Environmental Due Diligence Report

March 2017

People's Republic of China: Mountain Railway Safety Enhancement Project

Prepared by the China Railway Corporation for the Asian Development Bank.

CURRENCY EQUIVALENTS
(as of 4 January 2017)

Currency unit	–	yuan (CNY)
CNY1.00	=	$0.1439
$1.00	=	CNY6.9516

ABBREVIATIONS

ADB	–	Asian Development Bank
CRC	–	China Railway Corporation
CKRC	–	Chengdu-Kunming Railway Corporation
CKRL	–	Chengdu-Kunming railway line
CREEC	–	China Railway Eryuan Engineering Company
EIA	–	environmental impact assessment
EIR	–	environmental impact report
EPL	–	Environmental Protection Law
NDRC	–	National Development and Reform Commission
PRC	–	People's Republic of China

WEIGHTS AND MEASURES

km	–	kilometer

NOTE
In the report, "$" refers to US dollars.

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MOUNTAIN RAILWAY SAFETY ENHANCEMENT PROJECT
IN THE
PEOPLE'S REPUBLIC OF CHINA

0 50 100

Kilometers

- E'mei–Miyi Section
- Proposed Chengdu–Kunming Railway line
- Existing Chengdu–Kunming Railway line
- National Capital
- Provincial Capital
- City/Town
- SAR Special Administrative Region
- Provincial Boundary

Boundaries are not necessarily authoritative.

New Version C: 05 April 2016
First Proof: 05 April 2016
Second Proof: 13 April 2016
Third Proof: 16 January 2017
Fourth Proof: 31 January 2017

I. INTRODUCTION

A. The Project

1. The People's Republic of China (PRC) is a vast country where people and goods move over long distances and railways provide the most economic means of transport. The railway sector is vital to the PRC's economic and social development, international trade, continued economic growth, and ability to extend the benefits of development to people living in the more remote regions of the country. The railway has the competitive advantage in moving passengers, bulk goods and containers over medium to long distances. The government has therefore prioritized the expansion and modernization of the railway network. During 2003–2015, the rail network expanded by 65%, from 73,000 kilometers (km) to 121,000 km. The PRC has also developed the world's longest high speed rail network (19,000 km). However, improvements in the rail network have mainly occurred in eastern PRC and the network remains rather sparse and basic in western and southwestern PRC.

2. Rail development in southwestern PRC. Despite the PRC's vast expertise in developing the high speed rail network, constructing medium speed rail lines in a highly mountainous region, such as southwestern PRC, poses considerable difficulties. The difficult and dangerous terrain in southwestern PRC is one of the main reasons why the rail network in the region remains inadequate. The limited capacity for freight movements and high travel times of passenger trains are considered major obstacles to economic development and poverty reduction in the region. Hence, the PRC is prioritizing development of the railway infrastructure in this region to increase speeds and more than double the freight carrying capacity through its Western Development Strategy. However, the PRC needs assistance and expertise in ensuring that the railway lines are well designed, properly constructed, and conform to the highest standards of safety.

3. Safety is an integral part of providing competitive, high quality, and reliable transportation for people and goods. As the PRC railways have expanded, introduced new concepts and technologies, and increased speeds, safety needs have changed. The PRC recognizes this important aspect and seeks to promote modern rail safety technologies and emergency management systems consistent with the development needs of the country's railways. It seeks to attract foreign technology and expertise to meet these needs, an area where the Asian Development Bank (ADB) can play a significant role.

4. The safety issue is a challenge as the trains encounter difficult operating conditions amid varying geological features as they crisscross the length and breadth of the country. This is particularly so in southwestern PRC, where the terrain is mountainous and railway lines have to be built with many bridges and tunnels. Operating a railway through a number of tunnels poses significant challenges for railway safety. Special arrangements need to be made for signaling, ensuring speed restrictions, real time monitoring of tunnel conditions, lighting and establishing emergency systems for firefighting, ventilation, and rescue. A range of new technologies now exists for improving safety in rail tunnels, and can play a vital role in preventing accidents as well as ensuring a swift emergency response.

5. Southwestern PRC has two major fault lines (Anning River Fault Line and Daliang Mountain Fault Line) owing to which railway construction in the region requires high intensity earthquake fortification. Mountainous areas are also prone to landslides which cause rocks and

debris to block the track resulting in unsafe train operating conditions. A strengthened safety management system which includes advanced signaling and communication systems as well as an improved management information system is needed to prevent train accidents and to respond promptly if they do occur.

6. The Chengdu-Kunming railway line (CKRL) is a key part of a regional corridor that will eventually extend to the countries in the Greater Mekong Subregion, and thus become a part of an international railway route connecting the subregion to western PRC, Central Asia Regional Economic Cooperation countries, and the Eurasian land bridge.

7. The existing line between Chengdu and Kunming was built between 1958 and 1970. It is a single track line with operating speed in the range of 40-60 km per hour. It has been operating at near full capacity for more than 10 years. The China Railway Corporation (CRC) is constructing a railway line from Chengdu to Kunming for capacity expansion over the southwestern region of the PRC with 18 stations. This will involve construction of 860 km of double track electrified main railway line for passenger and freight transport operations. The proposed alignment of the new CKRL is shorter by 236 km (21.5%) compared to the existing single track line (1,096 km) and has better geometry. The development of the line will be done in various phases, namely Guangtong–Kunming, Miyi–Guangtong, Chengdu–E'mei, and E'mei–Miyi.[1]

8. The capacity along the entire route from Chengdu to Kunming will be greatly increased. Train speeds on the new railway line will be increased to 160 km per hour from the existing speeds of 60 km per hour. The tonnage could increase from 3,200 tons to 4,000 tons net per freight train and the capacity of passenger train-pairs per day increase from 12 to 35. The shorter alignment and faster train speeds will decrease the travel time to less than 8 hours for passenger trains. Presently, it takes 18 to 22 hours for people to travel from Chengdu to Kunming via rail.

9. ADB financing will support the provision of safety equipment for the E'mei–Miyi section (386 km) of the CKRL, which is the most difficult section of the railway. This section runs mostly through treacherous terrain traversing mountains and steep river valleys requiring 147 bridges (88.5 km) and 48 tunnels (201.8 km), 7 of which will be over 10 km, and climbing 1,400 meters at a grade of 1.3%. The total length of bridges and tunnels is 290.3 km, accounting for 75.6% of the alignment. The complex terrain coupled with the increased weight, speed and number of trains increases the importance of the safety of railway operations on the Chengdu–Kunming railway line. Within this railway line development, ADB's financing will support railway safety equipment that conforms to the best international standards. The cost of the equipment is relatively small compared to the cost of other capital assets or construction of a railway line, but the benefits are significant. For example, investing in a high quality signaling and information system, trackside defect detectors and advanced train control systems will ensure that unsafe movements of trains are prevented and train operators have the necessary and complete information needed for safe train operations including routing, spacing, speed control, protection and shunting. Since the line has many long tunnels, emergency rescue facilities and procedures are critical in preventing a disaster associated with an accident or a tunnel fire involving a train. The tunnel safety equipment planned for the E'Mei-Miyi serves to minimize risk and mitigate any

[1] Chengdu–E'mei will open in 2017; E'mei–Miyi will open in 2022; Miyi–Guangtong will open in 2018; Guangtong–Kunming opened in 2016.

potential casualties.

10. The capacity building component will assist the executing agency, implementing agency, and the Chengdu Rail Bureau in developing a strong understanding of international best practices of integrating safety and emergency response. Training railway staff in emergency response and evacuation procedures, along with recurrent emergency evacuation drills, will ensure that any emergency involving tunnels can be quickly dealt with by locally stationed personnel. The small investment would have a significantly high value addition, allowing considerable leverage of ADB financing.

B. Project Design

11. The impact will be a safe, reliable and efficient rail transport system in southwestern PRC. The outcome will be a safe and efficient railway corridor between E'mei and Miyi.

C. Project Outputs

12. **Output 1: Railway signaling, communications and power supply system developed.** This will include signaling and communication equipment to improve train operations safety such as centralized train dispatching and monitoring system, automatic block signaling, interlocking devices, and train control systems. This will also cover procurement of electric power supply and bridge bearings. The installation of bridge bearings will be done as part of civil works contracts which are domestically financed.

13. **Output 2: Tunnel safety operations and monitoring system installed.** This will comprise tunnel equipment to enhance safety. The equipment will cover lighting, ventilation, firefighting and fire control systems, and emergency rescue and disaster management systems; and

14. **Output 3: Institutional capacity on railway safety management enhanced.** This will support capacity building for railway safety measures and technology. Working with the executing agency, the design institutes and the railway administrations, the existing institutional arrangements for integrating safety measures in railway management will be reviewed, and recommendations made to make these more strategic and focused. Staff from concerned government agencies will receive training on railway safety, disaster prevention and emergency tunnel rescue operations to enable them to be better equipped to handle rescue efforts in the event of a tunnel accident. About 100 staff will be trained and technical exchanges on advanced technologies and new maintenance techniques will be organized to familiarize staff in these areas.

D. Implementation Arrangements

15. The executing agency will be the CRC, which will be responsible for overall project implementation. The Planning and Statistics Department of the CRC will coordinate and supervise project preparation, while the Material Department of the CRC will be responsible for supervising procurement and project implementation.

16. The implementing agency will be the Chengdu-Kunming Railway Corporation (CKRC), which is a joint-venture shareholding company established under the PRC company law. The

shareholders are the CRC and Sichuan Provincial Government. CKRC is responsible for project construction, operations management, finance and accounting and maintenance of infrastructure assets. CKRC will be responsible for coordinating and implementing all project components. CKRC does not have any previous ADB or World Bank project experience, and the staff is not familiar with ADB procurement policies and procedures. The executing agency has engaged a tendering company to assist in procurement. Further support will be provided by engaging a consulting team under Output 3 for guiding and training the staff in the implementing agency.

17. The project will be implemented over 7 years from June 2017 to June 2024. The longer implementation period is due to the fact that this project is linked to the construction of the railway line. All procurement to be financed under the ADB loan will be carried out in accordance with ADB's Procurement Guidelines (2015, as amended from time to time). All consultant services will be recruited in accordance with ADB's Guidelines on the Use of Consultants (2013, as amended from time to time).

