion or flooding.

293. There will be no drilling or blasting, and no known groundwater recharge areas will be affected; therefore, groundwater aquifers will not be impacted. No environmentally sensitive or culturally significant areas will be disturbed. There are no ecologically sensitive areas within 2 km of any of the first year roads.

294. A method for screening the environmental impacts and risks associated with proposed maintenance subprojects was developed. This method was used to screen the nine proposed subprojects. Roads S211 and X214 are considered to have environmental impacts and risks commensurate with ADB environment Category B. Due to lack of previous maintenance and intensive use by heavy vehicles, road reconstruction, including three major concrete culverts will be needed for these two roads. The other seven subprojects are considered to have environmental impacts and risks commensurate with ADB environment Category C. The EMP mitigation and monitoring measures address all subprojects.

295. Environmental clauses based on the templates provided in the EARF will be included in contracts for first year works to ensure that Contractors include costs and resources in civil work estimates for implementing environmental mitigation and monitoring measures associated with the works.

296. Prior to loan effectiveness, YHAB will set up a new unit, the ESSU, under its maintenance division. This unit will provide training and guidance on environmental, social and road safety assessment, management and monitoring for YHAB periodic, maintenance and rehabilitation works.

297. The implementation of this IEE and EMP will be supported through annual training and through ongoing guidance from the ESSU and International Environment Consultant. Training will help improve the environmental capacity of YHAB and its contractors and help ensure that the risk of environmental impacts during the proposed maintenance works are minimised and opportunities for environmental benefits are maximised.

298. The maintenance work will have a number of important benefits, as expressed by roadside residents during the public consultation program, including: reduced travel time to markets and services; improved public transport due to the attraction of providers to an improved road network; and significant reduction of road dust, resulting in less crop damage and fewer respiratory

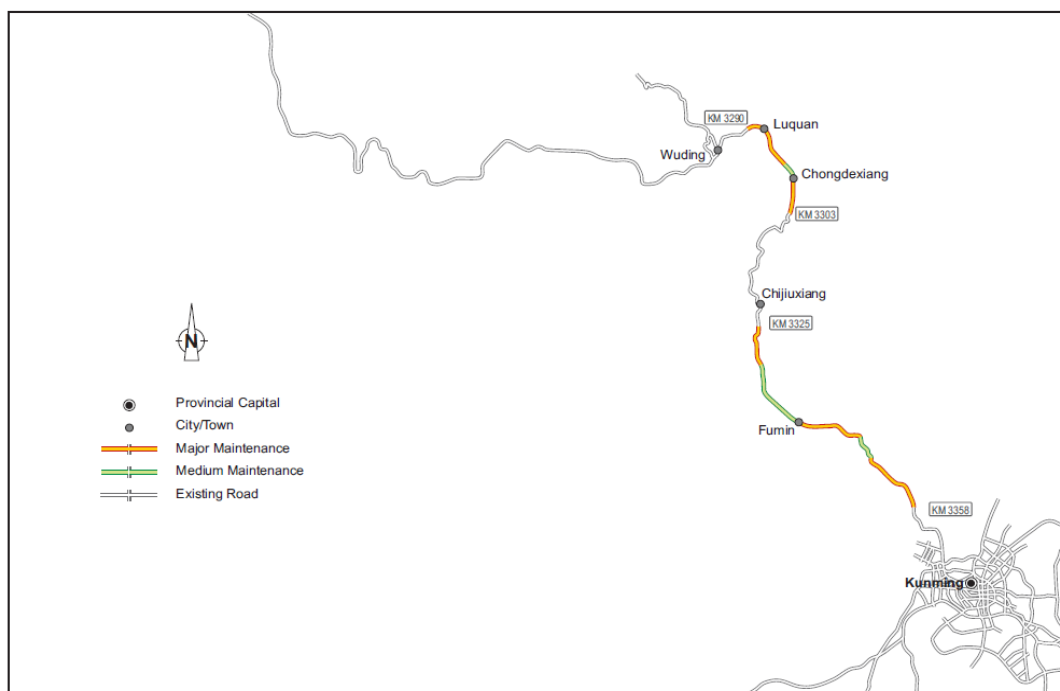
problems. With a significant road safety program targeting roads and communities, improved safety on subproject roads passing through urban areas is also anticipated.

299. This IEE and EMP provides YHAB with a comprehensive assessment of environmental impacts associated with all 10 subproject roads proposed during first year and sets out all necessary environmental management measures for design and implementation. No further surveys or studies will be required for first year subprojects as long as there are no major changes in the type and location of maintenance activities proposed.

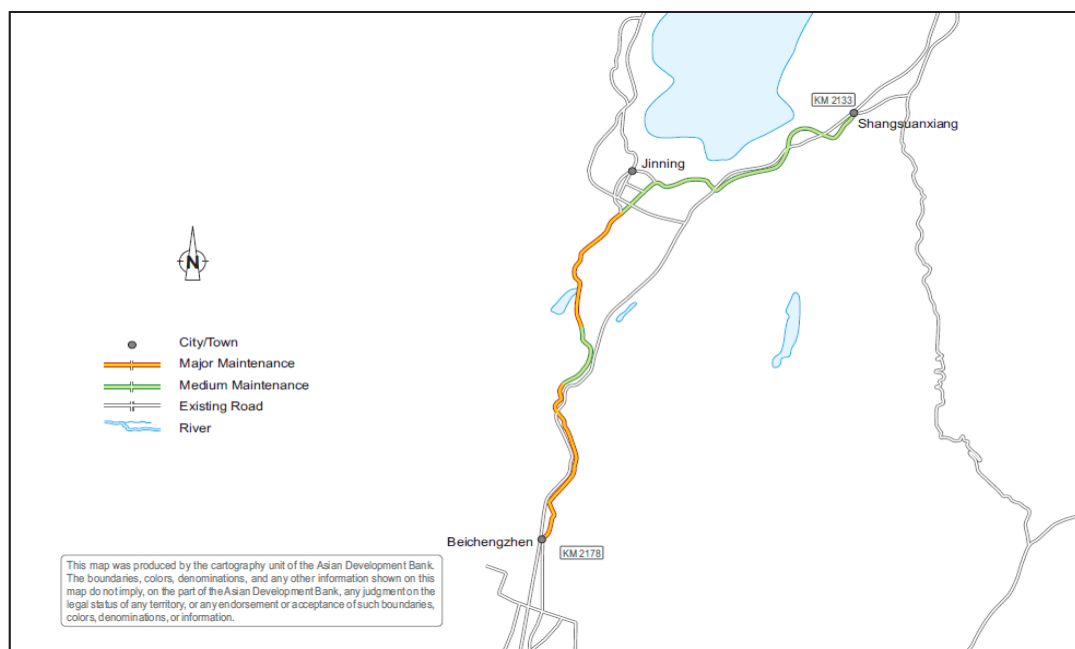
ANNEXES

- Annex A: Maps of Project Roads
- Annex B: Table 1-Environmental Management Plan: Mitigation Measures Table
Table 2-Environmental Management Plan: Monitoring Measures Table
- Annex C: Likely Impacts and Mitigation Measures for Road Maintenance Activities on Phase I-IV Subproject Roads
- Annex D: Examples of Bioengineering Methods
- Annex E: Records of Stakeholder and Public Consultation

