China: Ningxia Highway Project

Environmental Impact Assessment
Executive Summary

December, 2009
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1. INTRODUCTION

Background

This document summarizes the environment impact assessment of the Ningxia Highway Project in China, highlighting the main issues and conclusions of the Environment Impact Assessment (EIA), Environment Management Plan (EMP) and Environmental Safeguards Framework (ESF) of the project. According to both Chinese Environmental Assessment laws and regulations and the World Bank’s Operational Policy 4.01 Environmental Assessment, the proposed project is Category A for environmental assessment purposes, due to the scale and significance of potential environmental and social impacts and the sensitivity of the project areas. Therefore, a full environmental assessment report was required.

The Ningxia Transportation Department (NTD) retained Environmental Science Institute of Ministry of Communications (ESIMOC) for EA preparation. The ESI holds Class A environmental impact assessment accreditation from the Ministry of Environmental Protection (MEP). An EIA and an EMP for the Guyaozi-Qingtongxia Expressway (GQE) component, an Environmental Safeguards Framework for the Local Road Improvement Program (LRIP) component, and EIAs for 12 selected rural and local roads were prepared, all following relevant provisions specified in Chinese EA laws/regulations and technical guidelines as well as World Bank safeguard policies. This Executive Summary is based on these reports, as well as feasibility studies, design reports and relevant survey carried out for the project.

The EIA and EMP reports cover the Guyaozi-Qingtongxia Expressway (GQE) roadway, service areas, tolls, and all construction related infrastructure such as access roads, workers’ camps, borrow pits and disposal sites. The EIA framework and EIAs for the rural roads cover upgrading and rehabilitation of rural roads. All EIAs, EMP and EIA framework reports were submitted to the World Bank for review and they conform fully to Bank policy guidelines regarding environmental and social issues. All above reports have been made available in China and in the Public Information Center (INFOSHOP) of the World Bank. The Chinese EIA report was approved by Ningxia Environmental Protection Department in April, 2009. The approval attached to the EIA report.

As designed, the project (i) incorporated effective analysis of alternatives and engineering measures to maximize project benefits and minimize negative impacts that would have occurred; (ii) will not adversely affect or convert any critical natural habitats; (ii) will not adversely affect resources of high cultural value; (iii) will have minimized the need for resettlement and will provide adequate and just compensation and income restoration for affected peoples; and (iv) includes a management plan for addressing environmental and social issues during construction and operation of the project.

Project Development Objective

The project’s development objective is to provide high-capacity and quality transport connections between targeted development zones and urban areas, as well as develop all-weather road access in selected rural areas of Ningxia Autonomous Region.
Environmental Assessment Process and Legal Framework

A full Environmental Assessment (EA) was carried out following the Chinese environmental assessment laws/regulations as well as the World Bank safeguards policies. Of the ten World bank safeguards policies, the following ones are triggered: (1) Environmental Assessment; (2) Natural Habitats; and (3) Involuntary Resettlement. Compliance with these policies, and the World Bank’s disclosure of information policy, is summarized in Table 1. The project is also in full compliance with environmental policies, regulations and technical guidelines in China, summarized in Table 2.

Table 1 - Compliance World Bank Safeguards Policies

<table>
<thead>
<tr>
<th>Safeguard Policies</th>
<th>Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental Assessment (OP/BP 4.01)</td>
<td>• Category A project&lt;br&gt;• Full EIA and EMP prepared for GQE (Component A).&lt;br&gt;• EA framework prepared for road network improvements component, and EAs prepared 12 selected rural roads (Component B).</td>
</tr>
<tr>
<td>Natural Habitats (OP/BP 4.04)</td>
<td>• Alignment alternatives to avoid natural habitats&lt;br&gt;• Adequate assessment of impacted areas under protection and mitigation measures incorporated into the EMP.</td>
</tr>
<tr>
<td>Involuntary Resettlement (OP/BP 4.12)</td>
<td>• Resettlement Action Plan has been prepared</td>
</tr>
<tr>
<td>Pest Management (OP 4.09)</td>
<td>• This policy is not triggered. The project will not procure any pesticides nor will an increased use of pesticides result from the project. No action is required under the policy.</td>
</tr>
<tr>
<td>Physical Cultural Resources (OP 4.11)</td>
<td>• This policy is not triggered. The project will not adversely affect sites with archeological, paleontological, historical, religious, or unique natural values. The site selection criteria further ensure that all project areas do not contain physical cultural resources. Chance-find procedure will apply.</td>
</tr>
<tr>
<td>Forests (OP 4.36)</td>
<td>• This policy is not triggered. The project will not finance activities that would involve significant conversion or degradation of critical forest areas or related critical natural habitats as defined under the policy. No action is required under this policy.</td>
</tr>
<tr>
<td>Disclosure of Operational Information (BP 17.50)</td>
<td>• Policy is applied in support of public disclosure and coordination with local population. All of the safeguards documentation was advertised in the local major newspapers and available for those who are interested in the project information and policies.</td>
</tr>
</tbody>
</table>

Table 2 - Compliance with Chinese Regulations

<table>
<thead>
<tr>
<th>China Laws and Regulations</th>
<th>Project Compliance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental Protection Law</td>
<td>EIA is prepared according to relevant laws/regulations and technical guidelines Mitigation measures are developed in EMP and incorporated into project design, and are to be implemented and supervised during construction Final acceptance inspection will be carried out before commissioning.</td>
</tr>
<tr>
<td>Environmental Impact Assessment Law</td>
<td>Full EIA report is prepared, and approved by Ningxia Department of Environmental Protection.</td>
</tr>
</tbody>
</table>

