

**The World Bank Loan Project of Infrastructure Construction for  
the Urban and Rural Overall Development in the Core Area of  
Wuwei, Gansu Province**

**Environmental and Social Management Plan**

**Evaluated by Lanzhou University in August, 2014**

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Name of the client The Executive Office of the Leading Group of the World Bank Loan Infrastructure Construction Project for the Urban and Rural Overall Development in the Core Area of Wuwei City

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## Preface

It was proclaimed at the 3<sup>rd</sup> Plenary Session of the 17<sup>th</sup> Central Committee of CPC that China had entered the stage of using industry to promote agriculture and using urban development to boost rural development, and that China had also moved into a period of removing the urban-rural dual structures to form a new pattern of the urban-rural integration in social and economic development, which implies a more profound understanding of the overall development of China by the Party, and that also serves as a basis for formulating policies for the rural reform and development. The state's guiding principle to promote rural reform and development explicitly pointed out that the basic need is to accelerate this new pattern of urban-rural social and economic integration, and to uphold principles of industry fostering agriculture, cities supporting the countryside. Thus, giving more to, taking less from and loosening control of the countryside can help fulfill the important strategy of setting up a new relationship between urban and rural areas in order to speed up the modernization of China.

Located in the inland of China, Wuwei, because of its lack of mineral resources, is much slower in the economic development than the areas in the east of China, and even slower than the general development of other areas in the West of China and other parts of Gansu. It is really high time for Wuwei to find out a regional economic development pattern suitable to itself, for if it cannot develop faster, it will lag far behind. With the help of the central and provincial governments, Wuwei City has obtained this chance to apply for a loan from the World Bank (2013 Fiscal Year). The loan will mainly be used to quicken the pace of the interior transportation construction in Liangzhou District and Gulang, improve its road nets, enhance the service function thereof, guide the cross-border traffic, and improve the life and the ecological environment of residents along the roads.

The World Bank Loan Project of Infrastructure Construction for the Urban and Rural Overall Development in the Core Area of Wuwei Experiment District, Gansu

Province, satisfies the requirements of the World Bank for its loan support, is in line with the policy of speeding up the urbanization of the Chinese type proposed at the 18th CPC National Congress, and is in accordance with the plan for the regional economy and social development. The construction of the infrastructure facilities in the experiment district for urban and rural development will not only create more jobs for the local residents, but also enable them to share the benefits from the public infrastructure construction and service development by enhancing the equalization, rationalization and sharing level of the public infrastructure facilities in urban and rural areas, and thus will play an important role in improving the infrastructure of regional transportation and the living environment of both the urban and rural dwellers, helping the local people gradually change their old way of living, accelerating the integration of urban and rural development, and promoting the leap-forward development of the economy and society. Therefore, it is really very necessary to carry out the construction project.

Entrusted by the Executive Office of the Leading Group of the World Bank Loan Infrastructure Construction Project for the Urban and Rural Overall Development in the Core Area of Wuwei City, Gansu Kedi Engineering Consultation Co., Ltd. Compiled *The Feasibility Study Report on The World Bank Loan Project of Infrastructure Construction for the Urban and Rural Overall Development in the Core Area of Wuwei Experiment District.*

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# 1 Project Description

## 1.1 Project Background

It is put forward at the 17<sup>th</sup> National Congress of the CPC that “the major task of building a well-off society in an all-round manner includes balancing urban and rural economic and social development, establishing modern agriculture, developing rural economy and increasing income of farmers.” *Suggestions from General Office of the State Council on Further Supporting the Economic and Social Development in Gansu Province* (Document No. 29 delivered by the General Office of the State Council) states that all relevant departments of the State Council should take their responsibilities in researching specific supporting policies that help with the economic and social development of Gansu Province and guiding Gansu Province on further overcoming difficulties in development. With the support of the central government, Gansu provincial Party committee and Gansu provincial government established regional development strategy and grand aim to realize development by leaps and bounds---“leading force from central cities, keeping the development of peripheral areas, developing in an all-round manner, and promoting an overall development”.

As a crucial part of the northwest strategic channel, Wuwei is located in the center of the west line of Longhai Railway and Lanzhou-Xinjiang Railway. Its clear positional advantages, long history and rich culture hold huge potential for development. According to the new strategic orientation of Gansu, Wuwei needs to adjust its development ideas in areas such as environmental protection, industrial development and infrastructural development. A precious opportunity which can accelerate the construction in the core area of urban and rural integration is presented to Wuwei.