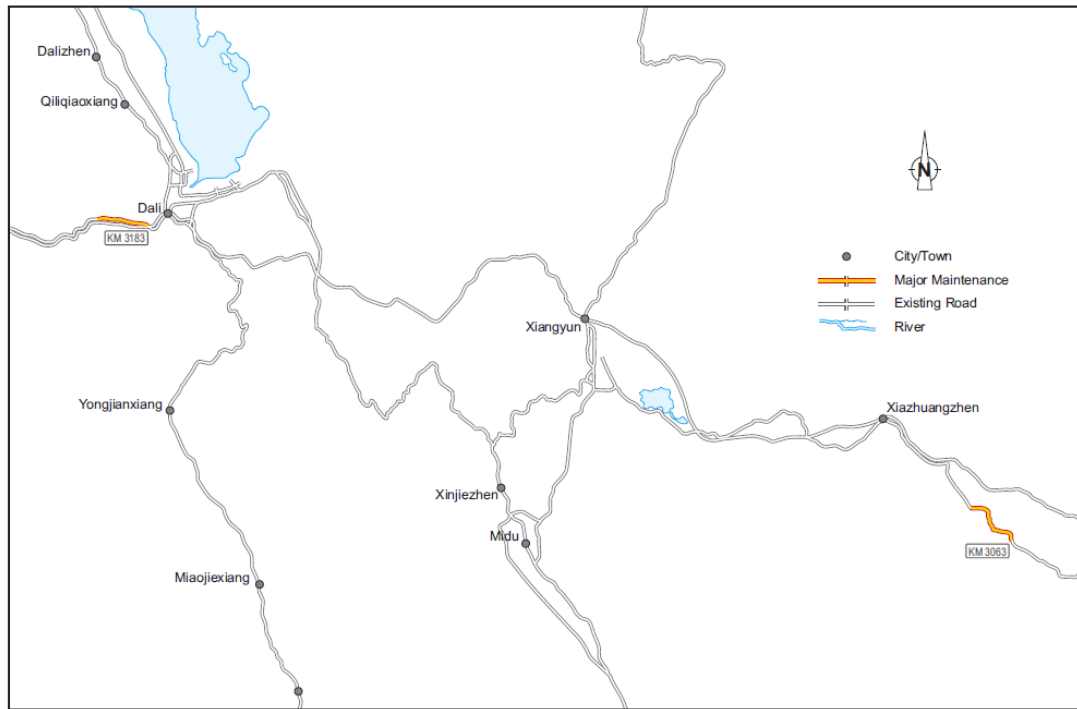
ANNEX A: Maps of Project Roads



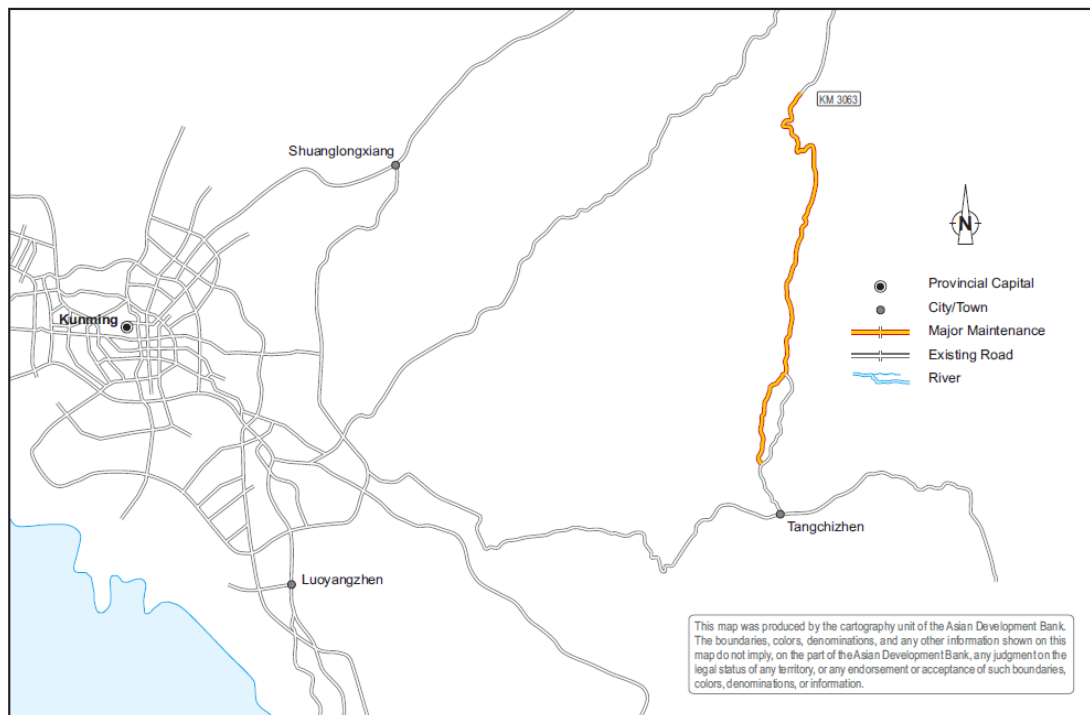
National Highway No. G108



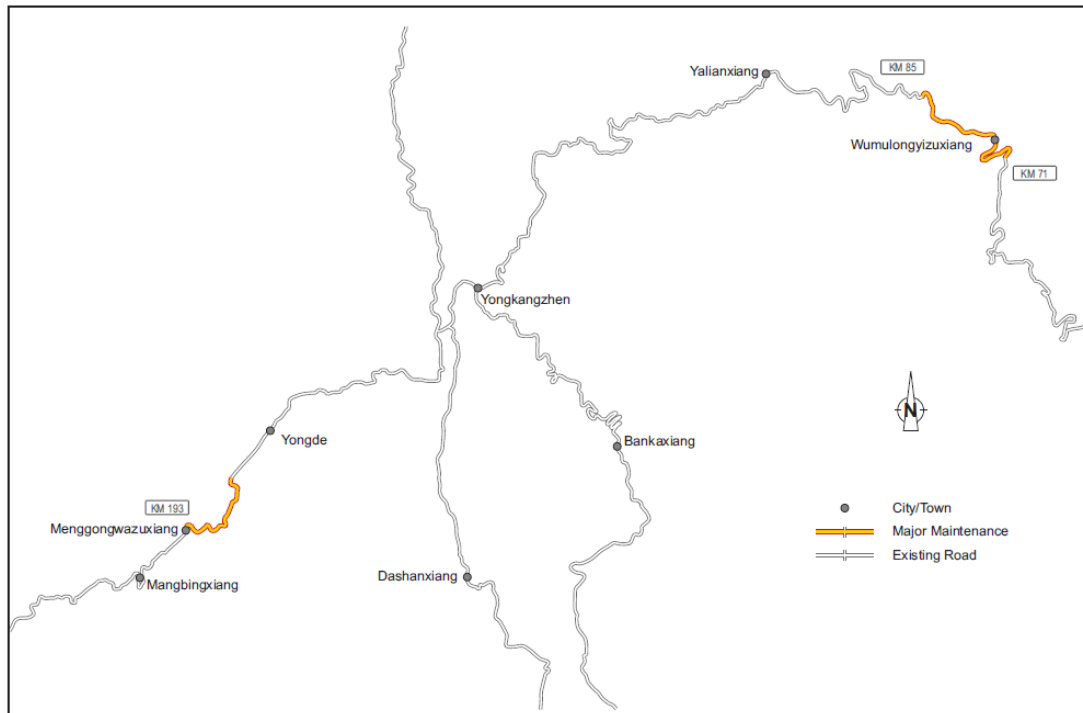
National Highway G213



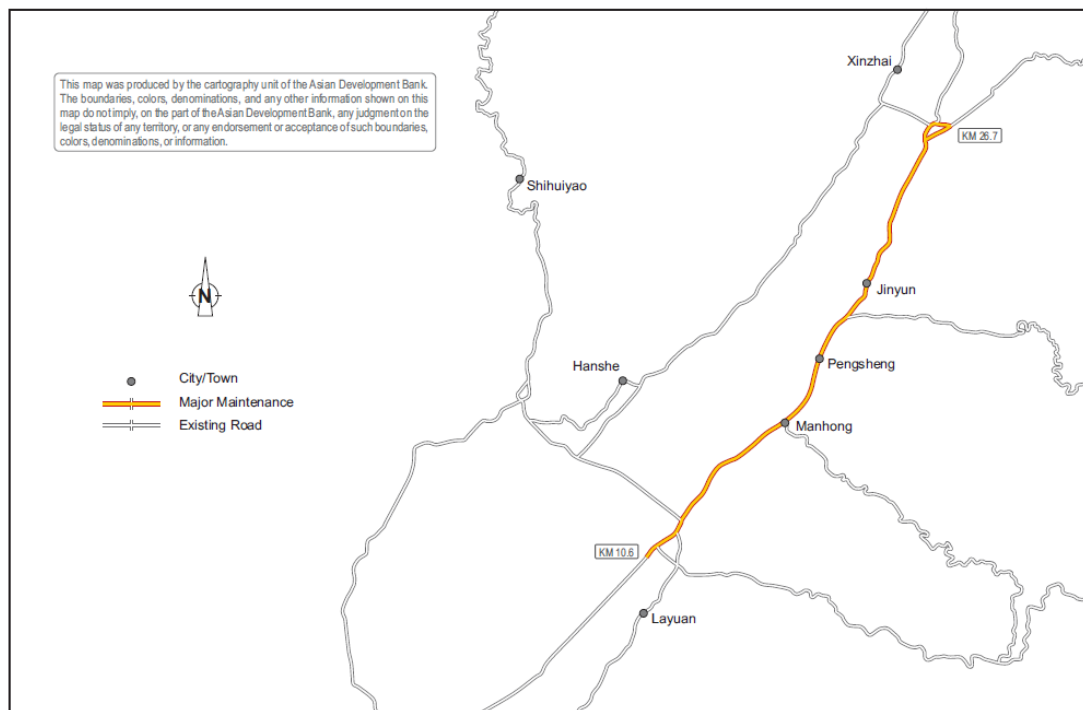
National Highway G320a



Provincial Highway No. S211



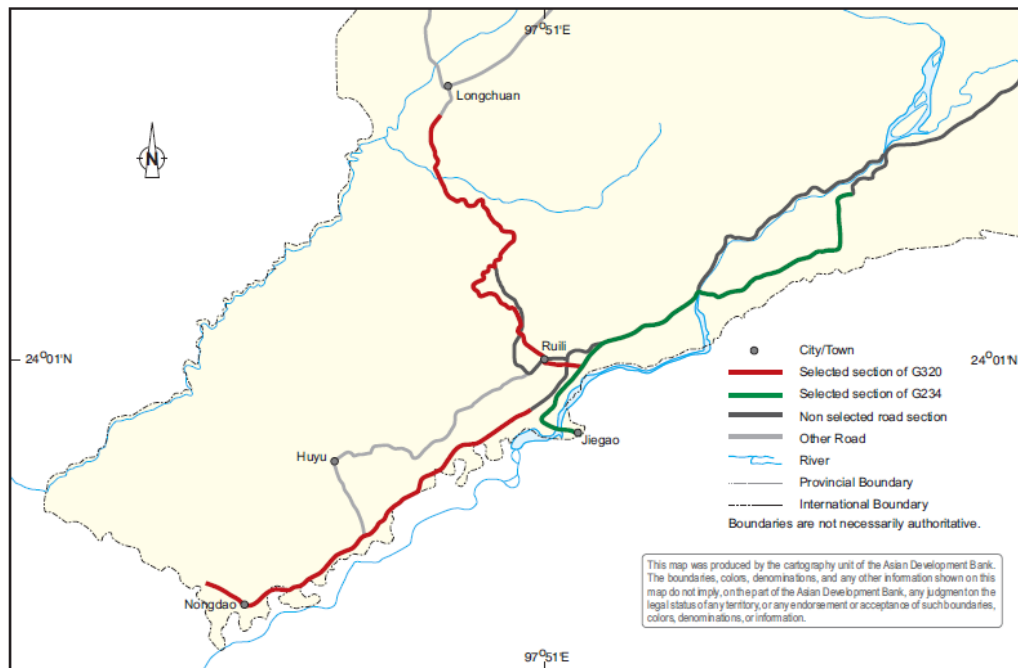
Provincial Highway S321



Prefecture Highway No. X214



National Highway G 323



Provincial Highways No. G320b and S234

ANNEX B

Environmental Management Plan (EMP): Mitigation Measures Table

Mitigation and monitoring are applicable to all subprojects. The two tables that follow, Mitigation Measures Table and Monitoring Measures Table, comprise the EMP. Column three of each of the tables links a subproject to specific mitigation and monitoring measures. Most of the measures apply to all subprojects, while a few only apply to particular categories of sub-project or to sub-projects with specific issues related to a particular maintenance activity or the environmental baseline conditions. Implementation and supervision responsibility is defined in the last two columns of the tables.

As described in Section E-Costs, pre-construction and operational costs associated with implementation of mitigation and monitoring measures will be the responsibility of YHAB. Construction costs of implementation of mitigation and monitoring measures will be included in contractor civil work estimates, this is clearly defined in the environmental clauses for all contracts.

Environmental Issue	Mitigation Measures	Applicable Subproject	Location ²	Time Frame	Responsibility	
					Implementation	Supervision
1. PRECONSTRUCTION PERIOD						
1.1 Lack of environmental technical capacity within YHAB and its General and Maintenance Sections in environmental assessment and design, management, supervision and reporting.	1.1 YHAB will establish a unit, the ESSU, to manage environmental, social and safety aspects of maintenance projects. The ESSU will be staffed by 3 full-time suitably qualified people. ADB will support international and national environmental consultancy services to develop and deliver a 5-day environmental assessment and management training workshop for YHAB staff and a 2-day workshop for first year Contractors.	All Subprojects	Headquarters of the General Sections involved	ESSU will be established prior to loan effectiveness. YHAB training will be completed during detailed design and prior to bidding. Contractor training will be on appointment.	YHAB	YHAB
1.2 Translation of IEE, EMP, contract clauses and other templates for use by General and Maintenance Sections,	1.2 ESSU will provide the design team with translated copies of IEE, EMP and templates and check relevant clauses have been included. YHAB/ESSU will provide the successful contractor with translated copies of IEE/EMP and assist contractor to prepare the Construction Environmental Work Plan (CEWP). General Section will provide the Maintenance Section site engineer with the IEE, EMP and other templates for use in their inspection process. Given the uncertainty of inspection qualifications , the workshops as defined above will be held at the six General Section offices	All Subprojects	As part of 1.1 Workshop will be held in General Sections	Translate during detailed design stage and provide instructions prior to contractor field mobilization. To be determined	ESSU	YHAB
1.3 Consideration of IEE/EMP in preparation of the detailed design and bid documents.	1.3 ESSU will check that design and bid documents are responsive to key environmental, social and safety considerations.	All Subprojects	NA	Before the bid documents for Section 3 and 6 contracts are completed	ESSU	YHAB
1.4 Optimise design and planning of works to minimise impacts	1.4 During detailed design YHAB will incorporate mitigation measures defined in the IEE as follows::	Category B X214 S211	1. At any locations where mature trees will be cut down 2. At all sites along	Design and implementation planning for subprojects	ESSU, YSRI	YHAB

Environmental Issue	Mitigation Measures	Applicable Subproject	Location ²	Time Frame	Responsibility	
					Implementation	Supervision
	1. minimize the removal of mature trees from roadsides; 2. optimise traffic management to minimise access restrictions 3. provide step-by-step guidance on environmentally acceptable bridge and culvert replacement methods	Category C S321	an existing road 3. N A			
1.5 Announcement of subproject with road signs	1.5 Four weeks before work begins announce the project on roadside sign(s), at a location(s) easily accessible by the public. Signs should be presented in a language that can be understood by affected people, in Yunnan, there may be a need to provide signs in multiple languages. At the same time, provide information on the construction activity via the Maintenance Section	All Subprojects	At both ends (boundaries) of the project	3-4 weeks before the start of work	Maintenance Section	General Section
2. CONSTRUCTION PERIOD						
2.1 Preparation of Environmental Documentation						
2.1.1 Technical environmental capacity of Contractor to prepare the CEWP and to implement all mitigation and monitoring measures	2.1.1 Contractor team will include a specialist with environmental assessment experience to prepare the CEWP and obtain all relevant permits. The contractor will not be permitted to mobilize the workers without an approved CEWP and the appropriate permits in place.	Category B X214 S211	NA	Prior to the start of the construction work.	Contractor	ESSU/ YHAB
2.2 Soils, Earthworks & Erosion						
2.2.1 Management of earthworks transport and Storage procedures, including cleaning; leading to dust and air pollution	2.2.1 Large volumes of crushed quarry rock, aggregate and sand may be transported to and/or stored in the work site. These operations and storage areas will be constantly exposed to the elements and will create primarily dust during the frequent windy conditions, and some silty runoff. Dust will be managed by daily use of watering trucks, subject to availability of water. All topsoil needs to be collected, stored and reused to rehabilitate/revegetate the areas disturbed. This is applicable only to projects with IEEs	Category B X214 S211 Category C X212 G 323 G320a	Anywhere where there is material moved, earthworks cutting and filling	Throughout the construction period	Contractor	ESSU/ YHAB
2.2.2 Erosion control and slope stabilization, risk of land slip and chronic erosion at cuts and water crossings.	2.2.2 Contractor will be required to know the subsoil materials that are being cut into and excavated and have ready appropriate plans to stop land slippage and erosion,. At water crossings where structures are to be upgraded, careful replacement and use of gabions with culverts and bioengineering methods for rapid revegetation and slope stabilization will be used. Bioengineering approaches to be explored as described in Annex D.	Category. B X214 S211	Based on an analysis of soil conditions by contractor and consultation with the General Sections hydrology and geotechnical expertise	Throughout the construction period	Contractor	ESSU/ YHAB
2.2.3 Slope slippage and landslide zones left unaddressed	2.2.3 In any road sections where maintenance takes place and where there is a history of landslides and slope slippage, the contractor will be required to report any such conditions (if not already known) to the Maintenance Section and propose a costed remedial action, then undertake this work to stabilize the road and reduce risk of failure; including bioengineering solutions, metal netting and other proven methods.	Category B X214 S211 Category C G323 S321	Roadsides	Prior to the start of maintenance work in that road section	Contractor	ESSU/ YHAB
2.2.4 Risk of erosion, landslide	2.2.4 Any need for borrow material outside of the RoW will be subject to	Category. B X214 S211	Along any stretches where road will be raised and fill is	Throughout the construction period	Contractor	ESSU/ YHAB

Environmental Issue	Mitigation Measures	Applicable Subproject	Location ²	Time Frame	Responsibility	
					Implementation	Supervision
and destruction of landscape from side borrow operations	local environmental approvals and procedures and should also be carried out in consultation with ADB. Bioengineering approaches should be considered.	Category. C G108 G323 S321	needed, particularly in areas with long visual distances			
2.2.5 Side casting of waste by Contractor degrading down-slope area and blocking/ contaminating water body	2.2.5 Side casting of waste earthen materials is not permitted where slope is more than 5% and a side cast waste materials cannot be easily stabilized and prevented from eroding during a rain event, or extend outside the road RoW.	All Subprojects	On all Project Roads	Throughout construction	Contractor	ESSU/ YHAB
2.2.6 Handling of contaminated construction waste materials	2.2.6 When encountering contaminated materials or it is a construction waste, contractors will follow PRC national and provincial requirements, consulting with EPBs if needed	All subprojects	Where existing road materials are to be excavated	Throughout construction	Contractor	ESSU/ YHAB
2.2.7 Inappropriate disposal of spoil from construction work leading to contamination	2.2.7 Contractors will be required to a) attempt to recycle all clean spoils material where possible and b) consider composting or b) dispose of all other material at sites approved by the local EPB.	All Subprojects	On all Project Roads	Throughout construction	Contractor	ESSU/ YHAB
2.3 Poor Contractor Operating Procedures						
2.3.1 Failure to adhere to construction related good housekeeping practices, including solid and sanitary waste management	2.3.1 Contractors will adhere to standard good housekeeping practices as defined in the contract Terms & Conditions and Contract Specifications. Special considerations will be given to 1. management of construction waste and water 2. equipment lubricants and fuel, including management and collection of waste oils and fuel particularly related to refuelling depots, maintenance areas and diesel generator sets 3. Sewage will require latrines or chemical toilets with complete clean up after the construction is complete. 4. Garbage will be collected and properly disposed of after recycling and sorting. This work will be completed in accordance with PRC, regulations and standards which the contractor will be expected to know. Also, the contractor shall orient all construction workers in basic sanitation and health care issues, and on the specific hazards of their work and will need to certify to that effect at the start of the construction period. 5. Once the site is no longer needed the contractor must fully decommission it, with special emphasis on waste removal and clean up of any spills or hazardous materials plus any necessary revegetation.	All Subprojects	All work sites, construction maintenance yards and any other areas operated by the contractor and involved in the project	During the construction period	Contractor	ESSU/ YHAB
2.3.2 Management of bitumen storage, asphalt, sealcoat and concrete production facilities to avoid leakage, dust and air pollution for community in vicinity	2.3.2 YHAB has indicated that no new facilities will be needed, but for smaller jobs bitumen will be stored at the worksites. Under these conditions, the contractor will be required to provide secure locations for storage, handling and safe disposal of any worksite bitumen supplies. PRC's hazardous materials handling regulations (as defined in IEE, Section II) will be adhered to.	All Subprojects	At any bitumen storage and heating areas	Throughout the construction period	Contractor	ESSU/ YHAB