5
<table>
<thead>
<tr>
<th>China Laws and Regulations</th>
<th>Project Compliance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Notice on Strengthening EIA Management for Construction Projects Funded by Loans from International Financial Institutions</td>
<td>EIA and EMP are prepared in compliance with World Bank OP4.01. Mitigation measures are developed in EMP and incorporated into project design, and are to be implemented and supervised during construction. Final acceptance inspection will be carried out by MEP before commissioning.</td>
</tr>
<tr>
<td>Environmental Protection Management Regulations for Transport Project</td>
<td>Mitigation measures are developed in EMP and incorporated into project design, and are to be implemented and supervised during construction. Final acceptance inspection will be carried out by MEP before commissioning.</td>
</tr>
<tr>
<td>Solid Waste Pollution Prevention and Control Law</td>
<td>A Water and Soil Conservation Plan (namely, a soil erosion control plan) is developed and incorporated into EMP and contracts for implementation. All waste spoils will be reused or properly disposed of in preselected and approved disposal sites with re-vegetation plan.</td>
</tr>
<tr>
<td>Water Pollution Prevention and Control Law</td>
<td>Mitigation measures are built into EMP. The alignment is carefully chosen to avoid drinking water resource protection areas.</td>
</tr>
<tr>
<td>Forestry Law</td>
<td>The alignment is designed to avoid clearance of any protected forests. As per the Forestry Law, necessary approvals for woodland clearance will be obtained during construction. A comprehensive restoration plan is developed.</td>
</tr>
<tr>
<td>Wildlife Protection Law</td>
<td>Alignment is carefully chosen to avoid protected natural habitats. Potential impact is thoroughly addressed in EIA, and necessary mitigation measures developed in EMP.</td>
</tr>
<tr>
<td>Wild Plants Protection Regulations</td>
<td>Protected wild plants are identified and protection measures developed.</td>
</tr>
<tr>
<td>Nature Reserve Protection Regulations</td>
<td>For un-avoidable Baijitan nature reserve, alignment is arranged in a developed transport corridor in the Experimental Zone. Other necessary measures are developed in EMP.</td>
</tr>
<tr>
<td>Scenic Area Management Regulations</td>
<td>Alignment is carefully chosen to avoid scenic areas as much as possible. For un-avoidable scenic areas, alignment is arranged to avoid main scenic spots. Greening plan and special design of stations are developed to be harmonious with the landscape.</td>
</tr>
<tr>
<td>Water and Soil Conservation Law</td>
<td>A Water and Soil Conservation Plan, namely a soil erosion control plan, is developed, and incorporated into EMP and contracts for implementation.</td>
</tr>
<tr>
<td>Urban Old and Famous Trees Management Method</td>
<td>Alternative alignment is studied to avoid old and famous trees.</td>
</tr>
<tr>
<td>Notice on Strengthening National Green Corridor Construction by State Council</td>
<td>Extensive greening plan is designed along the roadway following relevant technical guidelines.</td>
</tr>
<tr>
<td>Cultural Property Law</td>
<td>Cultural property survey along the whole line has been conducted with involvement of local relics management authority. Chance-find procedure will be strictly followed.</td>
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</table>

**Project Description**

The project is composed of two main components: (i) construction of a 75.6 km-long expressway (Guyaozi -Qingtongxia Expressway, GQE), that will cross north Ningxia Autonomous Region.
(NAR) and connect several major industrial areas; and (ii) a local road network of NAR, including portions of national highway and rural roads, will be improved to increase accessibility.

The GQE would connect Guyaozi with Qingtongxia on a new alignment bisecting nine major national and provincial highways. It would also include a bridge over the Yellow River. The highway would connect two major industrial areas at the extreme east and west of the corridor as well as link Wuzhong and Lingwu’s urban areas. These two major industrial areas are the backbone of Ningxia’s economy and the engine of its future growth: the Ningdong development zone (at the east) is of national importance, being one of the five largest coal reserves bases in China. The transport corridor—GQE is proposed to be built to a four-lane expressway standard. The Bank would partially finance this component, including earthworks, pavement, E&M and traffic safety facilities, for a total amount of USD 212 million.

Under the road network improvement program (RNIP) the project will finance improvements to national, county and township roads with the aim of improving connections to key industrial and agricultural areas, and improving the feeder network to the existing expressway network. It would include two sub-components: (i) improvements to rural roads in the poorest counties of Ningxia, including 38 local roads with Class IV, in a total length of 523.8 km, serving 240,000 villagers. As part of this program, the Bank would finance nine roads with a total length of approximately 99.3 km and an estimated cost of USD 8.15 million; and (ii) the rehabilitation of three badly damaged sections of National Highway (NH) G211 totaling 65 km between Lingwu and Huianpu. This component would provide a new pavement along the existing alignment. There would be no widening but engineering measures would be taken to improve traffic safety conditions along this corridor.
Component A: GQE
The GQE lies in central north of Ningxia Autonomous Region, extending from west to east from Qingtongxia city, to Wuzhong municipality and to Lingwu city of Yinchuan municipality. The GQE ends at Ningdong town of Lingwu.

Main Technical Specification of the GQE
- Approximate length: 75.6km
- Design speed: 100 km/h
- Maximum slope: 4%
- Embankment width: 26m
- Road width: 4*3.75 m
- Right hard shoulder width: 2*3.0
- Pavement: asphalt
- Design load class: highway-I
- Design flooding frequency: 1/300 for extra long bridge; 1/100 for long and medium bridge, viaduct and embankment
- Type of crossing: exchange

Component B: Road Network Improvement Program
- Improvements to rural roads in the poorest counties of Ningxia, including 38 local roads with Class IV, in a total length of 523.8 km;
- Rehabilitation of three badly damaged sections of National Highway (NH) G211 totaling 65 km between Lingwu and Huanpu.
2. ANALYSIS OF ALTERNATIVES

Alternative alignment analysis has been carefully conducted during the feasibility study and EA preparation process. Alternative alignment has been extensively studied to choose the optimal scheme in terms of environmental and social impact, technical feasibility and financial and economic benefits. Consultation with local governments and relevant authorities in charge of environmental sensitive areas and crossing of urban areas were conducted and fully incorporated into the alternative alignment selection process.