E. Purpose of Environmental Audit Report

18. The project is limited to the procurement of a range of railway safety equipment and other relevant equipment like bearings. Installation of bridge bearings is not a part of the project scope, as these must be installed only by the designated company with proper qualification under PRC regulations. Other safety related equipment will be installed and tested by the supplier. Thus, environmental impacts of the project will be limited to the installation of the safety equipment. Occupational health and safety measures and attention to solid waste management will be incorporated into the project and will be consistent with national laws and regulations.

19. Following ADB's Safeguard Policy Statement (SPS),[2] the project is categorized as C for environment but the E'Mei-Miyi section of the CKRL is considered as existing facility of the project. According to the ADB SPS, an environmental audit is required for the existing facility. As the E'Mei-Miyi section is under construction, this environmental compliance audit report covers environmental due diligence on domestic environmental impact assessment (EIA) process. During the project implementation, environmental compliance audit will continue through regular monitoring and reporting.

20. The environmental compliance audit was prepared based on review of the feasibility study report, original environmental impact report (EIR), as well as the revised EIR. During the preparation of this compliance audit, a series of discussions was conducted with the CRC, as well as the CKRC, which is responsible for the E'Mei-Miyi section of the CKRL. Site visits were also conducted in Mianning (existing station), Dechang West (new) and Xichang West (new) station locations.

[2] ADB. 2009. *Safeguard Policy Statement.* Manila.

II. DESCRIPTION OF EXISTING FACILITY UNDER CONSTRUCTION

A. Chengdu-Kunming Railway Line and the E'mei–Miyi Section

21. The CKRL is the railway line from Chengdu to Kunming located in the southwestern region of the PRC. CKRL, which was originally built in 1970 with a single track with low speed, requires major upgrade to function as an important transportation corridor. Presently, it takes 18 to 22 hours for people to travel from Chengdu to Kunming via rail. The National Development Reform Commission (NDRC) approved the construction of the new CKRL, replacing the existing one with better geometric alignment. The CRC is constructing CKRL, which will involve construction of 860 km (645 km in Sichuan, and 215 km in Yunnan) of double track class I electrified railway main line for passenger and freight transport operations. The proposed alignment of the new CKRL is shorter by 236 km (21.5%) compared to the existing single track line (1,096 km) and has better geometry. The train speeds on the new railway line will be increased to 160 km per hour from the existing speeds of 60 km per hour. The shorter alignment and faster train speeds will decrease the travel time to less than 6 hours for passenger trains. This railway line is also envisaged to be a part of a regional corridor that will eventually extend to the countries in the Greater Mekong Subregion, and thus become a key part of a regional corridor as well as a part of an international railway route.

22. Upgrading of the E'mei–Miyi section is in line with the "transformation and expansion of existing railway" under Type 1 Encouragement Category of the Guidance List for Industrial Structure Adjustment (2011 version)(amendment) under NDRC[3] decree [2011] number 21. It is also in accordance with the Medium and Long Term Development Plan for Integrated Traffic Network (NDRC [2007] No. 3045), Medium and Long Term Railway Network Plan (2008 Adjustment), Twelfth Five-Year Plan for Integrated Traffic and Transport System Planning (State Council [2012] No. 18), and Twelfth Five-Year Plan for Railway Development Planning (National Railway Bureau [2011] No. 80). The project proposal for upgrading of the E'mei–Miyi section was approved by the NDRC in 2013 (NDRC [2013] No. 1693).

23. The construction of new lines will be done in phases, segregating into 4 sections (see the Map provided in the main RRP): (i) Chengdu–E'mei; (ii) E'mei–Miyi, (iii) Miyi–Guangtong, and (iv) Guangtong–Kunming. The E'mei–Miyi section of the CKRL totals 392 kilometers (km), consisting of 386 km main line and 6 km branch line, which runs across mountainous areas. The CKRC, a joint venture company established under the PRC Commercial Company Law by the CRC, Sichuan Provincial Government (SPG), and the Chengdu Railway Bureau as shareholders. a joint venture between the CRC and Sichuan Provincial Government is constructing the E'Mei-Miyi railway line. When the construction is completed, the E'mei-Miyi railway line will be operated by the Chengdu Rail Bureau under an operation and maintenance agreement. Upon completion of the E'mei-Miyi railway line, the same entity will also operate the railway facilities with the Chengdu Railway Bureau running the trains and managing the stations including maintenance and repair of all facilities.

24. The southwestern PRC has two major fault lines, namely Daliang Mountain Fault Line and Anning River Fault Line, and the E'mei–Miyi section passes through these fault lines. Although the railway engineering design incorporated high intensity earthquake fortification, safety enhancement is essential to detect obstacles in railway to prevent accidents. Generally,

mountainous areas are prone to accidents induced by rocks and debris from landslide, for instance. While the construction of railway lines of the E'mei–Miyi section is domestically financed, the ADB-financed project focuses on a strengthened safety management system of the E'mei–Miyi section in CKRL. It includes advanced signaling and communication systems as well as an improved management information system that can prevent train accidents and respond promptly if they do occur. The ADB–financed project also includes the procurement of power line and bridge bearings for the E'mei–Miyi section.

B. China Railway Corporation and the Chengdu-Kunming Railway Corporation

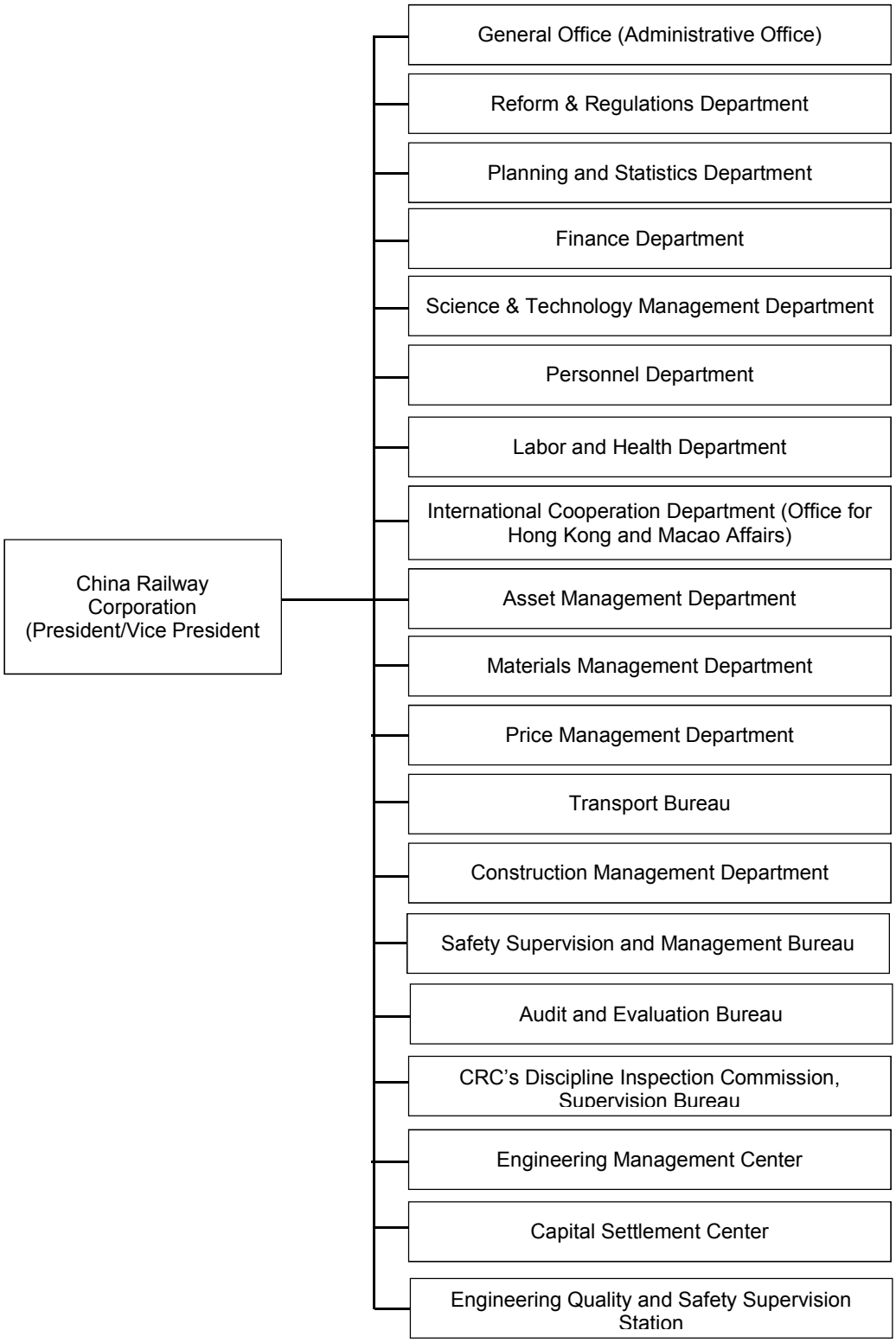
25. The CRC is the executing agency of the ADB-financed project. CRC is a solely state-owned enterprise under the management of the PRC government, set up by the approval of the State Council according to the PRC law on Industrial Enterprises Owned by the Whole People. CRC's registration capital is CNY1,036 billion. According to the Scheme of Institutional Reform and Function Transformation of the State Council approved on the first session of the 12th National People's Congress, the commercial arm of the railway sector shall be separated from the administrative arm to form the CRC. It was officially set up in March 2013.

26. The CRC focuses on railway passenger and freight transport services and carries out diversified business operation, including unified control and command of railway transport, operation and management of passenger and freight transport by national railways, public welfare transport specified by national regulations, key transport related to the national economy and the peoples' livelihood, as well as special transport, dedicated transport, and transport tasks for rescue and disaster relief; draft of railway investment and construction plans and suggestions on national railway network construction and financing schemes; preliminary work and management of construction projects; guarantee of national railway transport safety by undertaking the principal responsibilities for railway safe production. The organizational structure of the CRC is presented in Figure 1 and Figure 2 presents enterprises under CRC.

27. The CKRC is the implementing agency of the ADB-financed project. CKRC is a joint venture company established under PRC Commercial Company Law with CRC, Sichuan Provincial Government, and the Chengdu Railway Bureau as shareholders. Upon completion of the E'mei-Miyi railway line, CKRC will operate the railway facilities with Chengdu Rail Bureau running the trains and managing the stations including maintenance and repair of all facilities. Figure 3 show the organizational structure of the CKRC.