Environmental Issue	Mitigation Measures	Applicable Subproject	Location ²	Time Frame	Responsibility	
					Implementation	Supervision
2.3.3 Management of petroleum products such as fuel, lubricants and bitumen to avoid spill and contamination.	2.3.3 Contractor will be required to have the following spill prevention measures in place at all work sites: <ol style="list-style-type: none"> all fuelling to be done on a concrete surface provided with spill catch surfaces that can be cleaned and all spilled fuel recovered and recycled based on discussions with fuel supplier. All repair and maintenance work must either be done on a concrete surface with oil spill catch basin or oil catch pans must be provided at all service areas and training provided to all 'mechanics'. All fuel use areas where spills and leakage is possible, e.g. the generator, must have drip basins installed to prevent any leakage. These recovered materials must be recycled. A fuelling areas must be equipped with proper non-drip fuel nozzles All fuel tanks must have means for containment of accidental spills. All bitumen handling must not permit any material from leaking to the ground, including transfer areas and any areas where bitumen is transported in drums. Bitumen drums must be stored in a dry covered secure place where no leakage to water or ground is possible. Drums must be recycled at least once a year. Any spills must be cleaned up and contaminated soils and water treated according to PRC regulations and standards within 24 hours of the occurrence. 	All Subprojects	At any work camps, maintenance yards and any other areas that the contractor uses or subcontractor use during the construction period	Throughout the construction period	Contractor	ESSU/ YHAB
2.3.4 Overloading of construction vehicles leading to damage to existing roads	2.3.4 The tonnage of material hauled must not exceed the road capacity. If the material mobilization causes damage of the road, then contractor must repair it immediately.	All Subprojects	All materials haul roads	At all times	Contractor	Maintenance Section
2.3.5 No or inadequate consideration for recycling and reuse of construction 'wastes' by the contractor	2.3.5 The contractor will need to demonstrate that an attempt has been made to reuse, recycle, convert by composting construction wastes such as asphalt, wooden materials, plant materials and other benign organic matter	All subprojects	At construction sites where spoils exist	Throughout construction	Contractor	Maintenance Section
2.3.6 Work Duration	2.3.6 Contractors will be encouraged to complete the work as quickly as possible, consulting with local communities on best timing and agreeing to such a timetable	All subprojects	All construction sites	Throughout construction	Contractor	Maintenance Section
2.4 Surface Water, Drainage and Water Pollution						
2.4.1 Modification of surface drainage during culvert and bridge replacement and/or raising of horizontal road alignment	2.4.1 When modifying or interfering with surface drainage of any sort the contract will have to undertake the following: <ol style="list-style-type: none"> All culverts must be sized at or larger than the one being replaced and with care about slope and erosion protection at inflow and outflow. All construction materials at the entrance of culverts must be removed so as not to provide any obstruction. Culvert removal and replacement will be done when there are low flows or no water in the channel and during the dry months of the year. Confirm culverts are clear of debris on 	All Subprojects	1. At all existing culvert sites and where new culverts are specified in the design drawings	Throughout the construction period	Contractor	ESSU/ YHAB

Environmental Issue	Mitigation Measures	Applicable Subproject	Location ²	Time Frame	Responsibility	
					Implementation	Supervision
	<p>completion.</p> <p>2. Bridges will be repaired and widened and as such there will be machinery at least at the water edge. Maximum care is needed to avoid degradation of the river, stream shore and to undertake excessive excavation at the shore and in the water (at least not when there is water in the stream). Demolition must be done in a way that prevents large chunks of material from falling into the river. Stabilization of disturbed crossing banks must take place as part of the construction work and include filter fabric, gabions and preferably bioengineering techniques.</p> <p>3. Where horizontal alignments are raised to reduce flooding, extra care is needed to ensure that all drainage channels convey water properly. The contractor must undertake a surface drainage inventory of the future raised road sections, identifying where there will be new culverts or where existing culverts need to be replaced or relocated. This inventory needs to be submitted to the supervising engineer.</p> <p>4. When modifying the existing drainage system through culvert replacement, the contractor must minimize flood risk by carefully confirming that all works to be undertaken will not flood roadside properties due to improper design or construction practices. The contractor will be required to fully rehabilitate property damaged due to flooding.</p>		<p>2. At all bridges which will need widening and repair</p> <p>3. Along any road sections where vertical alignments are to be raised via the addition of fill material and where the draining system is to be modified.</p>			
2.4.2 Management of contaminated construction wastewater	2.4.2 Where drainage from a construction site involves more than 20 linear meters of roadway, a drainage channel into a grassed area of some detention area allowing an suspended sediment and minor contaminants to settle, must be prepared by the contractor(s).	S211 X214	All construction sites where silt runoff is possible	Throughout the construction period	Contractor	ESSU/ YHAB
2.4.3 Fuel storage for generators powering the asphalt plant, aggregate preparation plant, and for vehicles and avoidance of leakage of hazardous materials into surface and groundwater.	2.4.3 All fuel storage sites must be checked daily for leaks and held in an impervious site where spilled/leaking material can be collected.	All Subprojects	All Storage and handling sites	Daily check	Contractor	ESSU/ YHAB
2.4.4 Air pollution	2.4.4 TPM, SO2 and NO2 will be monitored once a month. Two samples will be taken (one during the morning traffic peak, and one when construction has stopped for the day) at each of six stations along the road.	G320a, X214, S211 and S 321	Two samples will be taken (one during the morning traffic peak, and one when construction has stopped for the day) at each of six stations along the road.	Monthly cycle for 4 subproject roads	Contractor or retained specialist consultant	ESSU/YHAB
2.5 Air and Noise Pollution						
2.5.1 Construction-period air pollution	<p>2.5.1 Emissions will be kept to a minimum by:</p> <ol style="list-style-type: none"> ensuring that the contractor's fleet of vehicles are properly maintained according to manufacturers specifications; and use acceptable fuel and haul loads within specified limits. Vehicle idling time limits to no more than 2 minutes and equipment maintenance specifications will be imposed 	<p>Category. B S211 X214</p> <p>Category. C S321 G213 X212</p>	Anywhere at construction sites where vehicles of the contractor or under the contractors control, such as subcontracted trucks and hauling materials	Throughout the construction period	Contractor	ESSU/ YHAB

Environmental Issue	Mitigation Measures	Applicable Subproject	Location ²	Time Frame	Responsibility	
					Implementation	Supervision
	<p>through construction inspection and regular reporting,</p> <p>5. Dust control at the construction site will be particularly stringently controlled by watering, setting strict speed limits of no more than 30kph in or near settled areas, and sweeping of paved haul roads.</p> <p>6. Equipment such as the diesel generator will be included in the emission control program and will be and regularly tuned to prevent excessive TPM pollution.</p>					
2.5.2 Dust and noise from road milling machine	2.5.2 Due to respirable silica dust from cutter heads, contractor needs to have water spray nozzles on milling machine a) directed at the point of cutting and the drum, one nozzle every 30-40 cm and b) nozzles along the conveyor on both sides every ½ meter. Avg. water flow should be around 24L/min. Alternative is to provide dust masks to all operators and workers supporting the milling operation	G320b S321	At any site where asphalt milling to take place	Prior to start of any milling work	Contractor	ESSU/ YHAB
2.5.3 Managing dust, noise and drainage associated with earthworks and haul roads.	2.5.3 Mitigation will involve <ol style="list-style-type: none"> enforcing a speed limit of 30 kph within 500m of any village and the use of chemical dust suppressants at least on road for 500m on either side of a village. Same approach is to be taken if the other site is used. restricting operating hours through roadside villages and settlements to between hours of 0800 and 1800. 	Category. B X214 S211 Category. C G108 S321	1-2. All access roads and haul routes for materials movement, particularly through settlement areas, villages and towns	Throughout the construction period	Contractor	ESSU/ YHAB
2.5.4 Excessive Noise	2.5.4 At the same locations and times that surface water quality is tested, noise measurements will be completed, but with site variations focused on sensitive receptors such as schools, residential areas and health care facilities. Measurement frequency will be the same as for air quality	G320a, X214, S211 and S 321	Two samples will be taken (one during the morning traffic peak, and one when construction has stopped for the day) at each of six stations along the road.	Monthly cycle for 4 subproject roads	Contractor or retained specialist consultant	ESSU/YHAB
2.6 Flora and Fauna						
2.6.1 Protection of roadside trees and shelter belt planting along roadsides	2.6.1 For each section of the road, contractors are required to develop a sketch map of the location number and species of trees along the roadside that are located within the area likely to be cleared. In areas where there are large trees creating a treed/shaded corridor, designers will be contacted and alternative designs, such as narrowing the carriageway and transforming this area into a roadside rest area should be discussed and an option found that requires the minimum tree loss. Any tree removed will be replaced by replanting several (>2) young trees of the same species.	All Subprojects	Along any section of the road where trees are encroaching into the area to be cleared for widening	Prior to any clearing taking place	Contractor	ESSU/ YHAB
2.6.2 Selection of landscape species and management of arisings	2.6.2 Specify native species of local provenance that are appropriate for the local setting for any new areas of landscaping. Ensure that any invasive species cleared during landscape works are managed in accordance with PRC regulations and standards. Consider opportunities for establishing composting facilities at General and Maintenance Sections, to enable recycling of green waste.	All Subprojects	At any site where landscape management takes place.	Design During clearance works	Contractor	ESSU/YHAB
2.7 Cultural Sites and Local Communities						
2.7.1	2.7.1		Locally important cultural heritage sites and features,	During the construction period and ahead of excavation at any such	Contractor	ESSU/ YHAB

Environmental Issue	Mitigation Measures	Applicable Subproject	Location ²	Time Frame	Responsibility	
					Implementation	Supervision
Loss of physical cultural resources	Since all the work is within existing RoWs and in previously disturbed soil, the risk of loss of historical or cultural relics is highly unlikely. However when widening roads in villages and towns, contractors will have to meet with local mayor to consult about any possible past relics or foundations of old buildings along the road. Contractor will also need to consult the database on archaeological sites in Yunnan, retained with the Provincial Cultural Relics Department as well as the County Cultural Relics Bureau. Any finds during works must be reported to the Maintenance Section Head and all construction work stopped until authorities have inspected the site.	Category. B S211 X214	particularly in ethnic minority areas and within 200m of any town or village along a project road.	site Prior to earth moving in these areas		
2.7.2: Loss of access for roadside residents	2.7.2 Contractor shall provide safe and convenient passage for vehicles and pedestrians to and from side roads and properties connecting the project road/area, whether public or private. Work that affects the use of side roads and existing access shall not be undertaken without provision of adequate alternate routes; to the prior satisfaction of the Engineer and affected persons.	All Subprojects	Along any project roads—where residences, businesses, etc. lead directly onto road where maintenance is taking place	Prior to the start of any work on each road	Contractor	ESSU/ YHAB
2.7.3 Traffic/access diversions and road dust management	2.7.3 Temporary bypasses will be constructed with the approval of the Engineer and in consultation with affected persons. The temporary traffic detours shall be kept free of dust by frequent sweeping or application of water.	All Subprojects	As defined by the YHAB representative on the job	Implemented at start of any work where traffic diversion or access reduction is expected	Contractor	ESSU/ YHAB
2.7.4 Spread of Vector-Born Diseases	2.7.4 Contractors will be required to conduct rigorous inspections of the work sites to be sure that there are no stagnant waters. This will include removal of items such as old tires, drums and other receptacles where water can collect. These are all breeding grounds for malaria, encephalitis and dengue fever mosquitoes.	All Subprojects	All construction sites, particularly these were excavation has taken place.	Within 5 days of any rain event capable of leaving ponded water. Throughout the construction period.	Contractor	ESSU/ YHAB
2.7.5 Community safety	2.7.5 In order to protect the safety of communities on the construction zone contractors will need to provide appropriate traffic management, lighting, management of excavations and making communities aware of any particular hazards.	All Subprojects	All construction sites involving a larger work area and period of more than or equal to 7 days	Prior to start of a construction activity	Contractor	ESSU/ YHAB
2.7.6 Hiring locally	2.7.6 Contractors will be encouraged to hire at least unskilled labour locally	All subprojects	For all work contracts	Immediately after contractor mobilization	Contractor	YHAB
2.7.7 Work outside the RoW	2.7.7 Construction activities may, in rare instances, be necessary outside the RoW. Where this becomes necessary, the use of land outside the RoW must be planned and agreed with owners of the affected land and properties prior to the start of the construction	Any subprojects where this is possible	Communities and/or owners affected	At least 2 weeks prior to start of work	Contractor	ESSU
2.8 Occupational Health And Safety						
2.8.1 Protecting the workforce and maintaining a safe working environment	2.8.1 Contractor to implement adequate traffic management measures, including safety cones, marking and use of traffic control personnel to maintain a safe environment for workforce and community. Contractor must provide safety vests, hard hats and protective footwear for all workers handling heavy materials, and working with caustic and hazardous materials such as concrete, asphalt, paints, cleaning agents, herbicides and pesticides. Contractor must provide protective masks to milling machine operators, and anyone working in the area of the milling machine dust-with masks of a micron size, capable of capturing dust down to 2 microns. Contractor must provide high-visibility clothing for workers at sites that have active traffic. Any works at night should be adequately lit and high visibility clothing worn. The contractor should provide basic training on use of protective clothing and equipment	All Subprojects	All work sites	All the time	Contractor	ESSU/ YHAB
2.8.2 Medical facilities and assistance	2.8.2 Contractor must have first aid services available to all staff and workers at all times; Contractor must have at least one emergency treatment specialist on call at all times and available for emergency treatment as required.	All Subprojects	All construction sites	All the time	Contractor	ESSU/ YHAB
2.8.3 Storage, handling and use of toxic and/or hazardous materials	2.8.3 Handling of all caustic, petroleum based materials, and other hazardous materials, such as pesticides/herbicides and cleaning agents, must be done, wearing protective footwear and clothing and	All Subprojects	For all construction operations	At any time during the construction period	Contractor	ESSU/ YHAB