Without Project Scenario

At present, the highway network in NAR is inadequate to meet increasing passenger and freight transportation demand. To meet the demand, in 2009 NAR updated its trunk highway network planning in which the proposed project is a crucial component. In addition, along with the rapid development of Wuzhong, Lingwu, Ningdong Energy and Chemical Engineering Base, and other adjacent industrial bases, the project corridor has become an important economic engine for the NAR. However, there is no efficient, comfortable and safe highway in the area. Existing roads will not be able to accommodate the regional economic development sustainably. Without the proposed project, the transportation demand would have huge pressure on the existing road network, thus imposing larger environmental and social threats to the area.

Corridor Analysis

The project corridor was selected taking into consideration the future development plans of all cities along the project corridor. In addition to Lingwu and Wuzhong cities, there are presently various major development zones under construction involving massive investments, taking advantage of mineral and coal resources of the area. The final alignment is compatible with the planning areas of nearby industrial areas such as Ningdong Base, Lingwu Wool Base, Wuzhong Jingji Base, and Qingtongxia Base. There is no existing road linking these areas, only a complex succession of local roads. So a new highway is needed to provide necessary connection and accommodate existing and growing traffic. The project corridor was selected taking into consideration the future development plans of all cities along the project corridor. In addition to Lingwu and Wuzhong cities, there are presently various major development zones under construction involving massive investments, taking advantage of mineral and coal resources of the area. The final alignment is compatible with the planning areas of nearby industrial areas such as Ningdong Base, Lingwu Wool Base, Wuzhong Jingji Base, and Qingtongxia Base. There is no existing road linking these areas, only a complex succession of local roads. So only a brand new alignment could be designed for this link. The project corridor is generic in terms of ecologic characteristics. In the west part, agricultural area is prevalent while in the east part the steppe desert is prevalent. Therefore, environmental impacts associated with the project are also generic, i.e. soil erosion. Hence, the project corridor is designed to be straightforward to the extent possible, while taken into account minimized land acquisition and resettlement, minimized impact to the protected reserve.

Alternative Analysis for Sections

Section-specific alignment alternatives that merit to be highlighted include:

- Baijitan Nature Reserve Section. Two alternative alignments were considered. One option would pass through the experimental zone while the second one would pass through buffer zone of the Nature Reserve. Though the former option presented relatively poorer geological environment than the latter, and more land acquisition/resettlement, the first option was finally selected because of the low potential impact to the Nature Reserve and water environment. This alternative also received high support from local communities and government/authority.

- East End Section. Two alternative alignments for the east end of the GQE were considered: starting from the north of Ningdong Energy & Chemical Zone and starting from Qingtongxia-Yinchuan Expressway. The first option was finally selected due to its less potential impact to Baijitan Nature Reserve, less resettlement and support from local communities, governments and authorities.
3. ENVIRONMENTAL SETTING

A necessary and important element of the EA was the baseline research that describes the physical, ecological, and social characteristics of the project area. A detailed environmental baseline was needed to highlight locations of highest potential impact. The GQE will traverse tableland that is dominantly steppe desert ecosystem and plain that is dominantly agricultural ecosystem with dense irrigating channels, transmission lines and road networks. The vulnerable steppe ecosystem and populated urban and rural situations will require careful planning and supervision during construction and operation (see Figure 2)

**Figure 2 – Typical Landforms along the GQE**

<table>
<thead>
<tr>
<th>Physical Setting</th>
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<tbody>
<tr>
<td><strong>Landforms.</strong> The GQE will traverse two major landforms including LingYan tableland and Yinchuan plain.</td>
</tr>
<tr>
<td><strong>Water Systems.</strong> The project area basically belongs to the Yellow River water system. The GQE will cross the Yellow River at LAK66 by an extra long bridge. In the alluvial area where the middle and west sections of the expressway are located, with dense irrigating channels dominating the water system. The irrigating system was originally developed around two thousand years ago and has been evolving till today.</td>
</tr>
</tbody>
</table>

**Sensitive Areas**

**Ecologically Sensitive Areas.** Field surveys were conducted along the corridor to identify ecologically sensitive areas. Extensive effort has been made for alternative alignment selection in order to avoid environmental, social and cultural sensitive areas. According to Chinese law, a typical nature reserve is composed of 3 zones: Core Zone, Buffer Zone and Experimental Zone. No one is allowed to enter the Core zone without approval. For the Buffer zone, only scientific research and observation activities are allowed. The periphery of the Buffer Zone is the Experimental Zone. Scientific experiments, teaching training, visit and observation, tourism and taming and breeding rare and endangered wild animals and plants and other activities are allowed. Road and railway projects within Experimental Zone are allowed, subject to approval of the nature reserve management authority. The GQE will cross the Experimental Zone of the Baijitan National Nature Reserve which is featured with steppe desert ecosystem. The section of GQE will fall into a reserved transport corridor which currently has developed transportation system including railways, highways and transmission lines. The section of GQE has been carefully selected to be at least 300 meters away from the Buffer Zone and 500 meters away from the Core Zone of the nature reserve. Consultation with the management authority of the Reserve has been carried out during the selection of the final alignment.

The alignment also avoids the core protection sections of all water source protection areas.

**Fauna and Flora.** Detailed field ecological surveys concluded that the vegetation along project corridor belongs to desert steppe and agricultural ecosystems. In the steppe area, the vegetation belongs to temperate grassland zone, but it is of obvious desert features. The vegetation is primarily divided into 2 types, i.e. desert grassland, grassland sand vegetation, and 5 vegetation formations and 24 associations. Dominant species or constructive species of communities are *Oxytropis aciphylla var.gracil*, *Reaumuria soongorica (Pill.) Maxim.*, *Salsola passerina Iljin*, *C.tragacanthoides Turcz.*, and other desert xeric shrubs and half-shrubs. In the agricultural area, the crops along the line of the project mainly include paddy rice, wheat, corn, soy, potato and other food crops.
Two distinct landform can be identified: LAK0–32 Section is desertification grassland, subject to little disturbance, with most wild animals concentrated in the Baijitan Natural Protection Zone, and LAK32–LAK78+400 is an agrarian zone, subject to serious human activity disturbance. The wild animals are mainly reptiles and pikas adapted to human life. The reptiles are mainly lizards. Such animals are distributed extensively with relatively low level of activities.