In order to achieve the economic and social development by leaps and bounds, Wuwei municipal Party committee and government have deepened understanding and made the strategic decision that the core area of urban and rural integration should be established in the region where economic and demographic advantages are integrated; namely, Liangzhou District and corridor of stream arrears of Gulang County. Priority must be given to the space structure of “one axis (Gold Avenue), two cities (Liangzhou and Dajing), and three groups (Yongfeng group, Huangyang group and Tumen group)”. The urban and rural limits must be diminished in order to expedite urban-rural integration, balancing urban-rural development, and seek new ways for the economic and social development in traditional agricultural areas,

achieving breakthroughs in the space development mode.

Therefore, Wuwei seizes the opportunity, putting forward that the World Bank loan should be used to accelerate the infrastructure construction of the core area of urban-rural integration.

At present, the project has been listed in the 2013-2015 fiscal year's backup projects plans in using World Bank loan in our country by the National Development and Reform Commission and is approved by the State Council.

## **1.2 Project Design**

The infrastructure construction project in Wuwei urban and rural integrative development core area of urban and rural development test area project co-funded by World Bank loan with the capital raised by Gansu Province includes 10 subprojects, among which 8 urban road subprojects are located in the Liangzhou District, Gulang County and the projected area in Dajing Town, 2 urban and rural road being located in the peripheral townships of Wuwei.

The proposed roads total 87.477Km, including:

A1 Golden Avenue-Fengle Town road project, an urban road, totaling 12.22km;

A2 Golden Avenue-Yongchang Town road project, an urban road, totaling 7.277km;

A3 Yanjia Village-Liuqi Village of Gaoba Town road project, an urban road, totaling 3.5km;

A4 Golden Avenue-Wunan Town road project, an urban road, totaling 4.2km;

A5 Golden Avenue-Huangyang Town road project, an urban road, totaling 5.8km;

A6 Township road project of Huangyang Town, an urban road, totaling 5.7km;

A7 Tumenzutuan road project in the core area of urban and rural integrative development, an urban road, totaling 12.7km;

A8 Tumen Town, Gulang County-the secondary road in Huanghuatan Village reconstruction project, a rural road, totaling 12.2km;

A9 Xiaoshanzi-the tertiary road in Dajing Town reconstruction project, a rural road, totaling 16.76km;

B New city area of Dajing Town road project, an urban road, totaling 7.12km.

For more details about the proposed project construction program, please refer to Table 1-1.