Environmental Issue	Mitigation Measures	Applicable Subproject	Location ²	Time Frame	Responsibility	
					Implementation	Supervision
	application on steep slopes avoided Storage of such materials must be protected from the weather, clearly marked and safe from potential tampering and theft. Transport of such materials will be made according to PRC regulations and standards including pre-notification of shipment to local EPB					
2.8.4 Provision of sanitary toilet facilities	2.8.4 Contractor must provide sanitary toilet for all full-time workers on the construction site and make sure it is serviced daily.	All Subprojects	All work sites operated by contractor and without existing facilities	At all times during the construction period	Contractor	ESSU/ YHAB
2.8.5 Control of movement of large equipment and handling of construction items	2.8.5 Ensure large vehicles have safety equipment such as reverse alarms and assistants are available to provide traffic control and direction when large equipment is moved on the construction site. Demarcate work areas and use traffic cones as needed.	All Subprojects	The entire construction operation	At all times throughout the construction period	Contractor	ESSU/ YHAB
2.8.6 Child Labour	2.8.6 No Children (less than 16 year of age) can work on any contract	All Subprojects	Everywhere the contractor is involved	At all times	Contractor	ESSU/ YHAB
2.8.7 Records of Safety and Health	2.8.7 The Contractor shall maintain such records and make such reports concerning safety, health, and welfare of persons and damage to property available for inspection as the Engineer may from time to time prescribe	All Subprojects	Everywhere the contractor is involved	At all times	Contractor	ESSU/ YHAB
2.8.8 Reporting of Accidents	2.8.8 The Contractor shall report to the Engineer details of any accident as soon as possible after its occurrence. In the case of any fatality or serious accident, the Contractor shall, in addition, notify the Engineer immediately by the quickest available means	All Subprojects	For all work sites	Weekly	Contractor	ESSU/ YHAB
2.8.9; Provision of Potable Water	2.8.9 The contractor shall provide potable water to all staff working on the worksite and at all times	All Subprojects	All construction sites	All the time	Contractor	ESSU/ YHAB
2.8.10 Working into the night and disturbing communities (see also 2.2.5)	2.8.10 Generally contractors will be restricted to work only during the daylight hours. However consultation and agreement with local communities will allow for modifications. Contractor consultation with subproject corridor communities will be important	All Subprojects	All construction sites within 500 m of a community or sensitive facility such as hospital or school	All the time	Contractor	ESSU/YHAB
3. OPERATING PERIOD						
3.1 Increased risk of pedestrian accidents due to improved roads, faster speeds and greater traffic volume	3.1 The project includes a road and community safety programme, which will include various mitigation measures to control traffic speed, reduce hazards and to increase awareness of local communities. Post-maintenance consultation with local communities is proposed to check that provisions are adequate.	Category B S211 X214 Category C G213 X212 S321	In village and towns where the roads will be improved	Planned during the detailed design stage and installed during the construction period then completed at the start of operations	General Section; Maintenance Section	ESSU/ YHAB
3.2 Diverted traffic damaging roads and endangering communities	3.2 A number of the subprojects parallel toll road and it has been observed that under these conditions, improvements to non tolled roads results in truck traffic shifting to avoid tolls. To prevent that YHAB will install height barriers at both entrances to the affected roads	G108, G213	Where the road parallels expressways	Immediately before the improved roadway becomes operational	General Section and ESSU	YHAB
3.3 Social and community-based enhancements in support of positive impacts	3.3 YHAB will support financial incentives for transport entities to re-establish public transport services along subproject roads and will monitor roads to assess changes in the provision of public transportation.	All Subprojects	Communities where special support provided by YHAB for re-establishing public transport services	Within 6 months of improved road being operational and continuing for 1 year	General Section and ESSU	YHAB

ANNEX B

Environment Management Plan: Monitoring Measures Table

Environmental Issue	Monitoring Details	Applicable Road	Timing	Executing Unit	Reporting Responsibility
1. PRE-CONSTRUCTION (DESIGN) PERIOD					
1.1 Lack of environmental technical capacity within General and Maintenance Sections	1.1 Confirm that YHAB and Contractor training is carried out during the relevant timescales.	All Subprojects	At least 1 month before construction begins Within the 1 st month construction begins.	YHAB	YHAB
1.2 Provision for translation of IEE and related documents for use by General and Maintenance Sections, and for use in Bid documents (at least the EMP)	1.2 Confirm that Chinese version of IEEs and EMPs are with the General and Maintenance Sections of YHAB Confirm that bid documents contain environmental clauses tailored to the project conditions as well as a general set	All Subprojects	Before bidding begins	ESSU/YHAB	YHAB
1.3 Lack of consideration of IEE/EMP in preparation of the detailed design and bid documents.	1.3 Confirm that design and bid documentation reflect IEE and EMP recommendations.	All Subprojects	After IEE has been completed and bid documents are under preparation	ESSU	YHAB
1.4 Inclusion of measures that will prevent later impacts such as poor traffic management and excessive tree removal	1.4 Monitor to verify that best practices and environmentally acceptable design elements including engineering methods are used in the engineering design documentation.	Category B S211 X214 Category C S321	1 month before the end of the 'design' period.	ESSU	YHAB
2. CONSTRUCTION PERIOD					
2.1 Preparation of Environmental Documentation					
2.1.1 Contractor fails to retain a environmental specialist to prepare the CEWP and to implement all mitigation and monitoring measures, leading to a failure to implement the EMP	2.1.1 Meet with contractor's environmental expertise and discuss all issues and confirm level of involvement in the job throughout the construction period.	All subprojects	Within 1 st month of contractor's work on the job	ESSU	YHAB
2.2 Soils, Earthworks & Erosion					
2.2.1 Management of earthworks transport and Storage procedures, including cleaning; leading to dust and air pollution	2.2.1 During construction inspections, confirm earthworks and dust are being managed, including use of tarpaulins by trucks hauling fine materials, watering and use of chemical suppressants along the haul road sections at villages and that a speed limit of 30 km/per hour is enforced. Applicable to Category C, only when larger earthworks involved	Category B S211 X214 Category C X212 G 323 G320a	As part of the regular engineering inspection schedule—a short confirmation statement will be provided	Contractor ESSU & General and Maintenance Section staff	ESSU/YHAB

Environmental Issue	Monitoring Details	Applicable Road	Timing	Executing Unit	Reporting Responsibility
2.2.2 Erosion control and slope stabilization leading to land slip and chronic erosion at cuts and water crossings.	2.2.2 Undertake regular inspection to confirm that slope stabilization and standard erosion protection method are being used by the contractor for all work where there is clearing of topsoil, cutting and filling	Category B X214 S211	Inspect all roads where slope instability is a problem and where such work is being undertaken	Contractor ESSU & General and Maintenance Section staff	ESSU/YHAB
2.2.3 Risk of slope slippage and landslide zones	2.2.3 Identify landslide, unstable slope areas and inspect on rehabilitation and stabilization	Category B X214 S211 Category C G323 S321	Same as above	Contractor ESSU & General and Maintenance Section staff	ESSU/YHAB
2.2.4 Risk of erosion, landslide and destruction of landscape from side borrow operations	2.2.4 Undertake inspections to determine the type of borrow operations the contractor is applying and ensure that roadside borrowing is not taking place and is always out of the visual field from the road.	Category B X214 S211 Category C G108 G323 S321	Early during construction	Contractor ESSU & General and Maintenance Section staff	ESSU/YHAB
2.2.5 Side casting of waste by Contractor degrading down-slope area and blocking/ contaminating water body	2.2.5 Contractor report on waste materials management and location of any side casting reviewed and inspection completed. If excessive side casting clean up required. An inspection report, including photos must be filed.	All Subprojects	Collect reports from contractor at least 1X/month	Contractor ESSU & General and Maintenance Section staff	ESSU/YHAB
2.2.6 Handling of contaminated construction waste materials	2.2.6 Examine contractor's reports on the management of contaminated construction materials; follow up by a discussion with local citizens in areas where such issues are likely.	Category B X214 S211	Confirm when 505c remains to be done,, via contractor statements, that handling of waste materials is compliant	Contractor ESSU & General and Maintenance Section staff	ESSU/YHAB
2.2.7 Inappropriate disposal of spoils from construction work leading to contamination	2.2.7 Contractor prepares a statement indicating disposal method and location for cleared materials.	All subprojects where waste earthworks material of any kind cannot be recycled and needs disposal	Within the first week of start of construction where spoils are generated	Contractor	Maintenance Section and ESSU
2.3 Poor Contractor Operating Procedures					
2.3.1 Good construction housekeeping practices, including solid and sanitary waste management	2.3.1. Using a monitoring checklist, confirm that the items as listed in the EMP; Mitigation Measures Table Item 2.1.3 [1-4] are fully implemented.	All Subprojects	Complete inspection after start of work and when 75% complete and submit checklist to General Section	Contractor ESSU & General and Maintenance Section staff	ESSU/YHAB
2.3.2 Management of bitumen/asphalt and concrete production facilities to avoid leakage, dust and air pollution for community in vicinity	2.3.2 Confirm that sighting specification for both asphalt and concrete plants are according to PRC's Regulation and Specifications, but also that are at least as far away from settlement areas as defined in the mitigation table. Bitumen storage and handling is done without spillage	All Subprojects	Before plant is sighted but when plans have been formulated	Contractor ESSU & General and Maintenance Section staff	ESSU/YHAB

Environmental Issue	Monitoring Details	Applicable Road	Timing	Executing Unit	Reporting Responsibility
2.3.3 Management of petroleum products such as fuel, lubricants and bitumen to avoid spill and contamination.	2.3.3 Using the monitoring checklist, the 8 specific spill and contamination prevention measures listed in item 2.3.3 of the Mitigation Table will be assessed and reported on. Any non-compliance will be rectified immediately.	All Subprojects	Inspect after start of work and 75% complete assignment	Contractor ESSU & General and Maintenance Section staff	ESSU/YHAB
2.3.4 Overloading of construction vehicles leading to damage to existing roads	Contractor to provide waybills—or record book entries of materials hauled as required by Maintenance Section and/or ESSU inspector(s)	All Subprojects	With each construction inspection cycle	General and Maintenance Sections and ESSU	ESSU/YHAB
2.3.5 No or inadequate consideration for recycling and reuse of construction 'wastes' by the contractor	2.3.5 The contractor will need to demonstrate that an attempt has been made to reuse, recycle, convert by composting construction wastes such as asphalt, wooden materials, plant materials and other benign organic matter	All Subprojects	Inspect as part of regular construction inspection or every three months, whichever comes first	Contractor ESSU & General and Maintenance Section staff	ESSU/YHAB
2.3.6 Work Duration	2.3.6 General or Maintenance section to discuss work duration with selected contractor and urge rapid completion—then track progress based on inspection reports	All subprojects	At start and midway through agreed to timetable	Contractor	General or Maintenance Section
2.4 Surface Water, Drainage and Water Pollution					
2.4.1 Modification of surface drainage during culvert and bridge replacement and raising of horizontal road alignment	2.4.1 The Construction inspector(s) will inspect and verify that adequate drainage works and protection have been provided: specifically that the four mitigation measures defined in 2.4.1 of the Mitigation Table are fully implemented in a timely manner. Clearing of all culverts, confirming that they have not been blocked with construction materials will be completed	Category C G108 G323 S211 X214 X212 S321 G320a	Complete as part of the regular construction inspection schedule	Contractor ESSU & General and Maintenance Section staff	ESSU/YHAB
2.4.2 Management of construction wastewater	2.4.2 Inspect large construction sites to verify drainage water management scheme	Category B S211 X214	Once the construction site is fully operational	Contractor ESSU & General and Maintenance Section staff	ESSU/YHAB
2.4.3 Storage of fuel and avoidance of leakage of hazardous materials into surface and groundwater.	2.4.3 Request inspection reports from contractor and undertaken spot audits of the asphalt plants and fuel storage sites for any work lasting more than 2 months and requiring on a mobile asphalt plant.	All Subprojects	Inspect the plant, 1 month after operations begin, and at the end of the job	Contractor ESSU & General and Maintenance Section staff	ESSU/YHAB
2.4.4 Air pollution	2.4.4 Review sampling results and confirm acceptable standards being maintained.	G320a, X214, S211 and S 321	Within 1 month of completion of testing	Contractor and specialists	ESSU/YHAB
2.5 Air and Noise Pollution					

Environmental Issue	Monitoring Details	Applicable Road	Timing	Executing Unit	Reporting Responsibility
2.5.1 Management of construction-period air pollutant emissions	2.5.1 Using a monitoring checklist confirm that the six mitigation actions defined in 2.5.1 of the Mitigation Table are being implemented.	Category B S211 X214 Category C S321 G213 X212	Complete half way through the specific maintenance activity	Contractor ESSU & General and Maintenance Section staff	ESSU/YHAB
2.5.2 Dust and Noise from Road Milling Machine	2.5.2 Inspect milling machine operations and check for dust suppression and operator masks-	Category C G320b S321	Inspect the milling machine operation 1X/week	Contractor ESSU & General and Maintenance Section staff	ESSU/YHAB
2.5.3 Managing dust, noise and drainage associated with earthworks and haul roads.	Obtain written confirmation from contractor that the mitigation measures defined are being implemented Confirm operating period restriction , but consider any agreements made with communities	Category. B X214 S211 Category. C G108 S321	AS part of regular inspection reporting by contractor	ESSU and Contractor	YHAB
2.5.4 Excessive Noise	Review noise data provided by contractor and confirm validity	G320a, X214, S211 and S 321	At end of each noise measurement cycle	ESSU and Contractor	YHAB
2.6 Flora and Fauna					
2.6.1 Protection of roadside trees and shelter belt planting along roadsides	2.6.1 Inspection of cutting plan and confirmation of consultation with local Forestry Dept., then review and record re-planting/revegetation efforts.	All Subprojects	1X after the trees have been replanted	Contractor ESSU & General and Maintenance Section staff	ESSU/YHAB
2.6.2 Selection of landscape species and management of arisings	Review landscape specifications proposed for subprojects. Review at which General Maintenance Sections composting facilities can be established.	All Subprojects	During design and planning	Contractor ESSU & General and Maintenance Section staff	ESSU/YHAB
2.7 Cultural Sites and Local Communities					
2.7.1 Loss of physical cultural resources	2.7.1 Confirm that all roadside cultural and historical sites have been identified and all proper procedures according to PRC regulations have been adhered to.	Cat B. S211 X214	Obtain confirmation documentation from contractor	Contractor ESSU & General and Maintenance Section staff	ESSU/YHAB
2.7.2: Loss of Access For Roadside Residents	2.7.2 Confirm that contractor(s) has re-established existing road access for roadside residents impacted.	Category B S211 X214 Category C X212 S321 G108	1time after work complete, but before final payment to contractor	Contractor ESSU & General and Maintenance Section staff	ESSU/YHAB
2.7.3 Management of traffic diversions and road dust	2.7.3 Inspect traffic management at diversion sites and time delays and record diversion staff functions	All Subprojects	2X during the conduct of the work	Contractor ESSU & General and Maintenance Section staff	ESSU/YHAB