According to ecological survey, consulting and reference to the relevant data, there are no rare endangered or protected plants or fauna species of concern distributed in the evaluated area except in the Baijitan National Nature Reserve.

**Socioeconomic Setting**

The project will be constructed in the economically underdeveloped Ningxia Autonomous Region, passing through Qingtongxia City, Litong District of Wuzhong City and Lingwu City. Though the GQE will connect several major industrial areas in the north Ningxia Autonomous Region, i.e. Ningdong Energy and Chemical Industry Base, Qingtongxia New Material Base, Lingwu Wool Industry Park and Wuzhong Jingji Industrial Park, the project areas are mainly rural, with dominant population live on agriculture. In 2008, the GDP per capita of Qingtongxia is RMB27,861, compared to RMB36,769 in Lingwu and CNY12,814 in Wuzhong.

**Indigenous Peoples**

A social screening was carried by the team out to identify the potential impacts on the expressway. The screening concluded that: 1) there is no special vulnerability on the part of members of the Hui ethnic minority groups who are included in the PAP. The five indicative characteristics of vulnerability contained in OP 4.10 are not present or relevant among the PAP; 2) there is no discernable identification by Hui individuals among the PAP as belonging to distinct ethnic minority groups. Individuals included in the PAP do not speak the Hui languages, have no special dress or body ornaments and decorations, housing styles or house locations, modes of production, special symbols, and world views or self-identification that distinguishes them from one another or from their local area Han neighbors; 3) there is wide-spread agreement among PAP Hui individuals interviewed that they cannot distinguish others as being Hui or Han based on language since all use Putonghua or the national language of China. 4) during interviews, Hui individuals included among PAP did not think that making distinctions based on ethnic minority group membership could benefit them during the course of Project planning or implementing. Thus, the ethnic minority group people in the project affected areas are informed and participated in decisions affecting them, but have not expressed any concern over the issue that the project would affect or impair their official classification as Hui people.

Based on the screening, it was concluded that the Ningxia Highway Development in the Poor Area which includes Hui individuals in the PAP will not result in these persons becoming especially vulnerable under OP 4.10 and that they will not have their human dignity, political representation, economic activities, standard of living or social and cultural life diminished, abridged or curtailed by the proposed project. As a result, IPP will not be triggered for this project.

**Physical Cultural Resources**

A cultural resources survey was conducted for all project sites in combination with consultation with local cultural property management authorities and the general public. No physical cultural property site was identified within the project assessment area. Chance finding procedures will be included in the EMP.

**4. ASSESSMENT OF IMPACTS AND MITIGATION**

As all transportation projects, the GQE will have the potential to cause direct, indirect, or cumulative impacts to the social and natural environments. The GQE will connect Ningdong Energy and Chemical Industrial Base, the backbone of Ningxia’s industrial development, with the energy and industrial development corridor of Wuzhong municipality. The GQE will also link national highways to regional road network. In a nutshell, GQE is anticipated to promote regional mobility and economic development through integrating regional energy sector development and transportation development. Manageable adverse impacts associated with GQE are primarily related to (i) crossing sensitive sites such as the Baijitan nature reserve; (ii) community impacts such as resettlement in urban and rural areas and community severance; (iii) induced and scenic impacts; and (iv) impacts during construction and operation.
The project has implemented a two-fold approach for the management of environmental impacts:

1. Avoidance: Alternative analysis has been regarded as one of the most important mitigation measures to minimize potential adverse environmental and social impact.

2. Comprehensive Mitigation Plans: detailed environmental design plans (green corridor and soil erosion control), environmental management plans, construction management, environmental supervision, resettlement action plans have been prepared in order to minimize unavoidable impacts from the project.

**Crossing Sensitive Areas**

**Nature Reserve.** There is one ecologically sensitive site identified along the project corridor – Baijitan National Nature Reserve in the city of Lingwu. It is a national level nature reserve featured with steppe desert ecosystem. Perennial herb dominates the natural vegetation. There are 3 protected flora species, distributed in the core zone and buffer zone dispersedly. Protected fauna are mainly birds, living only the core zone as the buffer zone and experimental zone cannot provide habitats to them. The GQE will traverse the experimental zone of the reserve; section LAK14+450~LAK30+850 of the GQE will fall into a developed transport corridor that belongs to the experimental zone of the nature reserve, with minimum distance of 300m from the buffer zone boundary, and minimum distance of 500m away from the core zone. The expressway portion will be around 16 km long within the experimental zone, with 7 viaducts, 1 exchange, 2 separate exchange and 2 underpasses. Site specific analysis has been conducted.

The project will permanently occupy 184 ha of land, mainly grassland (78%). There is no rare plants and fauna species of concern found in the ROW. Cleared vegetations are common species. Birds are occasionally seen in the project corridor. Construction will potentially cause soil erosion which will be well managed. In summary, construction of the GQE will cause minimal impact to the function and integrity of the nature reserve ecosystem. Consultation with nature reserve authority was conducted and approval was issued for acceptance of the proposed alignment.

As required by Chinese law, close consultations with relevant authorities have been carried out and legal approvals have been granted by these authorities. On January 21, 2009, the Forestry Bureau of Ningxia Autonomous Region put forward the opinions, summarized as follows:

- The expressway crosses the experimental area of Lingwu Baijitan Natural Reserve. Through field investigation by the management bureau of Baijitan Natural Reserve, the GQE crosses the experimental area of the protection area for 16.4km. In view of the great significance of this project and the specific situation of crossing the experimental zone of the protection area, our bureau agrees the crossing in principle.

- It is suggested that wood land of the protection area should be occupied as less as possible during the selection of route passing the protection area. The route should pass the periphery of the experimental area to reduce the damage to the wild life resources and the ecological system of the protection area.

- Before construction, relevant procedures should be transacted for the occupation of wood land according to relevant national laws, regulations and programs.