**Table 1-1 Proposed Project Construction Program**

Road Name	Line Route of Proposed Road	Existing Road Introduction	Design Standard	Construction Content	Environment Characteristic	
Li an g- zh ou Di str ict	A1 Golden Avenue- Fengle Town road project	<b>Liujiagou Village, Hoangxiang Town-Shatan Village, Fengle Town road:</b> The starting point is located in Group 9 in Liujiagou Village, Hoangxiang Town and the K22+800 of X159 line, going westward and crossing the Jiehe Dam, Sand Ditch. The terminal point is located in Group two in Shatan Village, Fengle Town. The route totals 9.2km.	The road (garden management committee) from the starting point K0+000 to K4+800 has been built with 8m wide gravel road surface, 18m wide roadway with street trees along both sides. The roadbed needs to be widened by 2m. The K4+800-K8+800 road has no roadbed and road surface. The old Utilizing road totals 4.8km .	The road will be constructed according to the urban secondary trunk road standard with the speed of 40km/h, 20.0m wide roadway, single width road and bituminous concrete road surface. The specific layout of its cross section is: 2.5m sidewalk+15m carriageway (motorway+bicycle lane) +2.5m sidewalk=20m.	This project is a comprehensive municipal project which mainly includes single projects like road, bridge and culvert, storm sewage, lighting, greening and traffic safety. The whole road needs to be built with 1 medium bridge (3 holes-20m prestressed concrete box girder L70m, W20m), 1 bridge (6 holes-20m prestressed concrete box girder, L130m, W20m), 3 intersections.	The project is located in Gobi wasteland (1)Sound sensitive spot: Lijiaci Village. (2)Water sensitive spot: Jiehe Dam, Sand Ditch and spillway of Gobi desert.
		<b>Golden Avenue connection road:</b> The starting point is located in the K3+300 of the mainline, then going southward. The terminal point is connected with the Golden Avenue. The road totals about 3.02km.	This road is 18m wide, with gravel road surface and simple roadbed, and can be fully utilized. It needs to be widened by 6.5m.	This road is designed according to the first-class highway with the speed of 80Km/h, 24.5m wide roadbed and bituminous concrete road surface. The layout of its cross section is: 0.75m(concrete shoulder pad)+2.5m(hard shoulder)+2×3.75 m(carriageway)+3m(medial strip)+2×3.75 m(carriageway)+2.5m hard shoulder)+0.75m(concrete shoulder pad)=24.5m.	The road needs to be built with 4 culverts and perfect safety facilities like traffic sign, marking and guard bar.	
	A2 Golden Avenue- Yongcha ng Town road project	<b>Golden Avenue-Xiazhai Village, Wuhe Township road:</b> The starting point is located in the forth group of Wuhe group, Wuhe Township, connected with the K11+400 of Golden Avenue, then going northward. The terminal point is located in Xiazhai Village, Wuhe Township. The road totals 3.914Km. <b>Xiazhai Village-Liupei Village of Wuhe Township road:</b> The starting point is located in the terminal point of Golden Avenue-Xiazhai Village, Wuhe Township road, then going eastward. The terminal point is located in the Liupei Village, Yongchang Town. The road totals 3.363Km.	New construction, without roadbed and road surface	This road will be constructed according to the urban trunk road standard with the speed of 40km/h, 28m wide roadway and bituminous concrete road surface. The specific layout of its cross section is: 2m sidewalk+3m bicycle lane+1.5m green belt+15m motorway+1.5m green belt+3m bicycle lane+2m sidewalk=28m.	This project is comprehensive municipal project which mainly includes single projects like road, bridge and culvert, storm sewage, lighting, greening and traffic safety. The whole road needs to be built with 8 culverts, 2 intersections.	
A3 Yanjia Village- Liuqi Village of Gaoba Town road project	The starting point is located in the Yanjia Village, Gaoba Town, and connected with the K6+700 of Tianma Avenue. The terminal point is located in the Liuqi Village, Gaoba Town, and connected with the K3+200 of X149 line (Lianggu Road). The road totals 3.5km.	New construction, without roadbed and road surface	This road will be constructed according to the urban trunk road standard with the speed of 40km/h, 28m wide roadway and bituminous concrete road surface. The specific layout of its cross section is: 2m sidewalk+3m bicycle lane+1.5m green belt+15m motorway+1.5m green belt+3m bicycle lane+2m sidewalk=28m.	This project is a comprehensive municipal project which mainly includes single projects like road, bridge and culvert, storm sewage, lighting, greening and traffic safety. The whole road needs to be built with 6 culverts, 11 intersections.	The road crosses farmland and needs to expropriate cultivated land for its construction. With villages along it, it is typical of rural environment. (4)Sound sensitive spot: Caijia Village, Shisanli Town, Liuqi	

	<p>A4 Golden Avenue-Wunan Town road project</p>	<p>The starting point is located in the Group 8 of Huasheng Village, Wunan Town, and connected with the K37+500 of Golden Avenue. The terminal point is located in the Group 2 of Qingshi Village, Wunan Town, and connected with the intersection of Tianma Avenue and Ronghua Avenue. The road totals 4.20km.</p>	<p>New construction, without roadbed and road surface</p>	<p>This road will be constructed according to the urban trunk road standard with the speed of 60km/h, 29m wide roadway and bituminous concrete road surface. The specific layout of its cross section is: 2m sidewalk+11m carriageway(motorway+bicycle lane)+3m green belt+11m carriageway(motorway+bicycle lane)+2m sidewalk=29m.</p>	<p>L4200m, W29m, to construct 7 culverts, 2 intersections. Providing necessary facilities like protection, drainage, lighting, greening and traffic safety.</p>	<p>The road crosses farmland and needs to expropriate cultivated land for its construction. With villages along, it is typical rural environment. (5) Sound sensitive spots: Shengjiaxia Village, Shengjiayi Village, Shengjiadong Village and Lujia Village.</p>
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Continued Table 1-1 Proposed Project Construction Program