28. The CRC and the CKRC are responsible for the planning, implementation, financing, and operation of the project after its completion. Safety supervision and management department at CRC and safety and quality department at CKRC will take responsibility any safeguards related issue of the E'mei–Miyi section of the CKRL. CRC will take final responsibility and CKRL will take implementation responsibility to ensure full compliance to the relevant PRC laws and regulations.

Figure 1: Organizational Structure of the China Railway Corporation

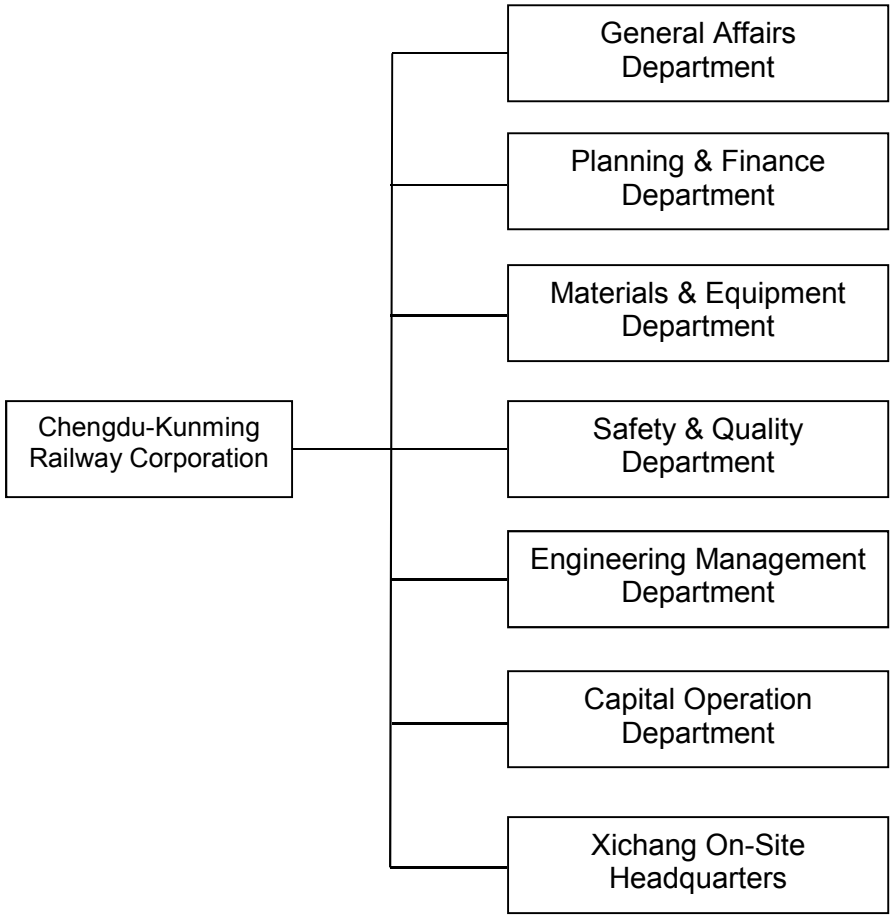


Source: China Railway Corporation

Figure 2: Enterprises under CRC (as of May 2016)

Source: China Railway Corporation

Figure 3: Organization Structure of Chengdu-Kunming Railway Corporation



Source: Chengdu-Kunming Railway Corporation

C. Technical Design of the E'mei– Miyi Section

29. The ADB-financed project includes the procurement of bridge bearings. The installation of bridge bearings will be carried out as a part of civil works of the E'mei–Miyi section of the CKRL. The installation of bridge bearings is not part of the ADB-financed project scope, but ADB recognizes the importance of the bride design and construction in relation to the ADB project meeting the project objectives-railway safety enhancement. Thus, the following due diligence was made for the technical design of railway and bridges of the E'mei– Miyi Section of CKRL.

30. A highly qualified design institute was engaged for the design of the entire E'mei– Miyi Section of CKRL, which is the China Railway Eryuan Engineering Company (CREEC).[4] CREEC

[4] More information on CREEC's profile is available at http://www.creegc.com/en/tabid/173/Default.aspx.

prepared all the designs of the E'mei– Miyi section, including concept design, preliminary engineering design, and detailed engineering design. CREEC is highly experienced in railway designs including bridges and tunnels and has extensive working relations with and been entrusted by the CRC. CREEC conducted railway design work for all of Southwestern PRC—the most difficult terrain for railway construction.

31. CREEC was founded in September 1952 and established its headquarters in Chengdu Province. CREEC is the largest multi-industry and comprehensive engineering survey & design corporation in the PRC, with survey, design, consulting, general contracting and system integration as the core businesses. CREEC is the core enterprise of China Railway Group Ltd. (ranking No. 95 among "World's Top 500 Companies" in 2011). Currently, CREEC has 25 subsidiaries (wholly owned or by joint venture), 17 institutes, and 10 overseas branch offices. CREEC has established a range of scientific research institutes including Post-Doctoral Researchers Center, Technical Research Laboratory of High Speed Railway, and National Engineering Practice Education Center. CREEC is committed to become the most outstanding general contracting and system integration corporation, and grow into a well-known international engineering enterprise.

32. Regarding survey, design and consulting, CREEC holds the Comprehensive "Class A" Qualification Certificate for Engineering Design, National Class A Qualification Certificates for survey, design, consulting, project supervision and EIA, and possesses related business licenses. CREEC's core businesses of survey, design and consulting cover the following fields: railway, road, urban rail transit, municipal engineering, environmental protection engineering, project supervision, geotechnical engineering, real estate, ferry terminal, etc. Since 1992, CREEC has been ranking top among National Comprehensive Top 100 Survey and Design Units, with its survey and design income topping the national railway industry since 2005.

33. CREEC takes general contracting and system integration as its core businesses and development priority. It uses advanced technology and business operations, and holds National Class A Qualification Certificate for General Contracting. As the earliest enterprise in the PRC to develop general contracting and business system integration, along with its more than 20 years of industry experience, CREEC has completed a considerable number of projects on railway, subway, road, municipal engineering, water supply & drainage, house-building, electric power, telecommunication, geological disaster, etc. both in the PRC and internationally. CREEC has received high reputation and client appraisal. Presently, CREEC is actively developing new business on a global scale in the fields of product industrialization, environmental-protection & energy-saving design, real estate and investment & financing, etc.

34. In terms of staff profile and qualifications, engineers that work on all stages of railway and railway bridge designs are highly qualified and specialized, including staff with expertise in route, track, geology, subgrade, bridge, hydrology, tunnel & underground engineering, station & yard, communication, signal, application of information technology, locomotive & rolling stock, machinery, structure, architecture, water supply and drainage, heating, ventilation and air conditioning, environmental protection, electric power, electrification, engineering cost, mining and ore dressing, airport electronics and aerial survey, and others. CREEC has more than 6,300 staff, and has expertise in 41 disciplines.

35. Quality control process for bridge designs of E'mei– Miyi Section of the CKRL was assessed. The bridge design and construction plan went through five levels of reviews and

monitoring for quality check and control, which are:

(i) Review and monitoring by the contracting firm,
(ii) Reviewed and monitoring by the construction supervision company,
(iii) Review and monitoring by Safety and Quality Department of the Chengdu-Kunming Railway Corporation (the implementing agency),
(iv) Review and monitoring by the Engineering Management Center and Quality Inspection Unit of the China Railway Corporation (the executing agency), and
(v) Review and monitoring by National Railway Administration.

36. Particularly for railway bridges, the design must undergo the highest level of scrutiny in the PRC, as the design is required to meet the PRC's Railway Bridge and Culvert Design Code TB10002.1-2005, which is higher than the national level bridge design code. Thus, third-party external quality check and monitoring were conducted by (i) Guizhou Railway Construction Engineering Quality Inspection company, and (ii) Beijing Taishi Engineering Inspection Company. The entire design approval process for railways bridges took over two years, as shown in Table 1.

Table 1: Milestone and Approval Dates for Railway Design (including bridges)

Milestone	Duration/Approval Date
Initial design and FSR approval	Aug 2013 - Sept 2014
Preliminary design approved	Aug 2015
Detailed design approved	Nov 2015

FSR = feasibility study report.
Source: China Railway Corporation.

37. The total design cost for E'mei– Miyi Section of CKRL, including bridges was $87 million.

38. The current ongoing construction of the E'mei– Miyi Section of CKRL, besides CRC and CKRC' supervision, a total of 7 highly qualified construction supervision companies are engaged to carry out the construction supervision to ensure the construction quality of E'mei– Miyi Section of CKRL. These construction supervision companies are:

(i) Zhengzhou Zhongyuan Railway Construction Supervision Co. Ltd;
(ii) Chengdu Southwest Transport University Engineering Construction Supervision Co. Ltd;
(iii) Sichuan Railway Science construction supervision co. Ltd;
(iv) China Railway Eryuan Supervision Co. Ltd;
(v) Chengdu Great Southwest Railway Supervision Co. Ltd;
(vi) Beijing Tongda Supervision Co. LTd;
(vii) Henan Changcheng Railway Construction supervision Co. Ltd; and
(viii) Beijing Railway Research Construction Supervision Co.Ltd.

III. THE PRC ENVIRONMENTAL IMPACT ASSESSMENT OF THE E'MEI– MIYI SECTION

39. In the PRC, EIA laws and regulations require all new railway projects and all electrified conversion of rail lines longer than 200 km the submission and approval of environmental impact reports by the Ministry of Environment Protection (MEP), the highest level of environmental impact reporting and approval.[5] Health and safety of rail projects are regulated under PRC's labor law and occupational disease prevention law, quality and safe operation of railway projects,[6] as well as environmental and sanitation standards on construction sites.

A. The PRC Laws and Regulations on Environmental Impact Assessment

40. The list the PRC's environmental laws, regulations, decrees, guidelines, and standards relevant to the E'mei–Miyi section of the CKRL is presented in Table 2. These requirements cover environmental protection and impact assessment; pollution prevention and control on air, noise, water, ecology and solid waste; and are supported by technical guidelines and standards for assessing atmospheric, noise, water, and ecological impacts as well as controlling pollutant emissions and discharges.