Environmental Issue	Monitoring Details	Applicable Road	Timing	Executing Unit	Reporting Responsibility
2.7.4 Spread of Vector-Born Diseases	2.7.4 Inspect all construction sites where earth removal can lead to ponding of stagnant water, particularly during the rainy season and where construction materials are stored in the open. Request immediate clean up and visual inspection for mosquito larvae.	All Subprojects	Visit project site twice 2-3 days after rain and during the warm season	Contractor ESSU & General and Maintenance Section staff	ESSU/YHAB
2.7.5 Maintaining and improving community safety	2.7.5 In order to protect the safety of communities on the construction zone contractors will need to provide appropriate traffic management, lighting, management of excavations, making communities aware of any particular hazards.	All Subprojects	All construction sites	Contractor ESSU & General and Maintenance Section staff	ESSU/YHAB
2.7.6 Hiring locally	Obtain written statistics on number of local hires	All subprojects	All construction sites	ESSU	YHAB
2.7.7 Work outside the RoW	Confirm that consultation and proper steps were taken prior to working outside RoW	Any subproject	Any possible sites where work is to be outside RoW	ESSU	YHAB
2.8 Occupational Health And Safety					
2.8.1 Provision of protective clothing and equipment	2.8.1 Complete a weekly occupational health and safety inspection reporting on all safety matters defined in Items 2.8.1-2.8.9—using a simple checklist provided—as this form.	All Subprojects	Weekly during the construction period	Contractor ESSU & General and Maintenance Section staff	ESSU/YHAB
2.8.2 Lack of medical assistance facility on site	2.8.2 See above, For Category C projects, very small work force and short duration, inputs, return to home each day..	Category B S211 X214	Weekly during the construction period	Contractor ESSU & General and Maintenance Section staff	ESSU/YHAB
2.8.3 Storage, handing and use of toxic, and/or hazardous materials	2.8.3 inspection of the storage areas and application sites of toxic materials to be undertaken	All Subprojects	Weekly during the construction period	Contractor ESSU & General and Maintenance Section staff	ESSU/YHAB
2.8.4 Provision of sanitary toilet facilities at all times	2.8.4 See above:	All Subprojects	Weekly during the construction period	Contractor ESSU & General and Maintenance Section staff	ESSU/YHAB
2.8.5 Improper control of movement of large equipment and handling of construction items	2.8.5 See above	All Subprojects	Weekly during the construction period	Contractor ESSU & General and Maintenance Section staff	ESSU/YHAB
2.8.6 Child Labour	2.8.6 Confirm that child labour is not practiced by examining the labour hire records	All Subprojects	Midway through the project	Contractor ESSU & General and Maintenance Section staff	ESSU/YHAB
2.8.7 Records of Safety and Health	2.8.7 See above	All Subprojects	Weekly during the construction period	Contractor ESSU & General and Maintenance Section staff	ESSU/YHAB
2.8.8 Reporting of Accidents	See above	All Subprojects	Weekly during the construction period	Contractor ESSU & General and Maintenance Section staff	ESSU/YHAB

Environmental Issue	Monitoring Details	Applicable Road	Timing	Executing Unit	Reporting Responsibility
2.8.9; Provision of Potable Water	2.8.9 Confirm that this is provided at all times and is accessible to all workers	All Subprojects	Daily	Contractor ESSU & General and Maintenance Section staff	ESSU/YHAB
2.8.10 Working into the night and disturbing communities (see also 2.2.5)	Verify that contractor is abiding by working hour restrictions as agreed in contract and with local communities	All Subprojects	Periodic inspection	Maintenance Section, reporting by local citizens	ESSU/YHAB
3. OPERATING PERIOD					
3.1 Risk of pedestrian accidents due to improved roads, faster speeds and greater traffic volume	3.1 Inspect urban areas where road has been improved, survey re average speed and define what speed management measures have been installed-if needed.	Category B S211, X214 Category C G213, X212 S321	6-8 months after improved road becomes fully operational again	ESSU	YHAB
3.2 Diverted traffic damaging roads and endangering communities	Confirm construction of the height barriers and report to YHAB	G108, G213	Immediately before the improved roadway becomes operational	General Section	YHAB
3.3 Social and community-based enhancements in support of positive impacts	Conduct the survey as defined in 3.1 and report results in annual operating period report	All Subprojects	Within 6 months of improved road being operational and continuing for 1 year	General Section	YHAB

Annex C: Environmental Classification of Road Maintenance Activities Proposed for Phase I-IV Subproject Roads

This table identifies the range of maintenance activities that may be carried out during the Project, key environmental impacts and relevant mitigation measures. A prediction is made of the environmental category associated with a particular maintenance activity. The mitigation measures cross-reference numbered mitigation measures set out in the EMP Mitigation Measures Table in Annex B which should provide a useful guide during the preparation of EMPs for future subprojects. If a number of maintenance activities are completed at the same time, the activity with the highest category defines the type of assessment for all the work.

The EMP includes generic *'for all subproject'* measures as well as specific measures that are relevant to specific subprojects or types of maintenance activities. In some cases all generic and specific measures apply *'Apply all EMP Measures'*.

This initial classification provides a reference source to support screening of future subprojects. It is assumed that this table will be used alongside YHAB's Operational Manual subIDForm. The subIDForm table that will be filled in for each road subproject will refer to the predicted environmental category in this table.

MAJOR CLASSIFICATION and Secondary Classification		Key Environmental Impacts	Relevant EMP mitigation measures	Predicted Environmental Category
1. ENTIRE ROADWAY STRUCTURE RESTORATION				
1.1 Minor Maintenance and Repair				
1.1.1	Finish hard shoulder construction, slopes, prune vegetation on side of hard shoulder	Minor noise and dust, some traffic delays	EMP 2.5.1 EMP 2.6.2 EMP 2.7.3	C
1.1.2	Median strip vegetation and revegetation	Some traffic delays	EMP 2.3 EMP 2.6.2.	C
1.1.3	Road debris removal	Some dust and traffic delays	EMP 2.7.3 EMP 2.7.5 EMP 2.8.1	C
1.1.4	Roadway sweeping	Some dust	EMP 2.3 EMP 2.8.1	C
1.1.5	Repair local damage to retaining walls	Minor works, brick replacement and possible minor stoneworks	EMP 2.8.1	C
1.1.6	Local shoulder reinforcement	Minor works , minor grading no impact	EMP 2.8.1	C
1.2 Medium Maintenance and Repair				
1.2.1	Some carriageway widening within RoW (<50m), improve curve safety	Some, noise, dust, temporary access restrictions	EMP 2.7.2 EMP 2.7.3 EMP 2.8.1	C
1.2.2	Comprehensive repair of retaining walls, slope protection, road shoulders, drainage ditches.	Some erosion, siltation into water courses during construction, access restrictions and delays Consider upgrade of drainage protection associated with water resources.	EMP:2.4.1 EMP 2.4.3 EMP 2.7.2	C
1.2.3	Comprehensive repair of landslide-damaged area	Potential for major erosion and materials movements— heavy equipment operation and sidelaying of waste materials down-slope	EMP 2.2.4 EMP 2.2.6	C
1.2.4	Clearing long stretches of ditches,	Proper disposal of waste	EMP 2.2.8,	C

MAJOR CLASSIFICATION and Secondary Classification		Key Environmental Impacts	Relevant EMP mitigation measures	Predicted Environmental Category
	drainage canals and paved ditches	from ditches as it could be contaminated, i.e. not near water courses, but in land-based disposal pits. Consider composting	EMP 2.3.1 EMP 2.3.5	
1.2.5	Minor bridge repair, such as railing and potholes repair and leveling of bridge deck	Some erosion, siltation into water courses during construction, access restrictions and delays, also possible drainage of small amounts of petroleum products into water course	EMP 2.3.1 EMP 2.3.3 EMP 2.3.4 EMP 2.4.1	C
1.3 Major Maintenance and Repair				
1.3.1	Roadway minor realignment but within RoW for road class	Dust, Noise, some water pollution, materials storage issues, tree removal and revegetation	Apply all EMP Measures	C
1.3.2	Reconstruction of large retaining wall or slope protection: $\geq 50\text{m}$	Extended construction period. Temporary degradation of environment, including air quality, noise, surface water quality—some erosion	Apply all EMP Measures	B (marginal)
1.3.3	Clean up after natural disaster such as flood, flash flood, large landslide, or mud flow—extending over an area exceeding 1km^2 .	Extended and intensified construction period. Temporary degradation of environment, including air quality, noise, surface water quality—some erosion.	Apply all EMP Measures	B (marginal)
1.3.4	Widen and upgrade a road so that it can be reclassified from class 4 to 3. <i>(Note: based on MEP Decree 2, 2008, reconstruction along an existing road regardless of length requires only a Category C assessment).</i> Further, under the Loan agreement, reclassification is not permitted	Extended and intensified construction period. Temporary degradation of environment, including air quality, noise, and surface water quality—some erosion. Some degradation will be permanent, possible change to surface water drainage	Apply all EMP Measures Note: This type of work is actually reconstruction not maintenance and could trigger Environment Category A and exclusion from the project.	B
2. PAVEMENT REPAIR				
2.1 Minor Maintenance and Repair				
2.1.1	Maintenance and removal of dirt and debris from carriageway	Minor noise and dust, some traffic delays	Apply “for all subprojects” EMP measures	C
2.1.2	Exclude surface water, snow, ice accretion, laying anti-skid material, dust extinguishing agent or compacted snow to maintain traffic	Minor noise and dust, some traffic delays, also draining of melt water into water courses and possible contamination or roadside wells	Apply “for all subprojects” EMP measures	C
2.1.3	Sand road evenness, repair rutting (road grading)	Minor noise and dust, some traffic delays, also draining of melt water into water courses	Apply “for all subprojects” EMP measures	C
2.1.4	Application of crushed gravel and sand to road surface dust suppression	Minor traffic delays and some noise and dust	Apply “for all subprojects” EMP	C

MAJOR CLASSIFICATION and Secondary Classification		Key Environmental Impacts	Relevant EMP mitigation measures	Predicted Environmental Category
	in those areas and determining via instrumentation the best way to repair the wear layer		measures	
2.1.5	Asphalt pavement sweeping, repair of cracks in asphalt,	Minor dust and traffic delays	Apply "for all subprojects" EMP measures and EMP 2.5.2	C
2.1.6	Daily application of clear seam to concrete asphalt cracks as required	Minor chemical leakages if rain occurs shortly after application	Apply "for all subprojects" and EMP 2.3.2 EMP 2.3.3	C
2.1.7	Curb repairs and whitewashed stone	Minor dust and traffic delays	Apply "for all subprojects" EMP measures	C
2.1.8	Minor repairs using local aggregate sources	Minor dust and traffic delays	Apply "for all subprojects" EMP measures	C
2.1.9	Repair/rehab of small roadside borrow areas	Minor dust and traffic delays	Apply "for all subprojects" EMP measures	C
2.1.10	Repair damage to culverts due to accidents	Traffic delay and minor silt addition to watercourse	Apply "for all subprojects" EMP measures	C
2.1.11	Concrete pavement partial repair of the pavement surface	Noise, dust and some traffic delay	Apply "for all subprojects" EMP measures	C
2.1.12	Repair frost heaves on gravel roads and add slab material	Noise, dust and some traffic delay	Apply "for all subprojects" EMP measures	C
2.2 Medium Maintenance and Repair				
2.2.1	Improve road cross-slope surface	Noise, dust and some traffic delay	Apply "for all subprojects" EMP measures	C
2.2.2	Application of gravel, intermittent pavement thickening and repair road 'humps and serious degradation.	Noise, dust and some traffic delay	Apply "for all subprojects" EMP measures	C
2.2.3	Apply seal coat	Spillage of materials and traffic delay during application	EMP 2.3.2 EMP 2.3.3 EMP 2.4.2	C
2.2.4	Placement and operation of a mobile asphalt processing plant	Serious Dust, Noise, air pollution, odour, surface water contamination with bitumen storage, leakage during application of asphalt, traffic delays, health effects	Apply all EMP measures	B
2.2.5	Pavement joint replacement	Dust, noise, traffic delays	EMP 2.5.2 EMP 2.7.2 EMP 2.7.3	C
2.2.6	Full replacement of curbs along the entire road section	Longer construction period , exposed soils and erosion, traffic delays	Apply "for all subprojects" EMP measures	C
2.2.7	Establishment and management of temporary bypasses at maintenance sites	Some dust, noise, air pollution, odour, surface water contamination with bitumen storage, leakage during application of	Apply "for all subprojects" EMP measures	C

MAJOR CLASSIFICATION and Secondary Classification		Key Environmental Impacts	Relevant EMP mitigation measures	Predicted Environmental Category
		asphalt, traffic delays, health effects		
2.3 Major Maintenance and Repair				
2.3.1	(i) Replacement of entire pavement layer for ≥ 10 km, including subgrade and raising horizontal alignment. (ii) Only pavement layer replacement Note: based on MEP Decree 2, 2008, reconstruction along an existing road regardless of length requires only a Category C assessment. A reasonable international best practice trigger between C and B will be 10 km.	(i) Serious Dust, Noise, air pollution, odour, surface water contamination with bitumen storage, leakage during application of asphalt, traffic delays, health effects from Asphalt milling machine (ii) same conditions as above but much less and only temporary effects	(i) Apply all EMP Measures (ii) Apply "for all subprojects" EMP measures	(i) B (ii) C
2.3.2	Pavement strengthening, including some widening within RoW, any distance	Serious Dust, Noise, air pollution, odour, surface water contamination with bitumen storage, leakage during application of asphalt, traffic delays, health effects	Apply "for all subprojects" EMP measures	C
2.3.3	Bridge deck pavement replacement but not full replacement to deck girders. No increase in bridge capacity	Some dust and danger of surface water contamination	Apply "for all subprojects" EMP measures	C
3. Bridges Culverts and Tunnel Maintenance Work				
3.1 Minor Maintenance and Repairs				
3.1.1	Dust, snow clearing, sanding and anti skid application	Minor noise and dust, some traffic delays, minor drainage of chemicals into water course	Not Applicable	C
3.1.2	Bridge joint and scupper maintenance (lubrication)	Minor noise and dust, some traffic delays	EMP 2.3.3 EMP 2.7.2 EMP 2.7.3	C
3.1.3	Bridge painting	Potential for paint spillage into watercourse	EMP 2.3.2 EMP 2.3.3 EMP 2.4.3	C
3.1.4	Routine culvert and bridge maintenance	Some minor amounts of materials (debris) into watercourse	EMP 2.4	C
3.1.5	Minor repairs of bridge railing and deck, and repair of non-structural damage to piers	Some minor amounts of construction materials (debris) into watercourse	EMP 2.4	C
3.1.6	Minor deck placement, strengthening and repair	Some minor amounts of construction materials (debris) into watercourse	EMP 2.4	C
3.1.7	Rock and masonry work repair	Some minor amounts of construction materials (debris) into watercourse	EMP 2.2.1	C
3.1.8	Clean debris and falling rock from entrances of tunnels	Minor traffic delay and localized dust and noise	EMP: 2.7.2	C
3.2 Medium Maintenance and Repair				
3.2.1 (i) and (ii)	(i) Repair or replacement entire wooden bridges, including application of wood preservative materials over water (ii) Same as (i) but not over	(i) Serious impact on watercourse, debris in water, materials and construction in watercourse on shore for piers.	(i) Apply all EMP Measures (ii) EMP 2.3.1 EMP 2.3.2	(i) B (ii) C