The analysis confirmed that there are very little potential adverse impacts envisioned and there will be no degradation or conversion of natural habitats; however, mitigation measures have been incorporated into EMP and design documents and will be strictly followed during construction to ensure impacts to fauna, flora and landscape can be avoided or minimized. Key mitigation measures include minimizing vegetation clearance; no camp, borrow pits and disposal sites located in the Reserve; tops soil reservation; worker behavior discipline, working time management to minimize disturbance to fauna; access road management including maximizing using of existing roads and minimizing length of new access road. Vegetation compensation and environmental supervision measures will also be strictly implemented. BOX 1 summarizes key information concerning the protection of Baijitan Nature Reserve.

**Water Resources Protection Areas.** There is only one water resources protection areas (drinking water intakes) along the corridor. The alignment has been shifted to avoid it by over 3-4 km. The adverse impact of project construction on these two protection areas is expected to be insignificant. In addition, run-off and sediment control measures during construction will be strictly enforced.
**Background** – It is a national level nature reserve featured with steppe desert ecosystem. Perennial herb dominates the natural vegetation. There are 3 protected flora species, distributed in the core zone and buffer zone dispersedly. Protected fauna are mainly birds, living only the core zone as the buffer zone and experimental zone cannot provide habitats to them.

**Relation with GQE Alignment** – Section LAK14+450–LAK30+850 of the GQE will fall into a developed transport corridor that belongs to the experimental zone of the nature reserve. The alignment will be at least 300 meters away from the buffer zone, and 500 meters away from the core zone of the nature reserve.

**Impact** – The project will permanently occupy 184 ha of land, mainly grassland (78%). There is no rare plants and fauna species of concern found in the ROW. Cleared vegetations are common species. Birds are occasionally seen in the project corridor. Construction will potentially cause soil erosion which will be well managed. In summary, construction of the GQE will cause minimal impact to the function and integrity of the nature reserve ecosystem. Consultation with nature reserve authority was conducted and approval was issued for acceptance of the proposed alignment.

**Mitigation Measures** – Key mitigation measures include minimizing vegetation clearance; no camp, borrow pits and disposal sites located in the Reserve; tops soil reservation; worker behavior discipline, working time management to minimize disturbance to fauna; access road management including maximizing using of existing roads and minimizing length of new access road. Vegetation compensation and environmental supervision measures will also be strictly implemented.

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**Experimental Zone** – a transport corridor with existing railways, highways, transmission lines and 1,020 permanent residents.

**Buffer Zone** – 24,219 ha in total. only 25% covered with vegetation.

**Core Zone** – 3 sub-zones, 25,305 ha in total.
Community Impacts

Community impacts are mainly related with (i) land acquisition, relocation of houses, and livelihood impacts; (ii) impacts on community infrastructure; (iii) noise impacts; and (iv) safety and connectivity especially in rural areas; and (v) nuisances from construction.

Resettlement Impacts

The proposed expressway project will affect 32 villages in 10 towns or townships in Wuzhong City, Lingwu City and Qingtongxia City in Ningxia. The construction of the expressway project will require permanent acquisition of 8,629 Mu (575 hectares) of land areas, including 4453 Mu of irrigated farmland (297 hectares), 260 Mu of housing plots (17 hectares), 222 Mu of forest land (15 hectares), 3,575 Mu of semi-desert grassland (238 hectares), and 121 Mu of state owned land (8 hectares). A total 2,395 households and 10,436 people from 32 villages will be affected by permanent land acquisition. Along with the land acquisition, 59,695 square meters of houses will be demolished, and 1,429 people in 310 households will be relocated accordingly.

A Resettlement Action Plan (RAP) was prepared by in accordance with relevant Chinese laws and regulations, as well as the World Bank Operational Policy OP4.12. For acquired farmland and housing plots, the compensation rate is set at CNY12,500 per mu; for affected houses, the compensation is set at CNY450 per square meter for brick concrete structures and CNY350 per square meter for brick wood structures. These compensation rates have been used in Ningxia for all large infrastructure projects in recent years and no major problems have been encountered when implementing these policies.

Based on consultations with affected villages, most of affected people due to land loss will select cash compensation for rehabilitation. They will be paid with 100% of land compensation and to be used to engage in other high yield economic crops on remaining farmland, or develop various non-land based and non-farm income generation activities. With rapid economic growth in the region the average income among affected villages is CNY5943 per capita with over 70% from non-farm activities. The impacts of land acquisition on their incomes and livelihood will be limited. In addition, for those above 60 years old, they will be enrolled into pension program so that they could receive living allowance each month, which will be more than the income from the field. Based on consultations among affected villages, detailed rehabilitation plans were prepared for 10 seriously affected villages and included in the RAP.

In addition, the NTD has agreed to provide additional in kind assistance with at least 20% of total resettlement budget (or 97% of total land compensation) in the project areas to enhance the overall compensation and rehabilitation package for the Project. The assistance includes a total of 178 kilometers of village road programs to be implemented in the next two years as part of rehabilitation package for the affected villages. They are either major access roads in the villages or roads in connection with the greenhouse fields or animal husbandry bases. The construction of these roads will greatly improve the local access for farming production and transportation, which were well received by local officials and affected people. The total investment directly benefiting affected villages amounts to CNY55.6 million.

To further enhance the compensation package to land loss farmers, more concrete rehabilitation measures have been developed based on consultations with affected villages, especially the households losing most of their lands. These rehabilitation measures include various options of animal husbandry, planting, migrant labors, and others. By providing sufficient trainings and necessary assistance to the land loss farmers, their income generation activities could be switched to these areas stated above with higher potential income. For those farmers who will lose significant portion of their land and would like to keep main source of income from farming activities, under assistance of local governments and their village committees, they could be provided with some replaced farmland through land readjustment or land lease from those who no longer want to farm any more.

For the relocated households, they will be provided with options of either rebuilding their own houses based on cash compensation of replacement value and allocated new housing plots by local governments; or replacement houses built by local governments. They will be consulted on the locations and sizes of new housing plots, and special assistance will be provided for those vulnerable households.