Table 2: Relevant PRC Laws, Regulations, Decrees, Guidelines, and Standards

Laws	
1	*Cultural Relics Protection Law of the PRC*, 1982 (amended in 2007)
2	*Water Pollution Prevention and Control Law of the PRC*, 1984 (amended in 2008)
3	*Wild Animal Protection Law of the PRC*, 1988 (second amendment 2016)
4	*Environmental Protection Law of the PRC*, 1989 (amended in 2014)
5	*Railway Law of the PRC, 1990*
6	*Soil and Water Conservation Law of the PRC*, 1991 (amended in 2010)
7	*Labor Law of the PRC*, 1994
8	*Solid Waste Pollution Prevention and Control Law of the PRC*, 1995 (amended in 2004)
9	*Environmental Noise Pollution Prevention and Control Law of the PRC*, 1996
10	*Atmospheric Pollution Prevention and Control Law of the PRC*, 2000 (amended in 2015)
11	*Occupational Disease Prevention and Control Law of the PRC*, 2001
12	*Water Law of the PRC*, 2002
13	*Environmental Impact Assessment Law of the PRC*, 2002
Regulations	
14	*Soil and Water Conservation Law Implementation Ordinance of the PRC,* 1993 (amended in 2011)
15	*Natural Reserve Ordinance of the PRC*, 1994
16	*Wild Plant Protection Ordinance of the PRC,* 1996
17	*Construction Project Environmental Protection Management Ordinance of the PRC*, 1998
18	*Basic Farmland Protection Ordinance of the PRC,* 1998
19	*Dangerous Chemicals Safe Management Ordinance of the PRC*, 2002 (amended in 2011)

[5] Directory for the Management of Construction Project Environmental Impact Assessment Categorization (MEP Decree [2015] No. 33).

[6] PRC. 2013. *Railway Safety Management Ordinance of the PRC*.

20	*Cultural Relics Protection Law Implementation Ordinance of the PRC*, 2003 (amended in 2016)
21	*Scenic Area Ordinance of the PRC,* 2006
22	*Plan Environmental Impact Assessment Ordinance of the PRC*, 2009
23	*Railway Safety Management Ordinance of the PRC*, 2013
Decrees and Announcements	
24	*Circular on Strengthening the Management of Environmental Impact Assessment for Construction Projects Financed by International Financial Organizations*, (MEP Announcement [1993] No.324)
25	*Management Measures for Inspection and Acceptance of Environmental Protection at Construction Project Completion* (MEP Decree [2001] No. 13 and 2010 Amendment)
26	*Environmental Protection Management Measures for Transportation Construction Projects* (Ministry of Transport [2003] No. 5)
27	*Notice on Problems related to Environmental Noise in Environmental Impact Assessment for Highways, Rail (including Light Rail) Construction Projects* (MEP Announcement [2003] No. 94)
28	*Announcement on Launch of Environmental Supervision for Transport Project* (Ministry of Transport and MEP Announcement [2004] No. 314)
29	*Specifications on the Management of Urban Construction and Demolition Waste* (Ministry of Construction Decree [2005] No. 139)
30	*Management Procedures for the Supervision, Inspection and Environmental Acceptance of Construction Projects under the "Three Simultaneities"* (on trial) (MEP Announcement [2009] No. 150)
31	*Technical Policy on Prevention and Control of Road Traffic Noise* (MEP Announcement [2010] No. 7)
32	*Management Measures for Operation of the Environmental Complaint Hotline* (MEP Decree [2010] No. 15)
33	*Opinion from the State Council on Important Tasks for Strengthening Environmental Protection* (State Council Announcement [2011] No. 35
34	*Measures for Environmental Supervision* (MEP Decree [2012] No. 21)
35	*Requirement for Preparation of Environmental Impact Report Summary* (MEP Announcement [2012] No. 51)
36	*Announcement on Stepping Up the Strengthening of Environmental Impact Assessment Management for Prevention of Environmental Risk* (MEP Announcement [2012] No. 77
37	*Atmospheric Pollution Prevention and Control Action Plan* (State Council Announcement [2013] No. 37)
38	*Policy on Integrated Techniques for Air Pollution Prevention and Control of Small Particulates* (MEP Announcement [2013] No. 59)
39	*Guideline on Government Information Disclosure of Construction Project Environmental Impact Assessment (on trial)* (MEP Announcement [2013] No. 103)
40	*Directory for the Management of Construction Project Environmental Impact Assessment Categorization* (MEP Decree [2015] No. 33)
41	*Measures for Public Participation in Environmental Protection* (MEP Decree [2015] No. 35)
42	*Management Measures for Environmental Impact Post Assessment of Construction Projects* (on trial) (MEP decree [2015] No. 37)
43	*On Issuing the Detailed List on Significant Changes for the Environmental*

	Management of Construction Projects in Some Industrial Sectors (MEP Announcement [2015] No. 52)
Guidelines	
44	HJ 2.1-2011 *Technical Guidelines for Environmental Impact Assessment – General Program*
45	HJ 2.2-2008 *Guidelines for Environmental Impact Assessment – Atmospheric Environment*
46	HJ/T 2.3-93 *Technical Guidelines for Environmental Impact Assessment – Surface Water Environment*
47	HJ 2.4-2009 *Technical Guidelines for Noise Impact Assessment*
48	HJ/T 10.2-1996 *Guideline on Management of Radioactive Environmental Protection - Electromagnetic Radiation Monitoring Instruments and Methods*
49	HJ/T 10.3-1996 *Guideline on Management of Radioactive Environmental Protection – Environmental Impact Assessment Standards and Methods on Electromagnetic Radiation*
50	HJ 19-2011 *Technical Guidelines for Environmental Impact Assessment – Ecological Impact*
51	HJ 24-2014 *Technical Guidelines for Environmental Impact Assessment of Electric Power Transmission and Distribution Project*
52	HJ 130-2014 *Technical Guidelines for Plan Environmental Impact Assessment - General Principles*
53	HJ 192-2015 *Technical Criterion for Ecosystem Status Evaluation*
54	HJ/T 298-2007 *Technical Specifications on Identification for Hazardous Waste*
55	HJ/T 393-2007 *Technical Specifications for Urban Fugitive Dust Pollution Prevention and Control*
56	HJ 610-2011 *Technical Guidelines for Environmental Impact Assessment – Groundwater Environment-*
57	HJ 616-2011 *Guidelines for Technical Review of Environmental Impact Assessment on Construction Projects-*
58	HJ 623-2011 *Standard for the Assessment of Regional Biodiversity*
59	HJ 630-2011 *Technical Guideline on Environmental Monitoring Quality Management*
60	HJ 663-2013 *Technical Regulation for Ambient Air Quality Assessment* (on trial)
61	HJ 664-2013 *Technical Regulation for Selection of Ambient Air Quality Monitoring Stations* (on trial)
62	HJ 710.1-2014 *Technical Guidelines on Biodiversity Monitoring - Terrestrial Vascular Plants*
63	HJ 710.2-2014 *Technical Guidelines on Biodiversity Monitoring - Lichens and Bryophytes*
64	HJ 710.3-2014 *Technical Guidelines on Biodiversity Monitoring - Terrestrial Mammals*
65	HJ 710.4-2014 *Technical Guidelines on Biodiversity Monitoring - Birds*
66	HJ 710.5-2014 *Technical Guidelines on Biodiversity Monitoring - Reptiles*
67	HJ 710.6-2014 *Technical Guidelines on Biodiversity Monitoring - Amphibians*
68	HJ 710.7-2014 *Technical Guidelines on Biodiversity Monitoring - Inland Water Fish*
69	HJ 710.8-2014 *Technical Guidelines on Biodiversity Monitoring - Freshwater Benthic Macroinvertebrates*
70	HJ 710.9-2014 *Technical Guidelines on Biodiversity Monitoring - Butterflies*
71	HJ 2005-2010 *Technical Specification of Constructed Wetlands for Wastewater*

	Treatment Engineering
72	HJ 2025-2012 *Technical Specifications for Collection, Storage, Transportation of Hazardous Waste*
73	*Technical Guidelines for Environmental Impact Assessment - Public Participation (public comment version)*, (January 2011)
Standards	
74	GB 3095-2012 *Ambient Air Quality Standards*
75	GB 3096-2008 *Environmental Quality Standard for Noise*
76	GB 3838-2002 *Environmental Quality Standards for Surface Water*
77	GB 8702-2014 *Controlling Limits for Electromagnetic Environment*
78	GB 8978-1996 *Integrated Wastewater Discharge Standard*
79	GB 10070-88 *Standard of Environmental Vibration in Urban Area*
80	GB 10071-88 *Measurement Method of Environmental Vibration of Urban Area*
81	GB 12348-2008 *Emission Standard for Industrial Enterprises Noise at Boundary*
82	GB 12523-2011 *Emission Standard of Environmental Noise for Boundary of Construction Site*
83	GB 12525-90 *Emission Standards and Measurement Methods of Railway Noise on the Boundary alongside Railway Line*
84	GB/T 14848-93 *Quality Standard for Ground Water*
85	GB/T 15190-2014 *Technical Specifications for Regionalizing Environmental Noise Function*
86	GB 15618-1995 *Environmental Quality Standard for Soils*
87	GB 16297-1996 *Air Pollutant Integrated Emission Standards*
88	GB 18597-2001 *Standard for Pollution Control on Hazardous Waste Storage*
89	GB 22337-2008 *Emission Standard for Community Noise*
90	GB 50118-2010 *Design Specifications for Noise Insulation of Buildings for Civil Use*
91	GB 50433-2008 *Technical Code on Soil and Water Conservation of Development and Construction Projects*
92	GB 50434-2008 *Control Standards for Soil and Water Loss on Development and Construction Projects*
93	JGJ 146-2004 *Environmental and Hygiene Standards for Construction Sites*

Source: Environmental Impact Report of the E'mei–Miyi section of the Chengdu-Kunming Railway Line.

41. The most far-reaching law on pollution prevention and control is the Environmental Protection Law of the PRC (EPL) (1989, amended in 2014) (item 4). Promulgated in 1989, it set out key principles for the nation's pollution control system, including the policy known as the "Three Simultaneities," the application of pollution levy, and requirements for EIA. The EPL was amended in 2014 and the amended EPL took effect on 1 January 2015. The implementation of "Three Simultaneities" was further strengthened by the decrees on its management procedures (items 25 and 30) and the Construction Project Environmental Protection Management Ordinance of the PRC (1998) (item 17).