MAJOR CLASSIFICATION and Secondary Classification		Key Environmental Impacts	Relevant EMP mitigation measures	Predicted Environmental Category
	waterbody	(ii) spillage of anticorrosion materials such as special paint and careful application according to applicable PRC-GB		
3.2.2	Apply anti-corrosion paint for metal to all medium size bridges, i.e ≤ 30m in length.	Spillage of anticorrosion materials such as special paint and careful use according to applicable PRC-GB and other guidelines	(ii) Apply "for all subprojects" EMP measures	C
3.2.3	Repair or replace bridge bearings, expansion joints,	Some minor amounts of construction materials (debris) into watercourse	EMP 2.2	C
3.2.4	Repair permanent abutments, sidewalls, decks	Debris and materials in water course, construction in water course, temporary flow diversion	EMP 2.2	C
3.2.5	Widen narrow bridge decks by ≤ 1m	Some minor amounts of construction materials (debris) into watercourse	EMP 2.2	C
3.2.6(i) and (ii)	River bed 'training' and pier reinforcement, to reduce wear on structures in riverbed.	This involves permanently change the course of a natural waterway, work in a waterway and application of materials in a watercourse	(i) If more than 30m of training and more than 2 pier repairs apply all EMP measures (ii) if <30m and <2 piers apply "for all subprojects" EMP measures.	(i) B (ii) C
3.2.7	Minor non-structure tunnel repair-reinforcement-type work	Dust, noise, temporary local air quality degradation	EMP No 2.5.1 (5)	C
3.2.8	Culvert Replacement and repositioning	Improper sizing and placement resulting in upstream ponding and downstream erosion—also blockage during construction	Apply "for all subprojects" EMP measures and EMP 2.2.2 EMP 2.2.3 EMP 2.4.1 EMP 2.4.2...	C
3.3 Major Maintenance and Repair				
3.3.1	Bridge deck pavement replacement	Some dust and danger of surface water contamination with asphaltic material	EMP 2.4.1, EMP 2.4.2	C
3.3.2	Widening and strengthening, deck replacement of medium size bridges (between 30m and 100m total length): without structural repair	Some impact on watercourse, debris in water, materials and construction in watercourse on shore for piers.	Apply "for all subprojects" EMP measures	C
3.3.3	Bridge abutment, sidewall and deck repair of small bridges	Some dust and danger of surface water contamination with asphaltic material as well as concrete	Apply "for all subprojects" EMP measures	C
3.3.4 (i) and (ii)	River entrainment structure installation/repair undertaken	This involves permanent change to the course of a natural waterway, work in a	(i) If more than 30m of training and more than 2 pier repairs	(i) B

MAJOR CLASSIFICATION and Secondary Classification		Key Environmental Impacts	Relevant EMP mitigation measures	Predicted Environmental Category
		waterway and application of materials in a watercourse	apply all EMP measures. (ii) if <30m and <2 piers apply EMP 'for all subprojects' measures	(ii) C
3.3.5	Medium size bridges (between 30m and 100m total length; repairs on suspension and cable stayed bridges, including individual cable replacement	(i) Some potential impact on water course, debris in water, materials and construction in watercourse on shore for piers.	Apply 'for all subprojects' EMP measures	C
3.3.6	Improve approaches to medium size bridges	Some small amounts of materials into water course or onto facility crossed by bridge—no significant impacts predicted	Apply 'for all subprojects' EMP measures	C
3.3.7	Construct new small interchange—but remaining within road RoW	Possibly short period of erosion, noise, dust and air quality disruption, access restriction and Need for revegetation	Apply 'for all subprojects' EMP measures	C If outside RoW; Category A
3.3.8	New short tunnel construction on existing road	This work is equal to a new road section, including all waste management, slope stability issues, access road construction etc.	Prepare a full EIA and EMP,	A As this work triggers a full EIA, not allowed as part of this project
3.3.9	New Road corridor—Also would cover a new access road to a ferry terminal	Potentially serious dust, noise, air pollution, surface water contamination, surface water flow disruption, construction materials handling and storage issues, access restriction issues, traffic delays, health effects	Prepare a full EIA and EMP,	A: As this work triggers a full EIA, it cannot be undertaken as part of this project
3.3.10	Tunnel ventilation and lighting, drainage overhaul or update of the facilities	Any work that does not include constructing new ventilation shafts or installing new large capacity transformers for greater power consumption —no significant effects are anticipated	Apply "for all subprojects" EMP measures	C
3.3.11	Tunnel reinforcement works beyond spot repairs	Dust, safety and traffic delays	Apply "for all subprojects" EMP measures	C
4. Traffic Engineering Works				
4.1 Minor Maintenance and Repair				
4.1.1	Maintenance of signage, km-markings/piles, boundary markers and cleaning of such items	Minor materials clean up and traffic delays	No impacts, as long as good housekeeping measures are applied as per EMP:2.3	C
4.1.2	Placement and repair of snow fencing,	Minor materials clean up and traffic delays	None needed	C
4.1.3	Painting of lines on road	Minor materials clean up	None needed	C

MAJOR CLASSIFICATION and Secondary Classification		Key Environmental Impacts	Relevant EMP mitigation measures	Predicted Environmental Category
		and traffic delays		
4.2 Medium Maintenance and Repair				
4.2.4	Replacement of any signs and markers, or provision of new ones at new locations	Minor materials clean up and traffic delays	None needed	C
4.2.5	Comprehensive replacement of existing guardrail, fencing and snow fencing	Minor materials clean up and traffic delays	None needed	C
4.2.6	Comprehensive road marking repainting for (3 sections)??	Minor materials clean up and traffic delays	None needed	C
4.2.7	Maintenance of any communication towers in RoW	Minor materials clean up issues, possible noise and anti corrosion paint use—or related tasks and traffic delays	None needed	C
4.3 Major Maintenance and Repair				
4.3.1	Adding new guardrails, replacement, fencing and snow fencing, etc.	Minor roadside construction activity and materials temporarily stored on roadside—no significant impacts anticipated	None needed	C
4.3.2	Update of telecommunication and electronics toll system; except towers	No environmental effects anticipated	None needed	C
4.3.3	Replacement of Communication towers in RoW	Some excavation and use of heavy equipment to replace communications tower(s). No significant impacts	EMP 2.2.2 EMP 2.2.3	C
4.3.4	Updating of power supplies to all road facilities, communication equipment including increases to power supply capacity-transformers, etc. <u>within RoW</u>	Updating power supplies involves increasing power supply, requiring upgrading of transformers, possibly the transmission lines from substation —environmental impacts are possible	EMP 2.8	C
5. GREENING WORKS				
5.1 Minor Maintenance and Repair				
5.1.1	Pruning and tending of trees	No impacts anticipated	EMP 2.6.1 EMP 2.6.2	C
5.1.2	Application of chemical fertilizers, pesticides, weeding	Potential for minor contamination of runoff water	EMP 2.8.3,	C
5.1.3	Replacement of trees and painting/whitewashing of tree trunks	No impacts anticipated	None needed	C
5.2 Medium Maintenance and Repair				
5.2.1	Add to and replace trees and plants from nursery	No impacts anticipated	None Needed	C

ANNEX D:
EXAMPLES OF BIO-ENGINEERING METHODS
 (Table copied from Howell, 1999 Figure 1.12)

Start(a)	→ (b)	→ (c)	→ (d)	→ (e)	→ (f)	→ (g)
Slope angle	Slope length	Material drainage	Site moisture	Previous/potential problems	Functions required	Technique(s)
> 45°	> 15 metres	Good	Damp	Erosion, slumping	Armour, reinforce, drain	Diagonal grass lines
			Dry	Erosion	Armour, reinforce	Contour grass lines
		Poor	Damp	Slumping, erosion	Drain, armour, reinforce	1 Downslope grass lines and vegetated stone pitched rills or 2 Chevron grass lines and vegetated stone pitched rills
			Dry	Erosion, slumping	Armour, reinforce, drain	Diagonal grass lines
	< 15 metres	Good	Any	Erosion	Armour, reinforce	1 Diagonal grass lines or 2 Jute netting and randomly planted grass
			Damp	Slumping, erosion	Drain, armour, reinforce	1 Downslope grass lines or 2 Diagonal grass lines
		Poor	Dry	Erosion, slumping	Armour, reinforce, drain	1 Jute netting and randomly planted grass or 2 Contour grass lines or 3 Diagonal grass lines
30° - 45°	> 15 metres	Good	Any	Erosion	Armour, reinforce, catch	1 Horizontal bolster cylinders and shrub/tree planting or 2 Downslope grass lines and vegetated stone pitched rills or 3 Site grass seeding, mulch and wide mesh jute netting
		Poor	Any	Slumping, erosion	Drain, armour, reinforce	1 Herringbone bolster cylinders & shrub/tree planting or 2 Another drainage system and shrub/tree planting
	< 15 metres	Good	Any	Erosion	Armour, reinforce, catch	1 Brush layers of woody cuttings or 2 Contour grass lines or 3 Contour fascines or 4 Palisades of woody cuttings or 5 Site grass seeding, mulch and wide mesh jute netting
		Poor	ny	Slumping, erosion	Drain, armour, reinforce	1 Diagonal grass lines or 2 Diagonal brush layers or 3 Herringbone fascines and shrub/tree planting or

Start(a)	→ (b)	→ (c)	→ (d)	→ (e)	→ (f)	→ (g)
Slope angle	Slope length	Material drainage	Site moisture	Previous/potential problems	Functions required	Technique(s)
						4 Herringbone bolster cylinders & shrub/tree planting or 5 Another drainage system and shrub/tree planting
< 30°	Any	Good	Any	Erosion	Armour, catch	1 Site seeding of grass and shrub/tree planting or 2 Shrub/tree planting
		Poor	Any	Slumping, erosion	Drain, armour, catch	1 Diagonal lines of grass and shrubs/trees or 2 Shrub/tree planting
	< 15 metres	Any		Erosion	Armour, catch	Turfing and shrub/tree planting
	Base of any slope			Planar sliding or shear failure	Support, anchor, catch	1 Large bamboo planting or 2 Large tree planting

ANNEX E: STAKEHOLDER AND PUBLIC CONSULTATION RECORDS DURING SURVEYS OF SUBPROJECT ROADS

MAY-JULY 2012

May 8, 2012

Highway G213

Stakeholder: YHAB Jinning Section, Deputy Director: Yang Lifeng (Female)

Questionnaire:

1. Do you expect noise, air pollution, sewage, solid wastes, or any other contamination during the maintenance implementation and operational phase after maintenance?
2. Do you think that the construction would block access to the road?
3. Do you support the road maintenance and if any annoyance arises from the maintenance what do you recommend for mitigation.

Essential Information Collected:

- ♦ The total length of G213 under Jinning section is 48.655 km. The following segments are to be rehabilitated using the ADB fund for the first tranche.
- ♦ K2115.235 - K2117.235 (there are roadside quarries)
- ♦ K2133.235 - K2136.735 (greenhouse for vegetables widely distributed)
- ♦ K2137.235 - K2139.235 (elder's home, its gate is about 30m away from RoW).
- ♦ K2143.235 - K2147.235 (greenhouse for rose, nursery for trees noticed along the highway, eucalyptus, ficus, camphor, and bougainvillea are typical plants for greening)
- ♦ K2147.235 -K2163.89 (houses, farmlands, hilly landforms)
- ♦ Major maintenance: Resurfacing, rehabilitation to cement treated layer, rebuilding of curbs; the road surface will be about 50 cm higher than the existing. No realignment and widening works are planned.
- ♦ Aggregates and asphalt concrete will be purchased from qualified suppliers with average transport distance of 30 km or so.
- ♦ No overflow or mud flow sections were found.

May 8, 2012 (afternoon)

Highway G213

Stakeholder: YHAB Yuxi General Section, Engineering & Planning Division Chief: Yang Zhimin (Female)

Questionnaire: The same as above.

Essential Information Collected:

- ◆ Yuxi general section has three sections overseeing the maintenance of G213 with total responsibility length of 208 km. The following segment of 14.11 km will be involved in the first tranche.
- ◆ K2163.89 - K2178: Up & down slopes, medium mountains, a few villages and townships are passed through. Main crops include rice, corn, and potato. Typical roadside plants include eucalyptus, ficus, camphor, bougainvillea, and ailanthus. No areas of high environmental sensitivity are found.
- ◆ Major maintenance: Resurfacing, rehabilitation to cement treated layer, rebuilding of curbs; the road surface will be 27-30 cm higher than the existing. No realignment and widening works are planned.
- ◆ Aggregates will be purchased from qualified suppliers with transport distance of 50-60 km.
- ◆ Asphalt concrete will be provided by section's own batching plant just beside the highway. In addition, the general section is establishing a new larger asphalt batching plant at K2176+800.
- ◆ There is a small bridge to be resurfaced.
- ◆ No overflow or mud flow sections were found.
- ◆ To ease the traffic flow, the approach of half side for maintenance and other half for traffic would be adopted. The parallel expressway G85 could also relieve the traffic pressure of G213.
- ◆ Existing traffic volume: 15195 vehicles per day on average, or 21042 pcu/d.

May 9, 2012

Highway S211

Stakeholder: YHAB Songming Section, Planning Division Chief: Ruan Chaoke, Engineer: Ma Xinglu, YHAB Yiliang Section, Deputy Director: Zhou Wencai

Questionnaire: The same as above.

Essential Information Collected:

- ◆ Songming Section under Kunming General Section will undertake rehabilitation of two segments of S211, i.e. K116+286 – K117+286 and K109+286 – K111+286. Yiliang Section

(also under Kunming General Section) will carry out most of S211 rehabilitation from K111+286 – K129+286. The road is class III and 7m-7.5m wide.

- ◆ The whole S211 segment to be rehabilitated goes up and down a medium mountain terrain, with altitudes of 1800m – 2250m ASL. A number of villager houses are scattered along the road. Main crops include rice, corn, and potato. Eucalyptus, ficus, camphor, tung tree, cypress, willow, and cryptomeria. No areas of high environmental sensitivity are found.
- ◆ Most road surface of S211 has been seriously damaged by larger traffic volume of overloaded heavy duty trucks, which mainly haul coal for a large scale power plant and concrete aggregates from seven huge quarries alongside the road. AADT was reported as about 6040 vehicles per day. Bad road conditions, heavy traffic loads, and long consecutive ascent/descent bending slopes jeopardize the road safety and environmental quality. Heavy dust caused by climbing trucks pollutes the ambient air of the road corridor seriously.
- ◆ Some segments within Yiliang Section are liable to be damaged by flash flood and mud flow during the rainy season.
- ◆ Major maintenance: Resurfacing, rehabilitation to cement treated layer, side ditch clearing and repair were planned within the chainage under Songming Section. For the chainage under Yiliang Section, the maintenance will be comprehensive, including resurfacing, rehabilitation to cement treated layer, rebuilding of curbs, repair of 12 covered culverts, clearing and repair of side ditches, reinforcement of slope protection and retaining wall.
- ◆ The road surface will be 50-60 cm higher than the existing. No realignment and widening works are planned.
- ◆ Aggregates will be purchased from qualified suppliers along the road with transport distance of 1-15 km.
- ◆ Asphalt concrete will be provided by section's own batching plant with average hauling distance of 30km.
- ◆ There is no bridge to be rehabilitated.

May 10, 2012

Highway G108

Stakeholders: YHAB Fumin Section, Deputy Director: Zhang Yantao, Engineering Division Chief: Chen Jiaqiang, YHAB Luquan Section, Planning Division Engineer: Liang Yan (Female), Comprehensive Management Office: Zhao Changhua

Questionnaire: The same as above.