Impacts on rural irrigation system. The construction and operation of the GQE have the potential to cut off existing developed irrigating system and to aggravate soil erosion that will result in deteriorating water quality or blocking water courses. Such impacts can cause effects on agriculture production and flooding control. Control measures have been identified in order to avoid potential damage to the irrigating system. All the rivers and channels will be crossed by
bridges or culverts. There will be 43 bridges and 220 culverts to be built for the entire GQE. In average, there will be one such structure every 300 meters.

**Safety and Community Severance.** Urban master plans, regional highway development plan, regional industrial zone development plans as well as environmental protection plans for all cities and industrial zones were carefully studied to determine the highway alignment. For major cities such as Wuzhong, Lingwu and Qingtongxia, alternatives were thoroughly compared in terms of compatibility with existing urban planning. For major industrial development zones such as Ningdong Energy and Chemical Industrial Zone and Qingtongxia new Material Base, alternatives also considered their compatibility with existing development planning. In addition, intensive consultation with local governments and authorities was carried out thus the final selection and all selected alignments were fully compatible with urban and industrial development planning and supported by local governments and relevant authorities.

Safety is a major concern for the operation of expressway. In this regards, the GQE will be fully fenced to restrict random access of pedestrians, animals, or vehicles to the highway tracks. This will effectively minimize the potential accidents of random highway crossing.

Impacts from a construction and operation of fully-fenced expressway - cross traffic and community severance - were fully considered during project design. All local road crossings are designed with interchanges to provide access for local communities. As a result, there set up 8 interchanges, 24 separate crossroads, 32 passages and 3 overpasses, in close consultation with local governments and communities. With these designs, the impacts on local traffic, community severance will be effectively minimized.

Construction of the project will inevitably cause traffic disturbance to existing roads and will impact communities located near the right-of-way. In particularly, construction near schools will require proper management of construction vehicles, and traffic control measures. The Contractors will be required to implement traffic control plans and raise awareness of workers to minimize safety risks to adjacent communities and schools.

**Construction Impacts**

Construction of the GQE will cause temporary impacts to the surrounding environment. Typical short-term construction impacts could include noise, vibration, air quality, water quality and solid waste. If properly planned, construction impacts to neighborhoods, businesses, and the natural environment can be minimized. Several aspects of construction have been received special attention such as access roads, disposal of excess material from construction, and management of camps. A comprehensive **Soil Erosion Control Plan**, as required by Chinese regulations, has been prepared and will address all erosion, stability and restoration issues associated with earth cuts, disposal sites, embankments and affected areas in general.

**Borrow Pits.** The project will need to use 3 borrow pits while no spoil disposal site is needed. These 3 borrow pits were identified through environmental and social screening (not in protected areas, not on flood plains or unstable area, least use of cultivated land, and compatible with local urban and water resource planning). Mitigation measures in terms of soil erosion control and rehabilitation and re-vegetation have been identified. These criteria will be strictly enforced during construction.

Prior to bidding, the Design Institutes will develop design and construction specifications for temporary works to ensure that they are environmentally sound. These specifications will be part of the Construction Contract documents.

An Environmental Safeguards Framework (ESF) for dealing with new borrow pits and disposal sites, access roads and other temporary works will be followed during construction. The ESF includes procedures and decision making criteria regarding new access roads that are identified during construction. Basic elements of ESF include:

- Contractors shall use existing roads as much as possible. Existing roads will be rehabilitated to meet relevant design standards, including erosion control, slope stabilization, etc. No temporary works will be approved in or through protected areas.
- After construction, all temporary works will be cleared or rehabilitated for community use.
- Any new temporary works, including access road, borrow pits and disposal site, camp, etc. that are proposed by contractors must be reviewed and approved by the Environmental Supervision Engineer.
**Access Roads.** Access roads will be required to provide access to the construction sites, borrow pits, construction camps, mix plants, casting yards, where necessary. Great effort has been made to follow ‘Requirements on implementing the strictest protection of cultivated land for highway construction (MOC circular, 2004)’ in order to minimize temporary land acquisition caused by these temporary works. For access roads, priority is given to using existing rural road networks, particularly in the vicinity of sensitive areas. As a result, only 0.96 km and 4.5m-wide of access roads are needed to be open to reach the borrow pits. Access roads will require careful design and construction in order to avoid typical impacts such as soil erosion, slope stability problems, pedestrian safety, among many others.

**Camps Locations and Management.** The number and location of camps are not known yet. It will depend on Contractors’ plans to manage their contracts and construction. Criteria for camp location have been identified and will be strictly enforced similar to abovementioned temporary works. Camp specifications include the type of facilities (adequate accommodations, water supply and sanitation, cooking facilities.) and the need for education and sensitivity programs on natural habitats, ethnic minorities and health.

**Cumulative and Induced Impacts**

The GQE will traverse Wuzhong municipality (Qingtongxia city and Litong district) and Yinchuan municipality (Lingwu city and Ningdong town) while connecting several major industrial bases including Ningdong Energy and Chemical Industrial Base and Qingtongxia New Material Base. The project area is a main industrial corridor in the north of Ningxia Autonomous Region. Apparently, GQE will provide excellent conditions for the regional industrial development. Thus, it is necessary to pay special attention to the cumulative and induced impacts in terms of natural resource exploitation, industrial development and pollution control, environmental capacity and pollution load, urbanization and related environmental issues, institutional capacity of environmental management etc. In addition, a highway G211 Lingw-Tianshui, which is being built, will intersect GQE at Wuzhong junction interchange. The cumulative impacts associated with the simultaneous construction and operation of the two highways are also worth careful investigation.

It is anticipated that potential cumulative and induced impacts will include habitat fragmentation, degradation and loss, decreases in the quality and quantity of soils, air emissions resulting in degradation of regional air quality, long range transport of air pollutants resulting in ecosystem acidification or eutrophication, loading large water bodies with discharges of sediment, thermal, and toxic pollutants, and social, economic, or cultural effects on low-income or minority communities resulting from ongoing development.