Road Name	Line Route of Proposed Road	Existing Road Introduction	Design Standard	Construction Content	Environment Characteristic	
Li an gz ho u Di str ict	A5 Golden Avenue- Huangy ang Town road project	It starts from the 7 <sup>th</sup> group of Square Village, Huangyang Town and connects with the K64+040 of Golden Avenue, by the way of Huangwu Road and Xindian Village, Huangyang Town, and ends in the 3 <sup>rd</sup> group of Daguo Village, Huangyang Town. The road totals 5.80km.	About 3.10km road of Golden Avenue-Huangwu Road (flax factory) is reconstructed. The old road is gravel road surface with 7.5m wide roadbed which needs to be widened by 16.5m. The old one still in use is 3.1km.	This road will be constructed according to the urban secondary trunk road standard with the speed of 40km/h, 24m wide roadway and bituminous concrete road surface. The specific layout of its cross section is: 2.5m sidewalk+1.5m green belt+16m carriageway(motorway+bicycle lane)+1.5m green belt +2.5m sidewalk=24m.	This project is a comprehensive municipal project which mainly includes single projects like road, bridge and culvert, storm sewage, lighting, greening and traffic safety. The whole road needs to be built with 10 culverts, 1 small bridge (L18m, W24m), 3 intersections.	The road cross Huangyang Town in the east. With farmland, villages and irrigation ditches along it, it is typical of rural environment. (6) Sound sensitive spot: Weijai Village, Yangjiapu, Liujia Village, Xiajia Village, Lijia Village, Yanjia Village and the first primary school of Square. (7) Water sensitive spot: the third main channel of Huangyang which is agricultural irrigation channel.
	A6 Townshi p road project of Huangy ang Town	<b>The north section of Weiqi Road:</b> the starting point connects with the K63+100 of Golden Avenue, then the road goes from north to south with its terminal point connecting with the Jinger Road, totaling 1.56Km.	New construction, without roadbed and road surface	This road will be constructed according to the urban trunk road standard with the speed of 40km/h, 28m wide roadway and bituminous concrete road surface. The specific layout of its cross section is: 2m sidewalk+2.75m bicycle lane+2m green belt+14.5m motorway+2m green belt+2.75m bicycle lane+2m sidewalk=28m.	The north section of Weiqi Road L1,560m, W28m; the south section of Weiqi Road L,930m, W18m; Jingyi Road L2,640m, W24m; Muxiao Road L570m, W16m; to construct 10 culverts, 9 intersections; providing facilities like drainage, lighting, greening and traffic safety. .	Being located within Huangyang Town area with typical rural environment, part of the road is located within Yu Town area with farmlands along. (8) Sound sensitive spot: Man Village, Huangyang Town street area, Weijia Village and Xujia East Village.
		<b>The south section of Weiqi Road:</b> the starting point connects with the Jinger Road, and then the road goes from north to south with its terminal point connecting with the Nongda Road, totaling 0.93km.	New construction, without roadbed and road surface	This road will be constructed according to the urban trunk road standard with the speed of 40km/h, 18m wide roadway and bituminous concrete road surface. The specific layout of its cross section is: 2m sidewalk+14m carriageway (motorway+bicycle lane) +2m sidewalk=18m.		
		<b>Jingyi Road:</b> the starting point connects with Huanxi Road, and then the road goes from west to east with the terminal point connecting with the East Road (project), totaling 2.640Km.	New construction, without roadbed and road surface	This road will be constructed according to the urban trunk road standard with the speed of 40km/h, 24m wide roadway and bituminous concrete road surface. The specific layout of its cross section is: 3m sidewalk+3m bicycle lane+2m green belt+8m motorway+2m green belt+3m bicycle lane+3m sidewalk=24m.		
		<b>Muxiao Road:</b> it starts from Jingyi Road and its terminal point connects with the Jinger Road (completed), totaling 0.57Km.	New construction, without roadbed and road surface	This road will be constructed according to the urban trunk road standard with the speed of 20km/h, 16m wide roadway and bituminous concrete road surface. The specific layout of its cross section is: 2.0m sidewalk+12m carriageway (motorway+bicycle lane) +2.0m sidewalk=16m.		

Gulang County	A7 Tumenzutuan road project in the core area of urban and rural integrate development	<p><b>Xinfeng-Wangfuying Road:</b> north-southeast trend, the starting point (north) is in the Xinfeng Village, Tumen Town, connecting with the K76+600 of Golden Avenue and its terminal point (east-south) is in the Wangfuying Village, Tumen Town, connecting with the Lianggu Road. The whole road totals 7.5Km.</p>	New construction, without roadbed and road surface	This road will be constructed according to the urban secondary trunk road standard with the speed of 30km/h, 16.0m wide roadway and single width road. The specific layout of its cross section is: 2.0m sidewalk+12m carriageway (motorway+bicycle lane) +2.0m sidewalk=16m.	Xinfeng-Wangfuying Road L7, 500m, W16m; 11 new culverts, 1 bridge (6 holes-20m prestressed concrete box girder, L126.5m, W16m), 1 level crossing (utilization), 5 intersections. Providing facilities like drainage, lighting, greening and traffic safety.	The road crosses farmland and needs to expropriate cultivated land for its construction. With villages along it, it is typical of rural environment (9) Sound sensitive spot: Heshang Village, the 1 <sup>st</sup> group of Xitan, Jia Village, primary school of Xitan, Shaungfeng, the 4 <sup>th</sup> group of Xitan and the 3 <sup>rd</sup> group of Xitan (10) Water sensitive spots: Gulang River, III class water body and no perennial drainage in the project road
		<p><b>Shuangfeng-Yuandunzi Road:</b> east-west trend, the starting point (east) is in the Shuangfeng Village, Tumen Town, intersecting in the K2+800 with the K1+828.5 of Xinfeng-Wangfuying Road, the terminal point (west) is in the Yuandunzi Group, Guanghui Village, Sishui Town. The road totals 5.2km.</p>	New construction, without roadbed and road surface			