Essential Information Collected:

- ◆ The proposed maintenance for G108 includes eight segments respectively managed by Kunming Section, Fuming Section, and Luquan Section (all under Kunming General Section). Kunming Section has only one segment of 1km, namely K3358 – K3359. Fuming Section is assigned four segments summing up 13km, which are K3311 –K3317, K3320 – K3325, K3331 – K3332, and K3340 – K3341. Luquan Section will undertake maintenance

for three segments totaling 12km, i.e. K3290 - K3292, K3295 – K3304, and K3307 – K3308. All the road segments are class II and 12m wide. G108 has heavy traffic volume (AADT of 8500) and suffers from poor conditions due to lack of major rehabilitation for a long time.

- ◆ The concerned road segments extend its way through a medium mountainous terrain with altitudes between 1660m and 2050m, except that the segments K3290 - K3292, K3295 – K3304, and K3311 – K3317 lies on the flat basins between mountains. Along the segments to be rehabilitated a number of villages and Luquan County Seat are located. Large area of farmlands were noticed with main crops of corn, vegetables, grape, red bayberry, nectarine, watermelon, and other fruits growing.
- ◆ Major maintenance will include resurfacing, rehabilitation to cement treated layer, side ditch clearing and repair, side wall repair, rebuilding of curbs, local replacement of subgrade. The road surface will be raised 40cm – 50cm after rehabilitation.
- ◆ There are one medium bridge and two small bridges to be resurfaced without any abutment or foundation works.
- ◆ No overflow or mud flow sections were found.
- ◆ Aggregates will be purchased from qualified suppliers with transport distance of 30-40 km. Asphalt concrete will be provided by section's own batching plant with average distance of 45 km as for Luquan Section, 35 KM for Fumin Section, and 2 KM for Kunming Section.

May 14, 2012

Highway S321

Stakeholders: Lincang General Section, Deputy Director: Luo Weixue, Deputy Director: Wu Jianbing, YHAB Yongde Section, Director: Chen Junjun

Questionnaire: The same as above.

Persons Interviewed for Public Consultation on S321 (K73, K78.6, K191)

No.	Name	Gender	Nationality	Occupation/Position	Village/Township
1	Yang Haimin	Female	Han	Township Head	Wu Mulong
2	Huang Zhaocai	Male	Yi	Farmer	Wu Mulong
3	Huang Guangcui	Female	Yi	Farmer	Wu Mulong
4	Zhang Shize	Male	Han	Inn Keeper	Wu Mulong
5	Zhao Xiaosan	Female	Han	Inn Servant	Wu Mulong
6	Zi Taijiu	Male	Yi	Tea Shop Owner	Wu Mulong
7	Liu Shuogui	Male	Han	Grocery Store Owner	Wu Mulong

No.	Name	Gender	Nationality	Occupation/Position	Village/Township
8	Li Liuzhen	Female	Han	Shop Clerk	Wu Mulong
9	Yang Yunze	Female	Han	Shop Clerk	Wu Mulong
10	Li Jincong	Male	Han	Villager	Wu Mulong
11	Li Fushun	Male	Han	Villager	Wu Mulong
12	Li Fulin	Male	Han	Villager	Meng Hong
13	Duan Wei	Male	Han	Villager	Meng Hong
14	Duan Jiankang	Male	Bai	Villager	Meng Hong
15	Li Xiucong	Female	Wa	Villager	Meng Hong
16	Yang Lixian	Female	Wa	Villager	Meng Hong

Essential Information Collected:

- ◆ The maintenance of S321 (class IV, 6.5m wide) will be carried out by Yongde Section under Lincang General Section with two far separate segments of 14 km and 8 km respectively involved.
- ◆ Both the road segments convolve around the mountains. Along the first segment between K71 and K85 (with elevations from 2000m to 2200m ASL), dry farmlands of sugarcane, banana, walnut, coffee, and corn are widely distributed. While for the second segment from K185 to K193 (1300m to 1500m ASL), sloping patches of tobacco, corn, and terraced paddies are mostly seen. Several tatty masonry workshops sporadically locate near the road. No sensitive or protected areas are found. Ficus, eucalyptus, bamboo, bombax, and bougainvillea are main plants alongside the road segments.
- ◆ Major maintenance: Resurfacing, rehabilitation to cement treated layer, rebuilding of curbs, rehabilitation and reinforcement of unstable slopes; the road surface will be about 30 cm higher than the existing. No realignment and widening works are planned.
- ◆ There is a small bridge to be resurfaced within the first segment.
- ◆ Aggregates will be purchased from qualified suppliers with transport distance of 30-40 km. Asphalt concrete will be provided by section's own batching plant with average distance of 30 km.
- ◆ No overflow or mud flow sections were found.
- ◆ Local people living in the highway corridor area long for the maintenance and think improvement of the highway conditions will certainly help enhance their living standard and provide them business opportunities. Since the newly built class II highway from Yang Touyan to Qing Shuihe (a port bordering Burma) was open to traffic, most of traffic volume has been diverted from existing S321, which more or less brings down the economy of the corridor area. Currently the traffic volume is very low.
- ◆ As for the environmental impacts, all the interviewed persons expressed little worries

and thought them short lasting, limited significance and reversible.

The main suggestions of the interviewed persons for the maintenance implementation are (i) keeping access to the road (also the half construction vs half traffic approach would be preferred); (ii) to ensure safety during the construction, flagmen need to be in place for traffic control, which is thought particularly important for the township fare trade held every six days; (iii) protecting the trees and farmlands near the RoW to the maximum efforts; (iv) minimizing the construction duration (the construction duration is estimated for about one month).

May 15, 2012

Highway X214

Stakeholders: YHAB Dehong General Section, Deputy Director: Zhang Mincai, YHAB Longchuan Section: Yang Yanjun

Questionnaire: The same as above.

Persons Interviewed for Public Consultation on X214 (K11.2, K17.5)

No.	Name	Gender	Nationality	Occupation/Position	Village/Township
1	Qiu Sumei	Female	Han	Clerk of Motorcycle Store	Jing Han Township
2	Cun Shizhi	Female	Han	Villager	Jing Han Township
3	Sun Dingmei	Male	Han	Villager	Jing Han Township
4	Yang Fan	Male	Han	Shopkeeper of photostudio	Jing Han Township
5	Yu Xingcai	Male	Han	Villager	Jing Han Township
6	Bao Fuqiang	Male	Han	Villager	Jing Han Township
7	Xiong Yongjian	Male	Han	Grocery shopkeeper	Jing Han Township
8	Xiong Xiancai	Male	Han	Clerk of grocery	Jing Han Township
9	Zhai Xiaofan	Female	Jingpo	Shop Clerk	Jing Han Township
10	Dong Chenggong	Male	Jingpo	Villager	Jing Han Township
11	Yang Congshun	Female	Bai	Grocery shopkeeper	Mang Huan Village
12	He Yanbo	Female	Han	Shop Clerk	Mang Huan Village
13	Yang Yonghua	Male	Bai	Villager	Mang Huan Village
14	Duan Shengqiang	Male	Han	Villager	Mang Huan Village

15	Zhou Dingcai	Male	Han	Villager	Mang Huan Village
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Essential Information Collected:

- ◆ The rehabilitation of X214 extends 16.1 km from K10+600 to 26+700, which is currently a county road (class III, 7.5m-12m wide) managed by Longchuan Section under Dehong General Section and will be upgraded to provincial highway. The AADT of X214 is estimated at 5800.
- ◆ The road section goes straight on a vast, flat and open plateau, through a few townships and villages. The elevation of the road section ranges from 890m to 990m ASL. Large farmland areas of sugarcane, tobacco, and paddy are distributed along the section. No sensitive or protected areas are found. Aged broadleaf ficus, Chinese banyan, and eucalyptus are seen all along the section.
- ◆ Major maintenance: Resurfacing, replacement of cement treated layer, rebuilding of curbs; the road surface will be about 48 cm higher than the existing. No realignment and widening works are planned.
- ◆ There is no bridge in this section. However, well developed irrigation system was noticed along both sides of the road. It was estimated that more than 40 underneath crossings of irrigation ditches need to be carefully treated during the maintenance.
- ◆ Aggregates will be purchased from qualified suppliers with average transport distance of 45 km. Asphalt concrete will be provided by section's own batching plant with average distance of 25 km.
- ◆ No overflow or mud flow sections were found.
- ◆ The people living in the highway neighborhood showed high enthusiasm for the maintenance since the highway has not got major maintenance for about 20 years and its conditions are rather poor that has imposed serious troubles to the traffic. The interviewed persons all agreed they would benefit from the maintenance and wished it start as soon as possible.
- ◆ As the potential environmental impacts consulted, all the interviewed persons expressed their willing to accept the temporary and minor impacts but they suggested that: (i) maintain access to the road (also the 'half to half' approach would be preferred); (ii) ensure safety during the construction, flagmen need to be in place for traffic control, which is thought particularly important for the periodic township fare; (iii) keep the irrigation system in good service and the underpasses crossing the road well protected; (iv) minimizing the construction duration (the construction duration is estimated for at most three month).

May 15, 2012

Highway G323

Stakeholders: Wenshan General Section Planning Division Chief: Zhao Shiyong, Engineer: Deng Xianhui Funing Section, Director: Tang Liudong, Senior Engineer: Yang Tinglan

Questionnaire: The same as above.

Persons Interviewed for Public Consultation on G323 (K1622, K1677)

No.	Name	Gender	Nationality	Occupation/Position	Village/Township
1	Zhang Houmei	Female	Zhuang	Restaurant Owner	Boai
2	Zhang Heteng	Male	Zhuang	Restaurant Staff	Boai
3	Pan Guixiu	Female	Zhuang	Civil Servant	Boai
4	Lei Xianyi	Female	Zhuang	Civil Servant	Boai
5	Huang Daman	Male	Zhuang	Civil Servant	Boai
6	Lao Guanglu	Male	Zhuang	Civil Servant	Boai
7	Luo Zhongchan	Female	Zhuang	Primary School Teacher	Boai
8	Yang Baohua	Male	Han	Primary School Teacher	Boai
9	Nong Xiantao	Male	Zhuang	Primary School Teacher	Boai
10	Pan Hong	Female	Zhuang	Primary School Teacher	Boai
11	Huang Cen	Female	Zhuang	Primary School Teacher	Boai
12	Li Yumei	Female	Han	Primary School Teacher	Boai
13	Tan Lin	Female	Zhuang	Primary School Teacher	Boai
14	Su Guangwen	Male	Han	Primary School Teacher	Boai
15	Lu Shaosong	Male	Zhuang	Primary School Teacher	Boai
16	Zhang zhenbin	Male	Han	EPB Official	Funing
17	Pan Haiju	Female	Zhuang	EPB Official	Funing
18	Li Na	Female	Han	EPB Official	Funing
19	Yang Yingchan	Female	Zhuang	EPB Official	Funing

Essential Information Collected:

- ◆ The maintenance of G323 (class III) will be carried out by Funing Section under Whenshan General Section.
- ◆ The whole section involved starts at the south of Boai township with the chainage mark K1622, and ends at the northeast of Guichao township with the chainage mark K1694, in which the maintenance segments are K1622+000 - K1642+600, K1662+600 - K1664+000, K1674+000 - K1677+000, K1679+000 - K1681+000, K1691+000 - K1694+000, summing up to 30 km.

- ♦ All of the road segments convolve around the medium mountains with gentle slopes. The road elevations were recorded as from 300m to 650m ASL. Within these maintenance segments there are more than thirty sharp switch-backs. The concerned road segments go through two townships and a few villages.
- ♦ The vegetation along the road is mainly subtropical evergreen broadleaf forest. There are a variety of floral species. The typical plants are subtropical coniferous and broad-leaved arbors, with fagaceae and leguminosae taking dominance. Masson pine, cedar, star anise, tung tree, lacquer tree, sweet gum, birch, camphor, kapok, camellia, bamboo, silver grass, and ferns are widely distributed.
- ♦ There is a river called Tuoniang River on the right of G323 marked between K1622 and K1623.
- ♦ The pavement type of this road is asphalt pavement, 7~7.5m wide. These sections have been damaged seriously, many parts of the pavement bump which need replacement. Major maintenance: Resurfacing pavement, refilling subgrade and rebuild of curbs, the road surface will be about 30 cm higher than the existing.
- ♦ Existing traffic volume: 4784 vehicles per day on average in 2010, and 4894 in 2011.
- ♦ There is a small bridge located at K1637+400 to be resurfaced.
- ♦ There is a culvert located at K1639+100 to be prolonged, and another culvert located at 1674+10 needs repairing.
- ♦ There is a location liable to suffer from landslide and rockfall at K1663+800.
- ♦ No flash flooding, mud flow and other geological disasters were found.
- ♦ There is no concrete mixing plant in these segments. Aggregates need outsourcing with hauling distance about 140 km away. Asphalt concrete will be provided by section's own batching plant with average distance of 40 km.
- ♦ Local people living in the highway corridor area yearn for the maintenance and think improvement of the highway conditions will definitely help enhance their welfares. About 1 km away from G323 there is Funing Port being built which will provide Yunnan province an important waterway port to the overseas. Therefore G323 can serve as a key connection between the inland of Yunnan and the port.
- ♦ As for the environmental impacts, all the interviewed persons expressed little worries and thought them short lasting, limited significance and reversible.
- ♦ The main suggestions of the interviewed persons for the maintenance implementation are (i) keeping access to the road (maintaining half side road for traffic); (ii) to ensure safety during the construction, flagmen need to be in place for traffic control, which is thought particularly important for the primary school and the township fare; (iii) protecting the trees and farmlands near the RoW to the maximum efforts; (iv) minimizing the construction duration. (v) stopping construction during night time.

May 16, 2012

Highway G320 and X212

Stakeholders: Dehong General Section, Deputy Director: Zhang Mincai, Ruili Section: Li Yanping

Questionnaire: The same as above.