A strategic environmental assessment (SEA) for the major industrial area - *Environmental Assessment for General Planning of Ningdong Energy and Chemical Base* has been conducted to address the impacts arising from the Base development. The SEA highlighted that “…ensure sound implementation of ecological protection of the Bajitan Nature Reserve, the mining boundary must be properly determined in order to avoid impacts caused by ground surface subsidence. Linear project corridor such as highway and railway must be properly planned. No crossing of core zone or buffer zone of nature reserve is allowed. Ecological plan need to put emphasis on land desertification control. Environmental protection indicators such as control rate of land desertification, soil quality, control rate of ground surface subsidence. Vegetation rate needs to be appropriately adjusted. The GQE will help meet the development needs of the Ningdong Base. The recommendations of GQE design and EIA are in accordance with the SEA. In addition, strengthening institutional capacity is the key meeting the environmental challenges in terms of cumulative and indirect impacts. The project will support raising awareness program on SEA among decision-makers and environmental management authorities for industrial development zones, capacity training on implementation of SEA, knowledge sharing of international good practice, etc.

**5. Environmental Management Plan**

A detailed Environmental Management Plan (EMP) addressing all issues identified in the EIA (i) organizes all measures to mitigate environmental impacts during the construction and operation; and (ii) establishes an organizational structure, procedures, institutional responsibilities for implementation, and a budget and source of financing for each activity. The EMP also includes an Environmental Safeguards Framework (ESF) specifically for the environmental management of temporary works that are left for contractor to design, and environmental monitoring and capacity building programs. Main components of the EMP are:
Environmental protection measures in design stage: mitigation measures have been incorporated in project design: alignment selection, slope stabilization, noise reduction, landscaping, and special attention to protect irrigating system.

Environmental protection measures during construction: these include: additional surveys (cultural resources), environmental specifications for construction, camp management, restoration of affected areas, access roads and borrow pits.

Environmental protection measures during operation: mainly monitoring programs.

In addition to the project-specific mitigation measures included in the EIA and EMP, project design and construction of the GQE line are also subject to a wide range of domestic laws, regulation, technical guidelines and codes of practice in China, which by default are legal requirement for project design and construction management. These include (i) Environmental Protection Specifications for Construction; (ii) Environmental Protection Management Guidelines for Transportation Construction; (iii) Requirements on implementing the strictest protection of cultivated land for highway construction; (iv) Notice on implementing environmental supervision for transportation; and (v) a wide range of standard and codes such as Highway Construction Safety Specifications (JTJ076-95), Environment and Hygiene Standards for Construction Site (JGJ146-2004), Management Regulations for Construction Sites, Safety Rules for Construction Project.

Management Organization and Responsibilities. Environment management responsibilities have been defined. Environmental management during construction involves the Project Office of Ningxia Transportation Department, Contractors and Environmental Supervision Engineers (Figure 5). During operation, environmental management responsibilities will rest with the Ningxia Transportation Department.

![Figure-5 Environmental Management during Construction](image)

**Environmental Monitoring.** Comprehensive environmental monitoring programs have been designed for both construction and operation phases. Monitoring includes water quality, noise, hydrology, construction dust and noise, as well as soil erosion and vegetation restoration. The Project Office will entrust environmental monitoring stations to carry out these plans. During operation, environmental monitoring will be carried out by provincial and prefecture (municipal) environmental protection bureaus, forestry bureaus, and water conservancy bureaus, which will be responsible for submitting the annual report on environmental management and for compiling the reports of environmental monitoring.

All personnel of the Project Office Environment Protection Section and construction workers will receive environmental training at least one time before commencement of construction. Key environmental administrative and monitoring personnel will also go through technical training provided by the project.

**Environmental Supervision.** During construction, environmental supervision shall be carried out by qualified supervision unit reporting to the Project Office of the Ningxia Transportation Department. Each Supervision Engineer company will be required by contract to assign at least one Environmental Supervision Engineer. The Environmental Supervision Engineers will:

- Review and assess on behalf of the Project Office whether the construction design meets the requirements of the mitigation and management measures of the EIA and EMP;
Supervise site environmental management system of contractors including their performance, experience and handling of site environmental issues, and provide corrective instructions;

Review the EMP implementation by the contractors and subcontractors, verify and confirm environmental supervision procedures, parameters, monitoring locations, equipment and results;

Report EMP implementation status to Project Office and prepare the environmental supervision statement during the construction period; and

Approve invoices or payments.

**Independent Environmental Consultant (IEC).** The Project Office of the Ningxia Transportation Department, will recruit an Independent Environmental Consultant (IEC) to conduct independent supervision on implementation of EMP. The lead IEC shall be a person who can independently and professionally examine records, procedures and processes. He/she may require a small team to assist him/her with checking the site (i.e. the IEC team). The IEC shall have extensive knowledge and experience in environmental monitoring and auditing to provide independent, objective and professional advice on the environmental performance of the project (at least 5 years experience is required). The IEC shall familiarize himself with the project works through review of the reports, including the project EMP. In particular, the IEC is expected to perform the following duties:

- Review and audit in an independent, objective and professional manner in all aspects of the EMP;
- Validate and confirm the accuracy of monitoring results, monitoring equipment, monitoring locations, monitoring procedures and locations of sensitive receivers;
- Carry out random sample check and audit on monitoring data and sampling procedures, etc;
- Conduct random site inspection;
- Audit the EIA recommendations and requirement against the status of implementation of environmental protection measures;
- Review the effectiveness of environmental mitigation measures and project environmental performance;
- On a need basis, verify and certify the environmental acceptability of the construction methodology (both temporary and permanent works), relevant design plans and submissions. Where necessary, the IEC shall seek the least impact alternative in consultation with the designer, the Contractor(s), and Project Office;
- Verify the investigation results of any non-compliance of the environmental;
- Quality performance and the effectiveness of corrective measures;
- Feedback audit results to Project Office and ESE team according to EMP procedures of non-compliance in the EMP, and provide Supervision Engineer (SE) suggests on actions of penalty, suspension or other punishment;
- Provide environmental training to the Contractors, Environmental Supervision Engineers (ESE) and the Project Office staff prior to and during construction; and
- Prepare semi-annual progress report to the Project Office, MOR and the World Bank.