Continued Table 1-1 Proposed Project Construction Program

Road Name	Line Route of Proposed Road	Existing Road Introduction	Design Standard	Construction Content	Environment Characteristic	
Gulang County	A8 Tumen Town, Gulang County-the secondary road in Huanghutan Village reconstruction project	<p>The starting point is located in Taizi Village, Tumen Town and connected with the S308 line, by way of Erdun Village and Huanghutan Village in Tumen Town. The terminal point is located in Huanghutan Village, Huanghutan Township, and connected with the K92+000 of Golden Avenue.</p> <p>The road totals 12.2km, The original horizontal and vertical index of Datu Ditch road is too low; therefore, the road is rerouted by 1.5km. Most of the sections will be reconstructed along the old road, except the curve cut-off of several sections.</p>	7m wide asphalt road surface which needs to be widened by 5m; 8.5m wide roadbed.	<p>The K2+000-K3+700 road is designed according to the secondary road standard with the speed of 40km/h and 8.5m wide roadbed (the width of the original roadbed will stay the same, considering that there are many resident buildings on both sides of this road and in order to decrease the quantity of expropriation lands and buildings, and ensure the traffic safety of residents). The other sections are designed according to the secondary road standard with the speed of 60km/h and 12m wide roadbed. The layout of its cross section is: 0.75m(concrete shoulder pad)+ 1.5m(hard shoulder pad) + 2×3.75 m(carriageway)+1.5m(hard shoulder pad)+0.75m(concrete shoulder pad)=12.0m</p>	<p>4 detachable viaducts in the whole route: the road will cross the Yingshuang Highway(14m clear width, 5.2m clear height) under the K3+360, cross the Golden Avenue(14.5m clear width, 5.5 clear width) under the K4+000, and undercross the Ganwu Railway(8.5m clear width, 4.5m clear width) in K4+380 and K13+450 by undercrossing the existing bridge holes; 2 new medium bridges (L=180, W=12m), 23 new culverts, 3 intersections. Besides, providing necessary facilities like protection and drainage and perfect safety facilities like traffic signs, markings and guard bars for the road.</p>	<p>The road with typical rural environment on both sides will be reconstructed along the existing road.</p> <p>(11) Sound sensitive spots: Tumen, Huajiantan, Yangjiatai, Erdun Village, Tumen Northeast Beach, Hanshihetai Village and Huanghutan Village.</p> <p>(12) Water sensitive spots: Hanshi River, III class water body, seasonal stream and no perennial water.</p> <p>(13) Geological disaster: sand damage.</p>
	A9 Xiaoshanzi-the tertiary road in Dajing Town reconstruction project	<p>The starting point is located in the K47+400 of Gulangshibali Town-Tiaoshan Road, Jingtai County. The terminal point is located in the Dajing Town, and connected with the starting point of Da(jin)Hai(zitan) Road. The road totals 16.76km. Most of the sections will be reconstructed along the old road, except the curve cut-off of several sections.</p>	<p>The existing roadbed with frost boiling and subsidence is 7.5m wide, the asphalt road surface with serious crack and potholes is 6.5m wide; the K2+100-K2+600 road goes into the west bank of Dajing Gorge Reservoir with elbows and abrupt slopes. the horizontal and vertical index cannot reach the tertiary road technical standard; therefore, the rocky slope on left side of the west bank needs to be excavated. The horizontal and vertical index of other sections can basically reach the tertiary road technical standard. The roadbed can meet the design requirement without any need to be widened. There are 7 medium and small bridges. Only one medium bridge in the starting point, with normal appearance and sound major structure, can be utilized. One stone arch bridge in K9+800 with 1 hole of 20m is verified to be dangerous and not suitable for continuous use, Other 5 bridges are all damaged to some extent in bridge deck system, conical slope and diversion facility. Some sections of the road is too old for vehicles or needs to be dismantled and reconstructed. The old road in use totals 16,300m.</p>	<p>This road will be constructed according to the tertiary road with the speed of 30km/h, 7.5m-wide roadway and bituminous macadam road surface. The horizontal alignment of the road should be refined. The layout of its cross section is: 0.5(earth shoulder)+2×3.25(carriageway)+0.5(earth shoulder)=7.5m</p>	<p>To construct 39 culverts, 6 small bridges (L138m, W7.5m), 2 medium bridges (L70m, W7.5m) and 5 intersections. Providing necessary facilities like protection and drainage and perfect safety facilities like traffic signs, markings and guard bars for this road.</p>	<p>With typical rural environment, the starting point is located in Dajing Gorge Reservoir, along Dajing River, by way of hilly and mountain area to river valley. The terminal point is located in the south of Dajing Town, with shops and residential areas along.</p> <p>(14) Sound sensitive spots: Shangyuan, Santai Village, Shilabatai, Dujia Village, Tuan Village, Zhaojiawan, Red Flag Village, Xiakou Village, Xiaoshanzi Village and the middle school of Minquan Township.</p> <p>(15) Water sensitive spot: Dajing Gorge Reservoir and Dajing River.</p> <p>(16) Environmental risk: to cross the second class water source conservation area of Dajing Gorge Reservoir, to cross the second class water source conservation area of Liujiatan, Dajing Town</p>