42. Public participation and environmental information disclosure provisions are among the most significant changes introduced in the amended EPL, further supported by the decrees on the preparation of EIA summaries for the purpose of public disclosure (item 35), information disclosure on construction project EIAs by government (item 39), methods for public participation in environmental protection (item 41), and technical guidelines (for comment) for

public participation in EIAs (item 73).

43. The amended EPL further defines enforcement and supervision responsibilities of all levels of environmental protection authorities, imposes stricter obligations and more severe penalties on enterprises and construction units regarding pollution prevention and control, and allows for environmental public interest litigation including through nongovernment organizations. The procedures and requirements for the technical review of EIA reports by authorities have been specified (item 57). Environmental supervision, inspection, and enforcement on design, installation, and operation of project-specific environmental protection and control measures are regulated under the "Three Simultaneities" (items 4, 17, 25, 28, and 30).

44. For grievance redress, a hotline number 12369 has been established at each level of environmental protection authority throughout the nation since March 2011 for receiving and resolving environmental complaints in accordance with the Management Measures for Operation of the Environmental Complaint Hotline (MEP Decree [2010] No. 15] (item 32).

45. The EPL also provides protection for community health, with protection of occupational health and safety provided by the Labor Law of the PRC (1994) (item 7), the Occupational Disease Prevention and Control Law of the PRC (2001) (item 11), the Dangerous Chemicals Safe Management Ordinance of the PRC (2002, amended in 2011) (item 19), and environmental and hygiene standards for construction sites (item 93).

46. EIA is governed by the Environmental Impact Assessment Law of the PRC (2002) (item 13), covering EIAs for (i) plans (such as new development areas and new industrial parks) and strategic studies which could also be deemed as strategic environmental assessments (SEAs), and (ii) construction projects. This was followed by the promulgation of two regulations: the Construction Project Environmental Protection Management Ordinance of the PRC (1998) (item 17) and the Plan Environmental Impact Assessment Ordinance of the PRC (2009) (item 22). Both require early screening and environmental categorization.

47. A recent MEP decree, the Directory for the Management of Construction Project Environmental Impact Assessment Categorization (MEP Decree [2015] No. 33) (item 40), classifies EIAs for construction projects into three categories with different reporting requirements, based on the "significance" of potential environmental impact due to the project and the environmental sensitivity of the project site as described in this directory. An EIR is required for construction projects with potentially significant environmental impacts. An environmental impact table is required for construction projects with less significant environmental impacts. An environmental impact registration form is required for construction projects with the least significant environmental impacts. Items 124, 125 and 126 under Section Q in the Decree specify the environmental impact reporting requirements for railway projects. It states that EIRs are required for (i) new railways; (ii) electrification modification of ≥200 km, expansion of ≥100 km, or railways involving environmentally sensitive areas, and (iii) large hubs. All other railway projects would require environmental impact tables. Environmentally sensitive areas, as defined in the Decree, include nature reserves and protected areas; scenic areas; world cultural and natural heritage sites; drinking water source protection zones; basic farmland and grassland; forest parks; geological parks; important wetland; natural woodland; critical habitats for endangered plant and animal species; important aquatic spawning, nursery, wintering and migration grounds; regions suffering from water resource shortage; serious soil erosion areas; desertification protection areas; eutrophic water bodies; inhabited areas with

major residential, health care, scientific research, and administration functions; cultural heritage protection sites; and protection areas with historical, cultural, scientific, and ethnic values.

48. On 4 June 2015, the MEP announced the 'On Issuing the Detailed List on Significant Changes for the Environmental Management of Construction Projects in Some Industrial Sectors' (MEP Announcement [2015] No. 52). The announcement provides attachments defining thresholds for significant changes in nine industrial sectors. Railway construction is one of the nine sectors. Any project that has changes triggering any of the thresholds is deemed to constitute significant changes, and a revised EIR shall be submitted to the relevant environmental authority for approval. Optimization of the E'mei–Miyi alignment during preliminary design resulted in a shifting of approximately 39% of the alignment, which triggered the threshold for significant change for railway projects. In compliance with the Announcement, a revised EIR was prepared in October 2015. The EIR of the E'mei–Miyi section of the CKRL was revised accordingly and got approved by MEP on 28 October 2015.

49. In 2015, the MEP issued a decree, Management Measures for Environmental Impact Post Assessment of Construction Projects (MEP decree [2015] No. 37) (item 42) to have, on a trial basis and effective 1 January 2016, follow-up actions between 3 to 5 years after commencement of project operation. Such actions would include environmental monitoring and impact assessment to verify the effectiveness of environmental protection measures and to undertake any corrective actions that might be needed. The decree also specifies that the institute that does the original impact assessment for the project cannot undertake environmental impact post assessment for the same project.

50. MEP has issued a series of technical guidelines for preparing EIAs. These include impact assessment guidelines on general EIA program and principles (items 44 and 51), atmospheric environment (item 45) and ambient air quality (item 60), noise (item 47), surface water (item 46), ground water (item 56), electromagnetic radiation (item 49), ecology (items 50 and 53) and regional biodiversity (item 58), biodiversity monitoring of various biota (items 62 to 70), quality management on environmental monitoring (item 59), and public participation (item 73). Standards issued by MEP generally consist of environmental quality (ambient) standards (applicable to the receiving end) and emission standards (applicable to the pollution source). The former includes standards for ambient air quality (item 74), noise (item 75) and vibration (item 79), surface water (item 76), groundwater (item 84), soil (item 86), and electromagnetic environment (item 77) etc. The latter includes standards for integrated wastewater discharge (item 78), construction noise (item 82) and railway operational noise (item 83), community noise (item 89), air pollutants (87), soil erosion (item 92) and construction site environment and hygiene (item 93), etc.

51. Regulations and decrees listed in Table 2 that are specific to railway projects include the Railway Law of the PRC (1990) (item 5), item 23 on railway safety management, item 26 on environmental protection management measures, item 27 on rail noise problems during impact assessment, and item 28 on environmental supervision for transport projects.

B. Environmental Impact Assessment of the E'Mei-Miyi Section

52. As the alignment of the E'Mei-Miyi Section passes through Giant Panda (Ailuropoda melanoleuca) habitats (Figure 4) in the Bayuelin Provincial Natural Reserve and scenic areas (Figure 5), additional five special assessment reports were prepared (Table 3). It is noted that

the alignment does not traverse through any cultural heritage site. The CREEC prepared an EIR for the upgrading of the E'mei to Miyi section of the CKRL, incorporating the findings from these special reports, and submitted it to the MEP in July 2014. The MEP approved the EIR on 16 September 2014, with some suggestions, namely (i) shifting of approximately 153 km (39%) of the alignment and (ii) lengthening of the tunnel alignment through protection areas in order to protect Giant Panda habitats and other protected and scenic areas with avoidance principle. A revised EIR was prepared and got approved by MEP on 28 October 2015. Information on the environmental impact assessment for the capacity enhancement of the E'mei–Miyi section was disclosed in the Sichuan Daily News twice, and a summary of the revised EIR was also disclosed on relevant government websites prior to approval in accordance with PRC's Requirement for Preparation of Environmental Impact Report Summary (MEP Announcement [2012] No. 51) and Guideline on Government Information Disclosure of Construction Project Environmental Impact Assessment (on trial) (MEP Announcement [2013] No. 103).

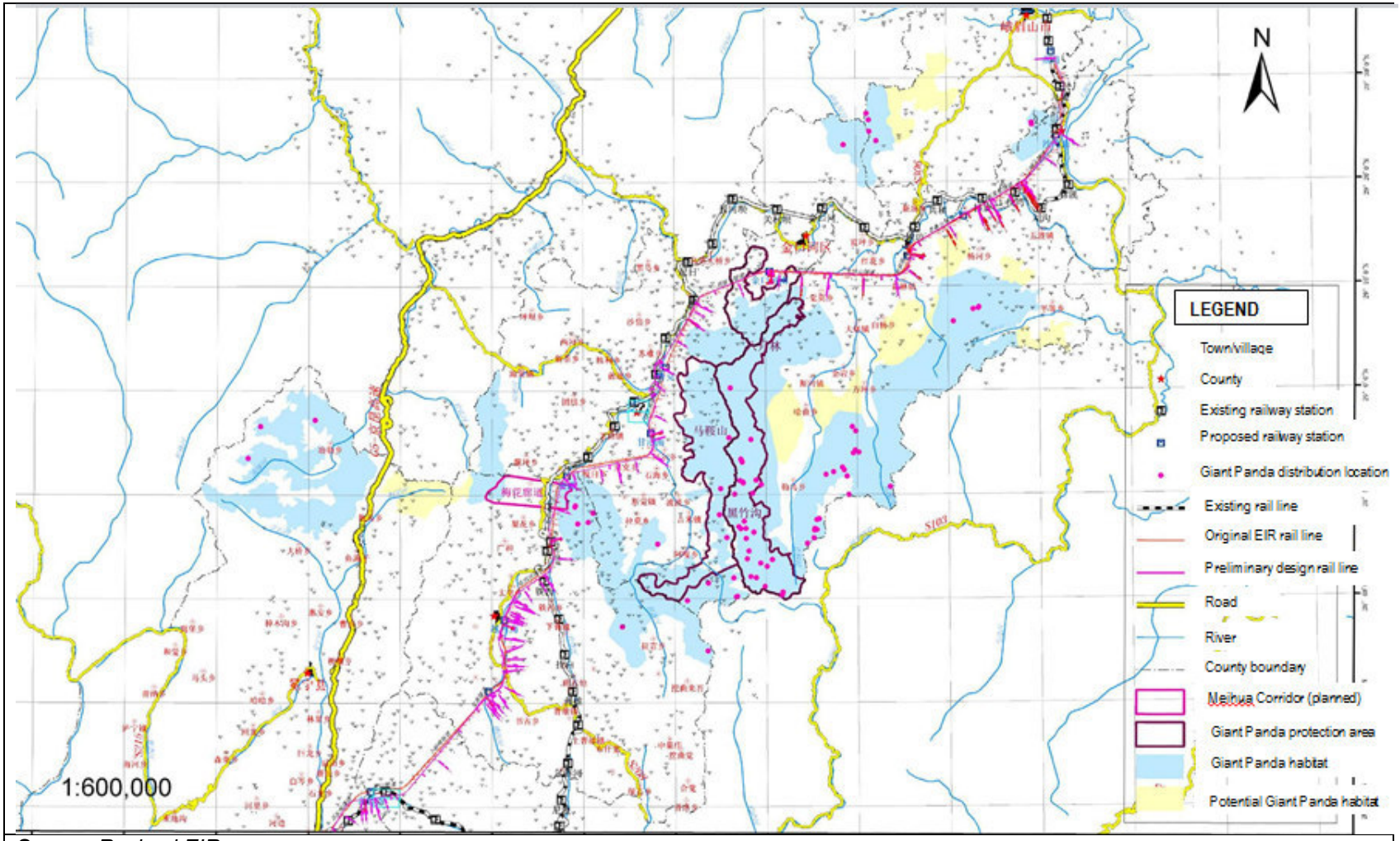
Table 3: Special Assessment Reports for the E'mei–Miyi Section