**Environmental Safeguards Framework**

An environmental management framework has been prepared for the upgrading and rehabilitation of rural road under the project. Given the nature and small scale of the proposed civil works under the rural roads component of the project, a formal environmental assessment report was not considered necessary. However, as in most cases construction activities are going to be undertaken in rural areas there likely to be some concerns relating to inconveniences or nuisances to surrounding areas. Careful construction planning and management are needed. Therefore, for the purpose of enhancing environmental friendly measures and mitigating any adverse impacts caused by the construction activities, this Environmental Safeguard Framework (ESF) for the rehabilitation and upgrading of rural roads funded under this project have been prepared and shall be implemented by the concerned implementing agencies.

Only rural road upgrading and rehabilitation projects will be eligible for financing. It is anticipated that only environmental concern for this component would be the management of construction related impacts. Contractor practices can cause readily visible environmental and aesthetic impacts especially from the inadequate disposal of construction
wastes and earth cuts. The proper management of excavation materials, river and drainage crossings, and the reduction of nuisances such as dust, noise, increased traffic, pedestrian safety concerns, and the presence of a large work force in or near small rural communities, will necessitate careful engineering planning, close supervision, and a continuous and intense community information program.

There will be four steps to be followed in the environmental safeguards framework: i) Environmental screening to identify any key environmental safeguard issues; ii) applying checklist for environmental design criteria; iii) application of standardized environmental specifications for contractors which have already been prepared, and iv) training on rural road maintenance for municipalities and counties.

**EMP budget.** All mitigation measures have been budgeted and fully incorporated in project costs including monitoring and supervision. A summary of the budget is shown in Table 7.

<table>
<thead>
<tr>
<th>Scope of special environmental protection</th>
<th>Engineering Amount</th>
<th>Amount</th>
<th>Subtotal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consultation of environmental protection</td>
<td>Environmental Impact Assessment</td>
<td>--</td>
<td>500</td>
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<tr>
<td></td>
<td>Environmental engineering design</td>
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<tr>
<td></td>
<td>Environmental protection supervision</td>
<td>--</td>
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<td></td>
<td>Check and accept of environmental protection</td>
<td>Acceptance consultancy and environment monitoring</td>
<td>849</td>
</tr>
<tr>
<td></td>
<td>Environmental Protection Training</td>
<td></td>
<td>215</td>
</tr>
</tbody>
</table>

| Ecology greening engineering | The calculation is made on the basis of RMB300,000 per km. except the bridge, whole line includes 68.854km subgrade engineering for express way. | 20656.2 |
| | Greening maintenance equipment: grass cutter/water pump etc | 2000 |
| | Usage cost for water spray vehicle | 100 |
| | Ecological recovery cost for the section within natural protection area | 2000 |
| | Water and soil conservation | 22956.2 |

| Water pollution prevention and treatment | Septic tanks for 8 interchanges, 2 super large bridges, estimated 10 construction camps for whole line; RMB 30 thousand per septic tank. | 300 |
| | There will be around 10 construction sites according to construction camps; one flow field of advection sediment Basin costs RMB10,000. | 100 |
| | Septic tank treatment devices | Septic tank devices should be installed for 1 parking lot, 1 service area, 7 toll stations, 1 management center, 1 curing working area. The cost of one septic tank is 50,00 Yuan RMB | 550 |
| | Strengthened crash barrier for large bridge | Reinforcing of crash barriers for ultra large bridge on Yellow River, 80,000 Yuan RMB per bridge | 440 |
| | Construction sewage sediment basin | 6 construction sites, RMB 20 thousand per basin | 120 |

| Treatment investment for solid waste | Waste boxes in construction camps | Estimated 10 construction camps: RMB 10,000 per camp | 100 |
| | Waste collector in service facility | 1 parking areas, 1 service areas, 7 toll stations, 1 management centers, 1 maintenance area; RMB 10,000 per place | 110 |

| Measures for social, economic and environmental protection | Protection of cultural relics | Whole line | 200.0 |
Environment monitor on water, gas and noise during construction period for 4 years, RMB 100000 per year | 400
---|---
Environment monitor on water, gas and noise during operation period for 20 years, RMB 30000 per year | 600
Noise prevention and treatment expense | 2453
To treat the dust during construction period: use water spray vehicle in the village for 4 years | 400
Contingency cost | 3900
Total | 80574.3

6. PUBLIC CONSULTATION AND DISCLOSURE

For GQE, a combination of opinion surveys and public meetings in the townships, village committee and affected villagers’ homes have been implemented during preparation of the EA and Resettlement Action Plan. Each mitigation measure was determined by suggestions from both experts and public. Most of the concerns have been incorporated either in project design or in the environmental management plan or resettlement plan.

A brief edition of the EA for this project was made accessible on the website of Ningxia Environmental Protection Department (http://www.nxep.gov.cn/readnews.asp?newsid=12352) and the EIA Public Participation Platform (http://www.acee.org.cn/public/viewtopic.php?f=4&t=698) in March 2009, to collect opinions, suggestions and concerns from communities along the line and public in general. Suggestions were provided via telephone, fax and e-mail.

The EIA Report has been reviewed and approved by Ningxia Environmental Protection Department (NEPD) in April 2009. Meanwhile, the content of the report is accessible to all interested parties in local transport bureaus of each city, township and in the Baijitan Management Office. NTD announced the disclosure of the final EA and RAP in the July, 2009 on the Ningxia Daily and disclosed the full document on the website of Ningxia Transportation Department, Yinchuan Library and local transport bureaus, and as such, the documents are easily accessible to the general public.

Environmental Assessment and Resettlement Action Plan were sent formally to the World Bank’s INFOSHOP in Washington, DC in September 2009.