Persons Interviewed for Public Consultation on G320 (K3618, K3619)

No.	Name	Gender	Nationality	Occupation/Position	Village
1	Pa Mao	Male	Dai	Former Village Head	Meng Ga
2	Yan Guan	Male	Dai	Villager	Meng Ga
3	Shuai Xiang	Female	Dai	Villager	Meng Ga
4	Ruan Han	Female	Dai	Villager	Meng Ga
5	Man En	Female	Dai	Villager	Meng Ga
6	En Shuai	Female	Dai	Villager	Meng Ga
7	Shuai Xianglun	Female	Dai	Villager	Meng Ga
8	Suo	Female	Dai	Owner of restaurant	Meng Ga
9	Han Bao	Female	Dai	Small store owner	Mang Lin
10	Yang Maisong	Female	Dai	Villager	Mang Lin
11	La Ying	Female	Dai	Villager	Mang Lin
12	Yan Shi	Male	Dai	Villager	Mang Lin

Essential Information Collected:

- ◆ The maintenance works of G320 (class II, 8.5m-12m wide) included in tranche one have four segments, i.e. K3523 – K3524, K3558 – K3561, K3589 – K3592, and K3605 – K3624+700, which sum up 26.7 km. In addition, a short segment of X212 (class II county road, 12m wide, serving as access to G320 from Wanding, a very small city near Ruili) between K12+500 and K15+500 will also be involved. All the four G320 segments and the X212 segment are managed by Ruili Section under Dehong General Section. The AADT of G320 is ?? and AADT of X212 is about 7000.
- ◆ The terrain G320 goes through generally presents a hilly landform. However, most of road segments to be rehabilitated are flat or slope ways with gentle gradient, except that a part of segment from K3605 to K3616 goes down in a continuous and quite rapid gradient. The elevation of the X212 segment varies from 780m to 800m ASL while the G320 segments go up and down from 770m to 1130m ASL.
- ◆ Along both sides of the X212 segment, rubber tree farms, coffee farms, and paddies consecutively adjoin. For the G320 segments, patches of banana farms, corn fields, watermelon fields, and other tropical fruit orchards distributed widely at both sides. No sensitive or protected areas are found. An ecological city park was noticed with its nearest end just 450m away from G320, but it has been confirmed without any protected nature. Acacia, heaven tree, eucalyptus, bamboo, bombax, and bougainvillea are main plants alongside the road segments.
- ◆ Major maintenance: Resurfacing, rehabilitation to cement treated layer, rebuilding of curbs, local subgrade replacement due to subsidence; the road surface will be raised

from 9cm to 50 cm depending on the type of rehabilitation. No realignment and widening works are planned.

- ◆ There is a large bridge overpassing the Ruili River but no abutment or piers works to be done, only resurfacing required.
- ◆ Aggregates will be purchased from qualified suppliers with transport distance of 5-40 km. Asphalt concrete will be provided by section's own batching plant with average distance of 40 km.
- ◆ No overflow or mud flow sections were found.
- ◆ The interviewed persons are all of Dai minority and enthusiastic for the road maintenance. For the temporary environmental impacts probably confronted during construction, they said these minor impacts are negligible and they would not mind if only the construction activities don't last too long. They also hope to be provided with convenient traffic bypass and dust damping during the construction.

May 17, 2012
Highway S237

Stakeholders: Liuku General Section, Director of Maintenance Center: Wu Xiaorong, Engineering & Planning Division Leader: Li Wenjie

Questionnaire: The same as above, but plus:

4. Do you think the road maintenance would bring significant impairment on the ecosystem?
 And if you do,

5. What would be most vulnerable and sensitive ecological resources which may be jeopardized by the maintenance activities?

6. Please advise us the key habitats, wildlife species, and any other eco-resources to be protected, as well as indicators and factors which determine the diversity and quality of the ecosystem.

Persons Interviewed for Public Consultation on S237 (K298, K299)

No.	Name	Gender	Nationality	Occupation/Position	Village
1	Deng Fubo	Male	Lishu	Villager	Buxidi
2	Du Dou	Female	Lishu	Villager	Buxidi
3	Qia Youye	Female	Lishu	Villager	Buxidi
4	San Jianchun	Female	Lishu	Villager	Buxidi
5	Na Lizao	Female	Lishu	Villager	Buxidi
6	Cai Qin	Female	Lishu	Grocery Owner	Buxidi
7	Na Qiukua	Female	Lishu	Villager	Buxidi
8	Wang Youdui	Male	Lishu	Self-employed hauler	Buxidi
9	Wang Dabo	Male	Lishu	School Principal	Buxidi branch of Bula Primary School
10	Yu Lizhong	Male	Lishu	Teacher	Buxidi branch of Bula Primary School
11	Wang Lizhen	Female	Lishu	Teacher	Buxidi branch of Bula Primary School
12	Li Meiyong	Female	Lishu	Teacher	Buxidi branch of Bula Primary School

Essential Information Collected:

- ♦ The road segment of S237 proposed as tranche one component is consecutive from K269 to K305 with total length of 36 km (class IV or even unclassified). This segment is mostly managed by Fugong Section (K269 – K302.5, 33.5 km), leaving 2.5 km to Gongshan Section (K302.5 – K305). Both sections are under Liuku General Section. According to the general section, Fugong Section will undertake the whole maintenance.
- ♦ S237 extends north to the upstream of Nujiang River. The proposed segment switches back along the edge of steep cliff cutting down into the roaring whitewater. The width of the road mostly (about 25km of which) varies from 2.8m-3.5m, only one thirds of the road has 5m-6m width. The topography is so difficult and dangerous that the alignment can only make its way by hanging on to the precipice with many hairpin bends. The elevation of the segment varies not so rapidly as from 1300m to 1370m ASL. Rockfall, landslide, mud and rock flow, and overflow road segments were all found.
- ♦ The ecosystem along the segment is well protected with only less populated villages and very limited farmlands distributed. The main crops include rice, corn, rape, peach, nectarine, walnut, and canna edulis ker (for pig raising). The common plants along the road segment are tung tree, toon, magnolia, tree fern, lacquer tree, five-leaved pine, incense cedar, Douglas fir, hollock, fargesia, etc. There are some wild animals reported in the project area such as tragopan, falcon, pangolin, and so on. Since the alignment is close to the river, no larger beasts inhabit near the road. No significant fishery exists in this area. Some fishes inhabit in the torrent of Nujiang River. Typical species include *Anguilla nebulosa*, Bullhead, *Pareuchiloglanis gracilicaudata*, *Schizothorax griseus*, *Bagarius yarrelli*, etc., most of which are native and locally distributed.
- ♦ It has been noticed that the road segments to be rehabilitated are close to the Gaoligong Mountain Nature Reserve. The Gaoligong Mountain Nature Reserve was originally established in 1983 by Yunnan provincial government. It later was upgraded to national level in 1986. The nature reserve presents in a north-to-south corridor along the Gaoligong Mountains with three separate parts coordinated as:
 - (i) Northern Part, N27°31 ' - 28°22 ' , E98°08 ' - 98°37 ' ;
 - (ii) Middle Part, N25°11 ' - 26°15 ' , E98°40 ' - 98°49 ' ;
 - (iii) Southern Part, N24°56 ' - 26°09 ' , E98°34 ' - 98°50 ' .

Currently we can't confirm if the road segments are within the nature reserve since we haven't got a map appertaining to the nature reserve. But it seems that they are close to the northern part of the reserve and might not be in it when compare the coordinates recorded during the survey as from N27°15 ' - 27°32 ' , E98°49 ' - 98°53 ' .
- ♦ The proposed works for S237 are comprehensive major maintenance, including: widening carriageway, reinforcement of slope, building of new retaining wall, resurfacing, rehabilitation to cement treated layer, rebuilding of curbs, anticollision parapet, and improvement of transport and safety facilities, etc. The road surface will be raised about 30 cm. No realignment is planned.
- ♦ There are 15 medium/small bridges to be rehabilitated, mainly for the arch ring masonry structure and some foundation reinforcement. The road segment also has 352 culverts to be extended with average 2 meters. In addition, four concrete round culverts are planned to build in.
- ♦ Aggregates will be purchased from qualified suppliers with transport distance of 30-40

km. Asphalt concrete will be provided by section's own batching plant with average distance of 35 km.

- ♦ The interviewed persons are all of Lisu minority and expressed their full support to the road maintenance. It was said that the highway S237 is the only road for transportation and provides vital important connection between the deep river valley and the outside world. Poor road conditions and unfavorable geographic localities with dangerous geological drawbacks often cause traffic jam and even dead stop to the transport. It is widely agreed the maintenance of the road segments will benefit the local people and bring prosperity to the local economy. The AADT was reported at 818 pcu (as for year of 2010), and projected at 980 pcu for year of 2013, as well as 1778 pcu for year of 2020. Meanwhile, the comprehensive rehabilitation will significantly improve safety performance of the road segments. According to the general section, each year in this thirty six road section more than ten persons were killed by serious accidents and more injured.
- ♦ For the potential environmental impacts expected during construction, the interviewees didn't show much care. They believe these physical impacts are minor and acceptable. However, the teachers of Bula Primary School suggested the safety of the pupils and school buildings might be jeopardized during the construction. They requested that special efforts need to be made for the road safety and proposed to fell down the tall roadside trees that the big trunks and boughs would not hit persons in the small school yard.
- ♦ Obviously, the local people didn't foresee any significant impacts on the ecosystem that may arise from the road maintenance. The indigenous Lisu people live in a relative lower life standard and have measly understanding of the significance of the well preserved ecosystem. Therefore they care more how to enhance their livelihood than protect the environment.

May 19, 2012

Highway G320

Stakeholders: YHAB Dali General Section Maintenance Division Leader: Wang Yongxing, Maintenance Division Engineer: Wang Jun, Dali Section, Deputy Director: Zhao Canyu (Female) YHAB Xiangyun Section, Director: Li Hongming, Deputy Director: Yu Tiqing

Questionnaire: The same as above.

Persons Interviewed for Public Consultation on G320 (K3163, K3169+100, K3183+800)

No.	Name	Gender	Nationality	Occupation/Position	Village
1	Dong Debao	Male	Han	Village Head	Xishan
2	Li Yan	Female	Han	Member of villager committee	Xishan
3	Li Guangpu	Male	Han	Villager	Shuipenpu

No.	Name	Gender	Nationality	Occupation/Position	Village
4	Li Zhenglin	Male	Han	Villager	Shuipenpu
5	Zuo Yinhua	Female	Yi	Villager	Shuipenpu
6	Liu Jiejiang	Male	Han	Restaurant Owner	Tangzipu
7	Yang Sheping	Female	Bai	Villager	Tangzipu
8	Yang Yan	Female	Bai	Restaurant Waitress	Tangzipu
9	Hou Jizhen	Female	Miao	Restaurant Waitress	Tangzipu
10	Yang Jili	Female	Bai	School Principal	Wenquan Primary School
11	Ma Yun	Female	Han	Teacher	Wenquan Primary School
12	Zhao Yanmei	Female	Han	Teacher	Wenquan Primary School
13	Yang Jing	Male	Bai	Teacher	Wenquan Primary School
14	Yang Guijun	Male	Bai	Teacher	Wenquan Primary School

Essential Information Collected:

- ◆ The maintenance works proposed for G320 under management of Dali General Section include four segments, namely K3063 – K3069, K3183 – K3187, K3189 – K3194, and K3262 – K3264, which sum up 17 km, among which we had only surveyed on the first and the second segments, maintained by Dali Section and Xiangyun Section respectively. Both segments surveyed are class III and 7.5m-8m wide.
- ◆ Both segments go in continuous slopes with a number of bends. The elevation of the first segment ranges from 1890m to 1980m ASL while the second segment goes up and down from 2115m to 2290m ASL.
- ◆ The first segment is located in the outskirt of Dali city and densely populated. Villager houses, restaurants, school, and hotspring resorts are distributed along the segment. AADT was reported huge as 11,000 vehicles per day. The second segment passes through a hilly terrain with large area of farmlands growing tobacco, corn, wheat, mulberry, and rape, a few villager houses sporadically distributed. Eucalyptus, bamboo, peach, walnut, and pear are typically seen along the segment. AADT of the second segment was reported as more than 2000, and even up to 20,000 when the expressway G56 was closed.
- ◆ Major maintenance: Resurfacing, rehabilitation to cement treated layer, rebuilding of curbs, repair of covered side ditches; the road surface will be raised 40cm to 50 cm. No realignment and widening works are planned.
- ◆ There is an arch culvert with diameter of 3.3m in the second segment but only road resurfacing work was planned.
- ◆ Aggregates will be purchased from qualified suppliers. The transport distance is averaged at 40 km for the first segment and 48 km for the second segment. Asphalt

concrete will be provided by section's own batching plant with average distance of 1 km for the first segment and 50 km for the second segment.

- ◆ No overflow or mud flow sections were found.
- ◆ The interviewed persons expressed their warm support to the road maintenance. The segments concerned often suffer from incredible huge traffic volume diverted from the parallel expressway G56 due to close down for maintenance or bad weather. Congested vehicles queue in G320 one by one even without enough room for bicycles getting through. The local people believe if the road conditions are noticeably enhanced, such deadly traffic jam can be avoided. For the temporary environmental impacts probably confronted during construction, the interviewees thought them minor and negligible. They would not mind if only the construction activities don't last too long. They also hope that convenient traffic bypass can be provided. Moreover, they reminded that proper traffic control and construction management would be important for the township fare held every three days.

July 30-31

Highway S234

Dehong General Section

Stakeholders: YHAB Dehong General Section Qian Bo, chief of Engineering Planning Division, Tang Yanhua, deputy chief of Engineering Planning Division and Ruili Maintenance Section, Liu Yu, director of the section, Lei Wendi, chief of Planning & Statistical Division.

Questionnaire: The same as above.

Essential Information Collected:

- ◆ The roadbed width ranges from 10 to 12 m. Reported daily traffic volume is 6709 vehicles. Road condition is pretty good.
- ◆ There are 5 medium bridges, 5 small bridges and 182 culverts with the maintenance segments.
- ◆ The proposed maintenance will be only routine and minor nature. Average transport distance of maintenance materials is estimated at 58 km.
- ◆ No mud flow, land slide, and flooded areas are reported alongside the road segments.
- ◆ For the first segment, most roadside areas are farmlands. An irrigation channel parallels with the road. While on both sides of the second segment, woodlands take most proportion. Urban and rural residents of four townships inhabit along the road. Two schools and one kindergarten near the RoW were visited. The first segment also passes through Long Dao township at K230-K233, where dense population dwells in.

Participants in public consultation

No negative public comments or remarks were recorded. Participants were generally supportive of the work.

S234: conducted at K179, K206, and K230, on July 31, 2012

No.	Name	Gender	Nationality	Occupation/Position	Village
1	Hao Lida	Male	Han	Restaurant Owner	K179
2	Li Muxiang	Female	Jingpo	Restaurant Waitress	K179
3	Shi Zhengrong	Male	Han	Villager	Bang Wan Village
4	Shi Yunlang	Female	Han	Villager	Bang Wan Village
5	Tuan	Female	Dai	Lunchroom Owner	K230
6	Han Mie	Female	Dai	Lunchroom Waitress	K230
7	Han Xin	Female	Dai	Lunchroom Waitress	K230
8	Rui Ming	Female	Dai	Small Store Owner	Long Dao Township
9	Guo Jiahe	Male	Han	Self-employed motor tricycle operator	Long Dao Township
10	Duan Mingzhu	Female	Han	Restaurant Waitress	K206
11	Zhang Lu	Female	Han	Student	K206
12	Li Guoxiang	Male	Han	Officer	Ruili EPB
13	He Xi	Female	Lisu	Assistant Engineer	Ruili EPB
14	Liu Xianxiang	Female	Han	Undergraduate	Ruili EPB