Special Assessement Report	Prepared by	Approval Authority and Date
Research report on impact assessment and protection measures for the Giant Panda and its habitat due to the upgrading of the E'mei to Miyi section of the CKRL (June 2014) (*Note that a supplementary report on impact assessment and protection measures for the Giant Panda and its habitat due to partial scheme revision was also prepared after the MEP's suggestion in the alignment to protect panda habitat.)*	Sichuan Province Forestry Survey and Design Research Institute	Sichuan Province Department of Forestry (7 July 2014) *(the supplementary report was approved in 25 March 2015)*
Impact assessment report on the natural resources, ecosystem and major protection targets in the Sichuan Bayuelin Nature Reserve due to the upgrading construction and operation of the E'mei to Miyi section of the CKRL (June 2014)	Sichuan Province Forestry Survey and Design Research Institute	Sichuan Province Department of Forestry-SPDF (7 July 2014)
Ecosystem, existing biodiversity and impact assessment report for the upgrading of the E'mei to Miyi section of the CKRL	Sichuan Province Forestry Survey and Design Research Institute	No approval needed. Findings and recommendations incorporated into the EIR
Special verification report on the impact of the E'mei to Miyi section of the CKRL on the Dadu River Mei'nvfeng Provincial Scenic Area (July 2014)	Sichuan Province Urban Rural Planning Design Institute	Sichuan Province Department of Housing and Urban Rural Development-SPDHURD (4 August 2014)
Special verification report on the impact of the E'mei to Miyi section of the CKRL on the Longtan Provincial Scenic Area (June 2014)	Sichuan Province Urban Rural Planning Design Institute	SPDHURD (4 August 2014)
Research (supplementary) report on impact	Sichuan Province	SPDOF (25 March

Special Assessement Report	Prepared by	Approval Authority and Date
assessment and protection measures for the Giant Panda and its habitat due to partial scheme revision	Forestry Survey and Design Research Institute	2015)

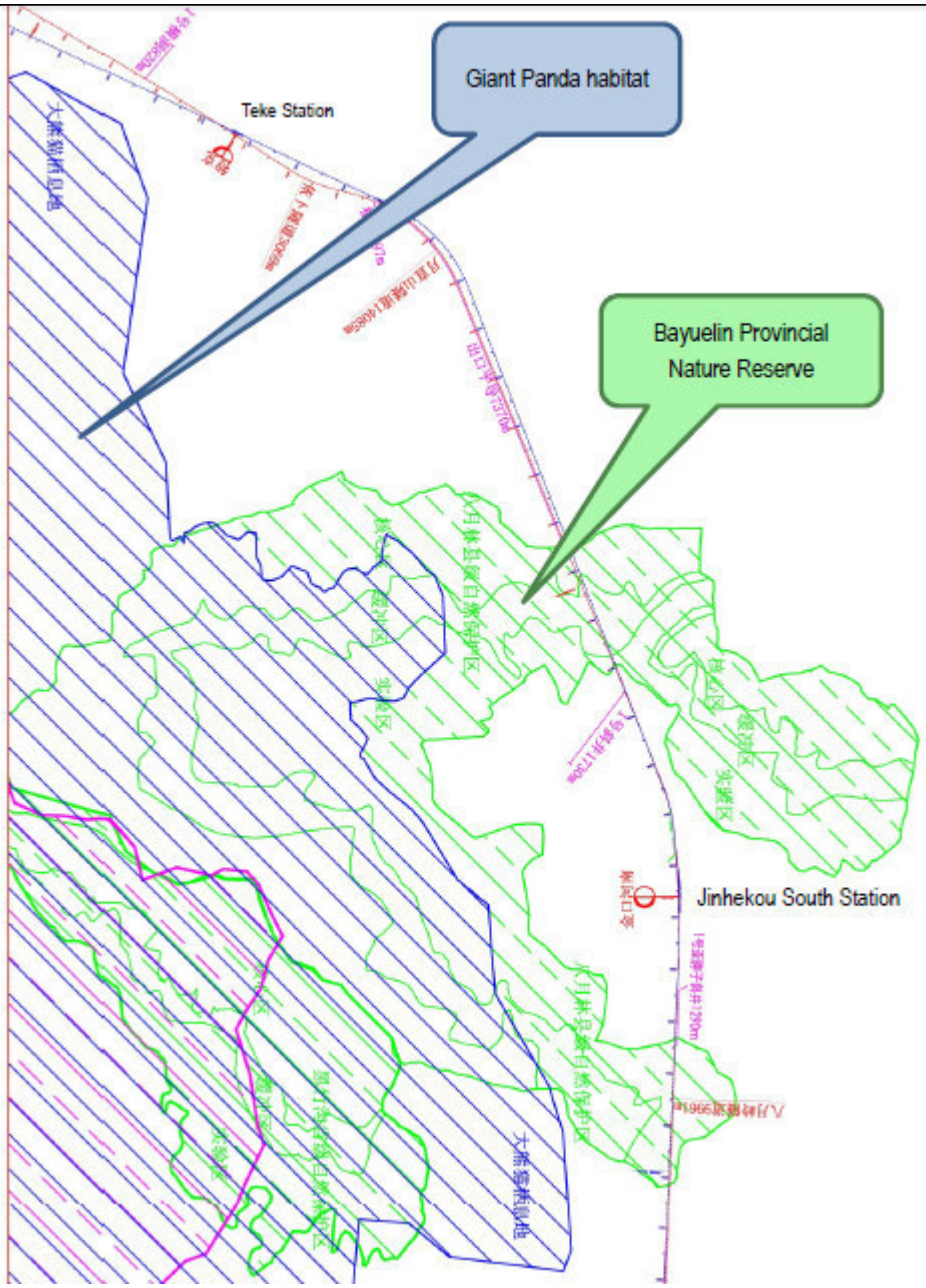
CKRL = Chengdu-Kunming Railway line, EIR = environmental impact report; MEP = Ministry of Environment Protection; SPDOF = Sichuan Province Department of Forestry; SPDOHURD = Sichuan Province Department of Housing and Urban Rural Development
Source: Approved EIR (2014)

Figure 4. Panda Distribution of Giant Panda habitats and protection areas relative to the railway tunnel alignment



Source: Revised EIR

Figure 5. Bayuelin Nature Reserve relative to the railway tunnel alignment



Source: Revised EIR

C. Anticipated Impacts and Mitigation Measures

53. The EIR is comprehensive and pays great attention to all aspects of environmentally and culturally sensitive areas and relevant potential impacts. Due to the locations of the E'Mei-Miyi Section and results of environmental impacts, engineering designs of the railway lines are

enhanced to protect these areas and mitigate impacts. For instance, the alignment passing Giant Panda habitats and the Bayuelin Provincial Nature will be through tunnels. The railway line passing two scenic areas like the Dadu River Mei'nvfeng Provincial Scenic Area and the Longtan Provincial Scenic Area will be via tunnels and/or bridges. The EIR requires comprehensive mitigation measures to address a wide range of issues and impacts including dust, noise, vibration, air quality, water quality, biodiversity, soil, waste management, community and workers' health and safety. Meaningful and sufficient public consultation were conducted, including information disclosure, questionnaire surveys and public discussion forums targeting affected communities along the alignment. The EIR also well described the good level of public consultation process for the railway construction.

54. **Vegetation**. The EIR records the vegetation types and their biomass within the ecological assessment area relevant to the railway project (300 m on both sides from the middle line of the railroad track, 100 m from the boundaries of temporary land take area, and 30 m on both sides from the middle line of haul road). The vegetation coverage within the ecological assessment area of 22,206 ha was dominated by agricultural species (≈52%) followed by coniferous woodland (≈15%) and broad-leaved woodland (14%). These vegetation types also dominated the biomass, with agricultural products (43.9%), broad-leaved woodland (23.5%) and coniferous woodland (18.4%) accounting for 86% of the total biomass of 14.7 million tons.

Table 4: Vegetation Types and Biomass within the Ecological Assessment Area

Vegetation Type	Representative Flora	Area (ha)	% of Assessment Area	Biomass (tons/ha)	Total Biomass (tons)
Coniferous woodland	*Pinus massoniana, Pinus yunnanensis, Cunninghamia lanceolate, Cupressus funebris*	3,361	15.1	804	2,702,244
Broad-leaved woodland	*Quercus acutissima, Cyclobalanopsis glaucoides, Quercus aquifolioides, Castanopsis delavayi*	3,106	14.0	1,109	3,444,554
Coniferous and broad- leaved mixed woodland	*Pinus yunnanensis, Quercus* spp., mixed woodland of *Keteleeria* spp.	305	1.4	912	278,160
Bamboo woodland	*Phyllostachys edulis, Bambusa emeiensis*	24	<0.1	865	20,760
Economic woodland	*Citrus* spp., *Dimocarpus longan, Carya cathayensis, Castanea mollissima*	287	1.3	925	265,475
Shrubbery	*Coriaria nepalensis, Vitex negundo, Rosa* spp., *Dodonaea viscosa, Bauhinia* spp.	1,754	7.9	523	917,342
Shrubbery with sparse trees	*Heteropogon contortus, Phyllanthus emblica,* shrubbery with sparse *Bombax ceiba*	590	2.7	424	250,160
Grass meadow	*Arundinella hookeri, Festuca ovina,* Poaceae, *Cyperus rotundus*	856	3.9	351	300,456
Agricultural	*Oryza sativa*, *Triticum aestivum,*	11,504	51.8	561	6,453,744

Vegetation Type	Representative Flora	Area (ha)	% of Assessment Area	Biomass (tons/ha)	Total Biomass (tons)
products	*Zea mays, Solanum tuberosum, Glycine* spp.				
Aquatic	Freshwater Chlorophyceae	419	1.9	123	51,537
	TOTAL	22,206		AVG=661	14,684,612

Source: Revised Environmental Impact Report.