B New city area of Dajing Town road project	<p><b>Weisan Road:</b> the road starts from the Big and Small Road and ends in the planning Xihuan Road, totaling 2.74km.</p>	New construction, without roadbed and road surface	<p>This road will be constructed according to the urban trunk road standard with the speed of 40km/h, bituminous concrete road surface, 44m wide planning roadway and 3 roadways. The specific layout of its cross section is: 4m sidewalk+4.5m bicycle lane +2.5m green belt+22m carriageway+2.5m green belt+4.5m bicycle lane +4m sidewalk =44m.</p>	<p>This road includes single projects like road, bridge and culvert, storm sewage, lighting, greening, traffic safety and management facilities, and 4 intersections along the road.</p>	<p>This project county road is located in Dajing County with residential areas and schools along both sides.</p> <p>(17) Sound sensitive spots: Anjia Village, Liangjia Big Village, public rental housing community in Dajing Town, residential building of Gulang third middle school, residential complex of Power Supply Administration, Beiguan Village, Dajing Town Center Kindergarten, Dajing Town Middle School, Dazhuang Village and Shuangcheng Village.</p>
	<p><b>Weisi Road:</b> the road starts from the Big and Small Road and ends in the planning Xihuan Road, totaling 2.86km.</p>	New construction, without roadbed and road surface	<p>This road will be constructed according to the urban secondary trunk road standard with the speed of 30km/h, bituminous concrete pavement, 20m wide planning roadway and single roadway. The specific layout of its cross section is: 3m sidewalk+14m carriageway+3m sidewalk=20m.</p>	<p>This road includes single projects like road, bridge and culvert, storm sewage, lighting, greening, traffic safety and management facilities, and 3 intersections along the road.</p>	
	<p><b>Quancheng Road:</b> the road starts from the Provincial Road 308 and ends in the Dajing Road, totaling 1.52km.</p>	New construction, without roadbed and road surface	<p>This road will be constructed according to the urban secondary trunk road standard with the speed of 30km/h, bituminous concrete road surface, 20m wide planning roadway and single roadway. The specific layout of its cross section is: 3m sidewalk+14m carriageway+3m sidewalk=20m.</p>	<p>This road includes single projects like road, bridge and culvert, storm sewage, lighting, greening, traffic safety and management facilities, and 4 intersections along the road.</p>	

Statistics suggest that the proposed project involves the construction of 18 roads in 10 subprojects, totaling 87.477km, among which 13 roads are completely newly-constructed and 5 roads are newly-constructed or reconstructed. The overall length of the new construction is 48.057km, and the length of the old road is 39.42km. For details of old roads, please refer to table 1-2.