55. The E'mei–Miyi section would take up 806.81 ha of land permanently for the tracks and stations. This accounts for 3.6% of the ecological assessment area. Temporary land take would total 1,244 ha, mainly for borrow pits and spoil disposal sites. This accounts for 5.6% of the ecological assessment area. Of the total land take of 2,051.81 ha, approximately 1,286 ha (63%) was agricultural land, accounting for approximately 11% of the agricultural land within the ecological assessment area. The remaining land take of 765.81 ha involving other vegetation types would account for approximately 7.2% of the remaining portion of the ecological assessment area. Based on the average biomass per ha in the ecological assessment area, permanent land take would remove approximately 3.6% of the biomass in the ecological assessment area permanently. Temporary land take would remove approximately 5.6% of the biomass within the ecological assessment area but these areas will be re-vegetated. Based on the scale of impact on vegetation in relation to the scale within the ecological area, the revised EIR concluded that such impact would not drastically alter the germplasm resource, the floral composition and the agricultural production structure within the ecological assessment area.

56. **Old and Valuable Trees**. Five Ficus trees (Ficus virens) that are more than 100 years old have been recorded between chainage DK482 to DK493. All have been tagged. Distances from the railroad track construction boundary ranged from 34 m to 93 m and would not be affected during construction works.

57. **Protected Flora and Fauna**. The revised EIR recorded 10 floral species and 38 faunal species within the ecological assessment area that are under national or provincial protection (Table 5). Of these, all 10 floral species and 28 faunal species were recorded within the Bayuelin Provincial Nature Reserve. The avoidance principle was adopted and the alignment would go through the Bayuelin Provincial Nature Reserve and Giant Panda habitats via tunnels and no impact on these species is expected. The revised EIR emphasized training for the construction workers on environmental management and conservation, minimizing disturbance and impact on the protected species during construction.

58. Of the above 48 species listed in Table 5, three floral species and 36 faunal species have been assessed as to their conservation status for the International Union for Conservation of Nature (IUCN) Red List. The IUCN Red List classifies conservation status into seven categories. These are, in decreasing order of risk of extinction: extinct (EX), extinct in the wild (EW), critically endangered (CR); endangered (EN); vulnerable (VU), near threatened (NT) and least concern (LC). NT and LC are deemed to have lower risk of extinction compared to the others.

59. According to the IUCN Red List, three of the 10 floral species (Katsura Tree, Chinese Tulip Tree and Rehderodendron macrocarpum) have been assessed as NT, indicating low risk

of extinction. Of the 38 faunal species, four (Reeve's Turtle, Sichuan Partridge, Forest Musk Deer and Red Panda) have been assessed as EN, six (Chinese Soft Shell Turtle, Giant Panda, Takin, Asian Black Bear, Sambar Deer and Sumatran Serow) as VU, four (Taliang Knobby Newt, Chinese Grouse, Himalayan Goral and Tibetan Macaque) as NT, and another 22 species as LC.

60. Of the four faunal species assess as EN, the Catalog of Life, China (2016 version) describes that the Reeve's Turtle (Chinemys reevesii) has been recorded to occur in at least 16 provinces in the PRC, the Sichuan Partridge (Arborophila rufipectus) in Sichuan and Yunnan Provinces, the Forest Musk Deer (Moschus berezovskii) in 15 provinces, and the Red Panda (Ailurus fulgens) in seven provinces. None of these species is endemic to the project area.

61. Of the six faunal species assess as VU, the Catalog of Life, China (2016 version) describes that the Chinese Soft Shell Turtle (Pelodiscus sinensis) has been recorded to occur in at least 25 provinces in the PRC; the Giant Panda (Ailuropoda melanoleuca) in Sichuan, Shaanxi and Gansu Provinces; the Takin (Budorcas taxicolor) in five provinces; the Sambar Deer (Cervus unicolor) in seven provinces; and the Sumatran Serow (Capricornis sumatraensis) in 15 provinces. The IUCN Red List describes the distribution range of the Asian Black Bear (Ursus thibetanus) to overlap with that of the Giant Panda. None of these species is endemic to the project area.

Table 5: Protected Flora and Fauna recorded within the Ecological Assessment Area

Type	No.	Species	Protection Status	Occurrence
Flora	1	*Davidia involucrata* (Dove Tree)	National Class I	Bayuelin Provincial Nature Reserve
	2	*Davidia involucrata* var. *vilmoriniana*	National Class I	Bayuelin Provincial Nature Reserve
	3	*Kingdonia uniflora*	National Class I	Bayuelin Provincial Nature Reserve
	4	*Cercidiphyllum japonicum* (Katsura Tree)	National Class II; IUCN: NT	Bayuelin Provincial Nature Reserve
	5	*Coptis chinensis* (Chinese Goldthread)	National Class II	Bayuelin Provincial Nature Reserve
	6	*Emmemopterys henryi*	National Class II	Bayuelin Provincial Nature Reserve
	7	*Liriodendron chinense* (Chinese Tulip Tree)	National Class II; IUCN: NT	Bayuelin Provincial Nature Reserve
	8	*Michelia wilsonii* (Yellow Lily-tree)	National Class II	Bayuelin Provincial Nature Reserve
	9	*Tetracentron sinense*	National Class II	Bayuelin Provincial Nature Reserve
	10	*Rehderodendron macrocarpum*	National Class II; IUCN: NT	Bayuelin Provincial Nature Reserve
Fauna	1	*Tylototriton taliangensis (*Taliang Knobby Newt)	National Class II; IUCN: NT	DK219-DK278 at altitudes 1390 m - 3000 m
	2	*Rana omeimontis* (Omei Wood Frog)	Provincial; IUCN: LC	DK167-DK230 agriculture areas
	3	*Chinemys reevesii* (Reeve's Turtle)	Provincial; IUCN: EN	Tributary streams of the Dadu River and Anning River
	4	*Pelodiscus sinensis* (Chinese Soft Shell	Provincial;	Tributary streams of the Dadu

Type	No.	Species	Protection Status	Occurrence
		Turtle)	IUCN: VU	River and Anning River
	5	*Arborophila rufipectus* (Sichuan Partridge)	National Class I; IUCN: EN	Sparse activities observed in the vicinity of the alignment from Bayueling to Ganluo
	6	*Bonasa sewerzowi* (Chinese Grouse)	National Class I; IUCN: NT	Bayuelin Provincial Nature Reserve
	7	*Aquila chrysaetos* (Golden Eagle)	National Class I; IUCN: LC	Bayuelin Provincial Nature Reserve
	8	*Aviceda jerdoni* (Jerdon's Baza)	National Class II; IUCN: LC	Bayuelin Provincial Nature Reserve
	9	*Accipiter nisus* (Eurasian Sparrowhawk)	National Class II; IUCN: LC	Bayuelin Provincial Nature Reserve
	10	*Accipiter soloensis* (Chinese Sparrowhawk)	National Class II; IUCN: LC	Bayuelin Provincial Nature Reserve
	11	*Accipiter virgatus* (Besra)	National Class II; IUCN: LC	Bayuelin Provincial Nature Reserve
	12	*Spizaetus nipalensis* (Mountain Hawk-eagle)	National Class II	Bayuelin Provincial Nature Reserve
	13	*Milvus migrans* (Black Kite)	National Class II; IUCN: LC	Bayuelin Provincial Nature Reserve
	14	*Chrysolophus amherstiae* (Lady Amherst Pheasant)	National Class II; IUCN: LC	Bayuelin Provincial Nature Reserve
	15	*Chrysolophus pictus* (Golden Pheasant)	National Class II; IUCN: LC	Bayuelin Provincial Nature Reserve
	16	*Tragopan temminckii* (Temminck's Tragopan)	National Class II; IUCN: LC	Bayuelin Provincial Nature Reserve
	17	*Ithaginis cruentus* (Blood Pheasant)	National Class II; IUCN: LC	Bayuelin Provincial Nature Reserve
	18	*Treron sphenura* (Wedge-tailed Green-pigeon)	National Class II; IUCN: LC	Bayuelin Provincial Nature Reserve
	19	*Glaucidium brodiei* (Collared Owlet)	National Class II; IUCN: LC	Bayuelin Provincial Nature Reserve
	20	*Asio otus* (Northern Long-eared Owl)	National Class II; IUCN: LC	Bayuelin Provincial Nature Reserve
	21	*Asio flammeus* (Short-eared Owl)	National Class II; IUCN: LC	Bayuelin Provincial Nature Reserve
	22	*Merops orientalis* (Asian Green Bee-eater)	National Class II; IUCN: LC	In Miyi
	23	*Bambusicola fytchii* (Mountain Bamboo Partridge)	Provincial; IUCN: LC	Bayuelin Provincial Nature Reserve
	24	*Porzana fusca* (Ruddy-breasted Crake)	Provincial; IUCN: LC	Mostly in paddy fields
	25	*Cacomantis merulinus* (Plaintive Cookoo)	Provincial; IUCN: LC	Mostly in woodland with sparse canopy at around 1900 m altitude
	26	*Tachybaptus ruficolli* (Little Grebe)	Provincial	Activities observed in the vicinity of the Gongzui Hydropower Station where the alignment crosses the Dadu River.

Type	No.	Species	Protection Status	Occurrence
	27	*Ailuropoda melanoleuca* (Giant Panda)	National Class I; IUCN: VU	Near Shawan urban section and Yuexi river shoal section
	28	*Budorcas taxicolor* (Takin)	National Class I; IUCN: VU	Bayuelin Provincial Nature Reserve
	29	*Moschus berezovskii* (Forest Musk Deer)	National Class I; IUCN: EN	Bayuelin Provincial Nature Reserve
	30	*Ursus thibetanus* (Asian Black Bear)	National Class II; IUCN: VU	Bayuelin Provincial Nature Reserve
	31	*Ailurus fulgens* (Red Panda)	National Class II; IUCN: EN	Bayuelin Provincial Nature Reserve
	32	*Viverra zibetha* (Large Indian Civet)	National Class II; IUCN: LC	Bayuelin Provincial Nature Reserve
	33	*Cervus unicolor* (Sambar Deer)	National Class II; IUCN: VU	Bayuelin Provincial Nature Reserve
	34	*Capricornis sumatraensis* (Sumatran Serow)	National Class II; IUCN: VU	Bayuelin Provincial Nature Reserve
	35	*Pseudois nayaur* (Bharal; Blue Sheep)	National Class II; IUCN: LC	Bayuelin Provincial Nature Reserve
	36	*Naemorhedus goral* (Himalayan Goral)	National Class II; IUCN: NT	Bayuelin Provincial Nature Reserve
	37	*Macaca thibetana* (Tibetan Macaque)	National Class II; IUCN: NT	Bayuelin Provincial Nature Reserve
	38	*Macaca mulatta* (Rhesus Monkey)	National Class II; IUCN: LC	Bayuelin Provincial Nature Reserve

Sources: Revised EIR; IUCN
Note: ICUN = International Union for Conservation of Nature; LC = least concern; NT = near threatened; VU = vulnerable; EN = endangered

62. Ecologically sensitive areas include Giant Panda habitats and the Bayuelin Provincial Nature Reserve. There are two Giant Panda populations inhabiting within the ecological assessment area: (1) Daxiangling mountain range B1 population habitat near the Shawan District urban area in Leshan City and (ii) Liangshan mountain range A1 population habitat near the river shoals in Yuexi County in Liangshan Yi Autonomous Prefecture. The two habitats are connected by the planned Meihua Corridor. The Daxiangling mountain range habitat totals 122,000 ha and the Liangshan mountain range habitat totals 302,400 ha. The planned 4.7 km wide Meihua Corridor runs 14.4 km east-west connecting these two habitats covering an area of 62,460 ha.

63. The Bayuelin Provincial Nature Reserve is located in the Jinshanhe District in Leshan City. It has a total area of 10,234.5 ha, consisting of 4,763.43 ha core zone, 2,005.15 ha buffer zone and 3,465.92 ha experimental zone.

64. Table 6 shows that the alignment will adopt the avoidance principle and will go through Giant Panda habitats and the Bayuelin Provincial Nature Reserve with tunnels and bridges. There would be no impact to these ecologically sensitive areas.

Table 6: Alignment Scheme in relation to Ecologically Sensitive Areas.

Ecologically Sensitive Area	Affected Chainage	Alignment Scheme
Daxiangling mountain range B1 population	3.99 km:	3.62 km tunnel and

Ecologically Sensitive Area	Affected Chainage	Alignment Scheme
habitat near the Shawan District urban area in Leshan City	(i) DK174+490 – DK175+760 (ii) DK178+070 – DK180+790	0.37 km bridge
Liangshan mountain range A1 population habitat near the river shoals in Yuexi County in Liangshan Yi Autonomous Prefecture	4.81 km: D1K300 +720 – D1K305+530	All tunnel
The planned Meihua Corridor	4.48 km: D1K300+220 – D1K304+700	All tunnel
Bayueling Provincial Nature Reserve	5.31 km: (i) DK233+840 – DK236+700 (ii) DK244+030 – DK246+480	All tunnel

Source: Revised Environmental Impact Report.

65. Scenic areas along the alignment include the Dadu River Mei'nvfeng Provincial Scenic Area located in Shawan District in Leshan City and the Longtan Provincial Scenic Area located in Miyi County in Panzhihua City. The alignment will go through the Dadu River Mei'nvfeng Provincial Scenic Area via tunnels and the Longtan Provincial Scenic Area with tunnels, bridges and at grade. The revised alignment scheme has taken into account recommendations from the EIR and has increased the length of tunnels while reducing the lengths of bridges and at grade sections. Land take within the Longtan Provincial Scenic Area would total 6.08 ha, which accounts for only 0.09% of the total area (62 km2) of the scenic area. No borrow area or spoil disposal site will be allowed in the scenic areas during construction. Table 7 shows the alignment schemes through the two scenic areas.

Table 7: Alignment Scheme through the Scenic Areas

Scenic Area	Affected Chainage	Alignment Scheme
Dadu River Mei'nvfeng Provincial Scenic Area	3.40 km: DK181+600 – DK185+000	All tunnel
Dadu River Mei'nvfeng Provincial Scenic Area	5.53 km: (i) D2K524+260 – D2K526+807 (ii) D2K526+900 – D2K527+140 (iii) D2K528+560 – D2K531+300	2.45 km tunnels (increased from 1.61 km) 1.42 km bridges (decreased from 2.21 km) 1.66 km at grade (decreased from 1.77 km)

Source: Revised Environmental Impact Report

66. The alignment does not traverse through any cultural heritage site. The revised alignment scheme has taken into account recommendation from the authority to shift the alignment further away from the Hejiaba cultural relic site. The shortest distance from the alignment to this site has been increased from 780 m to 1,180 m. No impact on physical cultural resource is anticipated.

67. Noise. The revised EIR identified 116 noise sensitive receptors consisting of 102

residential areas, 13 schools and one hospital; and 103 vibration sensitive receptors consisting of 97 residential areas and six schools along the E'mei – Miyi section. Construction noise impact would mainly come from the use of power mechanical equipment such as excavator, loaded vehicle traffic and compactor during bridge and train station construction, track subgrade works and blasting at tunnel openings. Mitigation measures at the EIR include: (i) restrictions on night time construction in areas with concentration of sensitive receptors, (ii) siting of pre-casting yards and asphalt mixing stations away from noise sensitive receptors, (iii) control of construction vehicle speed and restriction on using the horn, (iv) installation of temporary noise barriers on sections with nearby sensitive receptors, (v) reasonable scheduling of construction activities such as no heavy machinery during night time construction and close liaison with nearby schools, hospital and communities, (vi) inclusion of noise protection measures in all tender documents and civil works contracts, and (vii) approval of environmental protection authorities prior to night time construction. Implementation of these measures would mitigate construction noise to acceptable levels.

68. Operational noise exceedance of the applicable standards was predicted at 93 residential areas and 9 schools. Noise mitigation measures at the EIR include the relocation/resettlement of 1,025 households and 3 schools, provision of noise barriers at 142 locations totaling 38 km in length, and installation of double glazed windows at 101 households totaling 38,000 m2. With these measures in place, operational noise impact would be mitigated to acceptable levels.

69. Construction vibration is mainly caused by blasting during tunnel construction, and was predicted to potentially affect six sensitive receptors located above the tunnel alignments, with mostly one- to two-storey buildings constructed in the 1980s. Mitigation measures would include controlling the quantities of explosives used for blasting and monitoring of building conditions during construction. The revised EIR provided the quantities of explosives that could be used with respect to distance from the nearest sensitive receptor. Operational vibration impact was predicted to affect 17 households, which leads relocation of these households so that vibration impacts will be mitigated.

D. Public Consultation

70. Public consultation for the E'mei–Miyi section of the CKRL included disclosure of the revised EIR in the newspaper and on local web-sites, and questionnaire surveys and discussion forums targeting affected communities along the alignment.

71. Information on the revised EIR was disclosed in the Sichuan Daily Newspaper and the web-sites of the Leshan News, Liangshan Environmental Protection Bureau and Panzhihua Public Information in February and June 2015.

72. Questionnaire surveys included 176 survey forms from various groups such as rural committees, community groups, schools and government departments; and 1,433 survey forms from individuals. Two discussion forums were held in Dechang County and Xichang City. All the groups surveyed supported the project. Of the 1,433 individuals surveyed, 1,399 (97.6%) supported the project, 27 (1.9%) did not support the project with the environmental concern that the project could potentially affect drinking water sources and would also have visual impact, and 7 (0.5%) did not express any opinion. It was explained during the discussion forum that no

drinking water source would be affected by the project. Most of the concerns expressed by participants in the surveys and discussion forums were related to construction impact. These views and concerns were taken into consideration in the revised EIR.

73. The revised EIR contains an environmental management plan to mitigate environmental, health and safety impacts of the railway project, which includes (i) environmental management measures during pre-construction, construction and operation stages; (ii) environmental acceptance inspection requirements; (iii) environmental monitoring of air quality, noise and vibration, and wastewater during the construction stage, and noise and vibration and wastewater during operation; (iv) environmental supervision requirements during construction; and (v) environmental training.

IV. CONCLUSION AND RECOMMENDATIONS

74. A national environmental impact assessment of the E'mei–Miyi section of the CKRL was well performed, obtained all the necessary requirements including the section of E'mei–Miyi Railway line. The EIR is well prepared and comprehensive covering the wide range of environmental issues in all phases of pre-construction, construction and operation. Appropriate measures have been identified and described to mitigate potential environmental impacts and risks during construction and operation. Information disclosure and public consultation have been properly carried out. The environmental management plan includes the implementation of environmental management measures, environmental monitoring, environmental supervision, environmental training, and environmental acceptance inspection upon completion of construction. Provided that the items described in the environmental management plan are properly carried out during project implementation, potential environmental impacts should comply with applicable regulations and environmental standards. The environmental due diligence of the E'mei–Miyi section of the CKRL met highest level of environment, health and safety standards in the PRC under the relevant laws and regulations, which is equivalent to the ADB SPS (2009) requirements.

75. The CRC and the CKRC are responsible for the project's full compliance to all the requirements under all the relevant the PRC laws and regulations (environment, health and safety) and the EIR. The following has been confirmed: (i) all the civil work contracts signed included specific clauses on environment, health and safety; (ii) all the contractors have designated environment, health, and safety staff; (iii) all the construction supervision companies also have environment, health, and safety managers to ensure the construction of the railway line to be fully complied with the PRC requirements, which are equivalent to the ADB Safeguards Policy Statement (2009). It is confirmed that there was no public complaint was received by the time of this environmental audit.

76. ADB will continue conducting this environmental compliance audit during the construction of the E'mei–Miyi section through monitoring and reporting. If any issues are identified, a proper corrective action plan with specific timeframe and budget will be prepared. The CRC and the CKRC will take full responsibility to implement the corrective action plan effectively and in timely manner.