**Table1-2 Construction Description of Each Section in the Proposed Project**

Road Section Name		Construction Description	Length (km)	Old Road Utilization (km)
Liangzhou District	A1 Golden Avenue-Fengle Town Road Project ——Road from Liujiagou Village of Hongxiang Town to Shatan Village of Fengle Town	Newly-constructed, Reconstructed	9.2	4.8
	A1 Golden Avenue-Fengle Town Road Project ——Golden Avenue Connecting Line	Reconstructed	3.02	3.02
	A2 Golden Avenue-Yongchang Town Road Project ——Golden Avenue to Xiazhai Village of Wuhe Township Section	Newly-constructed	3.914	/
	A2 Golden Avenue-Yongchang Town Road Project ——Xiazhai Village of Wuhe Township to Liupei Village Section	Newly-constructed	3.363	
	A3 Yanjia Village-Liuqi Village of Gaoba Town Road Project	Newly-constructed	3.5	/
	A4 Golden Avenue-Wunan Town Road Project	Newly-constructed	4.2	/
	A5 Golden Avenue-Huangyang Town Road Project	Newly-constructed, Reconstructed	5.8	3.1
	A6 Huangyang Town Road Project ——the North Section of Weiqi Road	Newly-constructed	1.56	/
	A6 Huangyang Town Road Project ——the south Section of Weiqi Road	Newly-constructed	0.93	/
	A6 Huangyang Town Road Project ——Jingyi Road	Newly-constructed	2.64	/
	A6 Huangyang Town Road Project ——Muxiao Road	Newly-constructed	0.57	/
Gulang County	A7 Tumen Group Road Project in the Urban and Rural Fusion Development Core Area ——Xinfeng to Wangfu Camp Road	Newly-constructed	7.5	/
	A7 Tumen Group Road Project in the Urban and Rural Fusion Development	Newly-constructed	5.2	/

	Core Area ——Shuangfeng to Yuandunzi Road			
	A8 Golden Avenue to the New Rural Demonstration Area of Huanghua Shoal 2nd-class Road Construction Project	Reconstructed	12.2	12.2
	A9 Xiaoshanzi-Dajing Town 3rd-class Road reconstruction Project	Reconstructed	16.76	16.3
	B the New City Zone Road Project of Dajing Town ——Weisan Road	Newly-constructed	2.74	/
	B the New City Zone Road Project of Dajing Town ——Weisi Road	Newly-constructed	2.86	/
	B the New City Zone Road Project of Dajing Town ——Quancheng Road	Newly-constructed	1.52	/
Total			87.477	39.42

## 2. Environment standards and the protection objectives

According to the compartmentalization of environmental function of areas along the roads, the single compartmentalization of environmental function of the project and the assessment standards are as follows:

### 2.1 Compartmentalization of Water Environmental Function and the Assessment Standards

(1) Rivers and water bodies involved into the proposed project mainly are Jiehe Dam and Shagou in Liangzhou District, and Gulang River, Hanshi River, Datugou, Dajing River and Dajingxia Reservoir. According to *Compartmentalization of Water Body Function in Gansu Province*, the target water quality of Gulang River, Dajing River and Dajingxia Reservoir are Class III water body while the other rivers have no compartmentalization.

Details of the compartmentalization of above rivers are in Table 2-1.

**Table 2-1 Compartmentalization of Water Bodies' Environmental Function along the Proposed Project**

No.	Name	Target Water Quality	Function of Water Body	Relation with the Project	Notes
1	Daihe Dam	Null	Null	Crossing of Gold Avenue to Fenge Town Road Project	Located in Gobi deserts with no running water, and regarded as flood-relief channel in rainstorm.
2	Shagou	Null	Null		
3	Gulang River	III	Agricultural Water	Running along with Tumen Group Road Project	This part in construction areas is dry.
4	Hanshi River	Null	Null	Crossing of Tumen Town of Gulang Country to Huanghuatan Class II Road Reconstruction Project	Seasonal river without running water.
5	Datugou	Null	Null		
6	Dajing River	III	Agricultural Water	Running along with Xiaoshanzi to Dajing Town Class III Road Reconstruction Project	The part near Dajing Town is almost dry; K2+500-K6+600 pass through Liujiatan water source Class II conservation area in Dajing Town
7	Dajingxia Reservoir	III	Agricultural Water		through Dajingxia Reservoir water source Class II conservation area

The compartmentalization of water environmental function of rivers along the proposed roads is in Figure 2-1.

(2) Because Daihe Dam, Shagou, Hanshi River and Datugou involved in the proposed project have no water body functional compartmentalization, these rivers without running water are flood-relief channels in rainstorm. With the principle that downstream rivers should be protected during running and the compartmentalization of the water bodies' function, constructing roads affecting Jiehe Dam, Shagou, Hanshi River, Datugou, Dajing River and Dajingxia Reservoir will execute standard III in *Environmental Quality Standard of Surface Water* (GB3838-2002).

Details are in Table 2-2, 2-3.

**Table 2-2 Standards of Water Environment Assessment Involved in the Proposed Project**

No.	Water Bodies	<i>Environmental Quality Standard of Surface Water</i> (GB3838-2002)
1	Jiehe Dam	III
2	Shagou	III
3	Gulang River	III
4	Dajing River	III
5	Dajingxia Reservoir	III

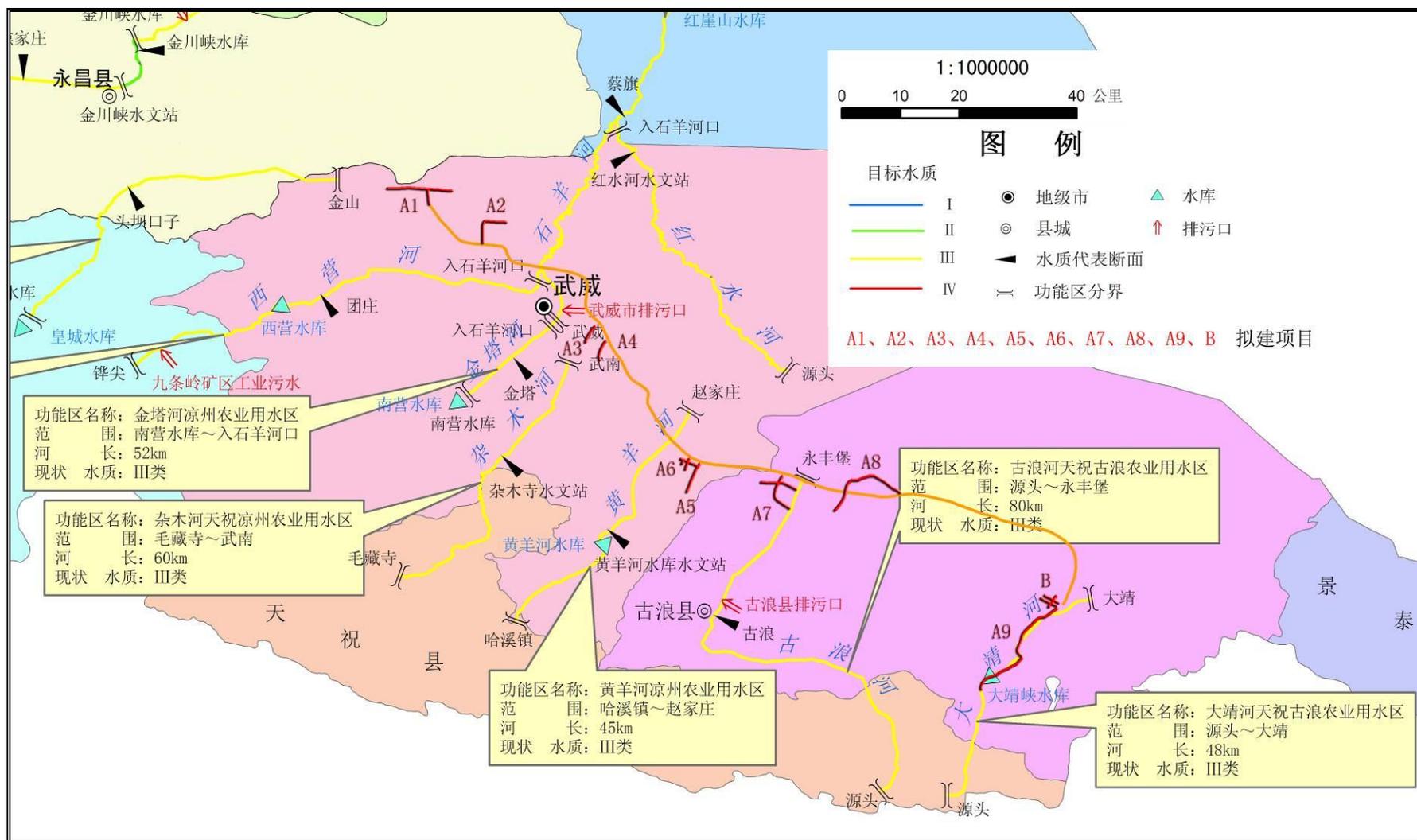


Figure 2-1 Compartmentalization of Water Environmental Function

**Table 2-3 Environmental Quality Standards for Surface Water (Unit: mg/L)**

No.	Classification		Grade II	Grade III
	Reference Quantity			
	Item			
1	Temperature (°C)		Range of man-made environmental temperature change of water should be Maximum weekly temperature rise: ≤1 Maximum weekly temperature drop: ≤2	
2	pH (non-dimensional)		6 ~ 9	
3	DO (dissolved oxygen)	≥	6	5
4	permanganate index	≤	4	6
5	COD (chemical oxygen demand)	≤	15	20
6	BOD5 ( five-day biochemical oxygen demand)	≤	3	4
7	NH3-N	≤	0.5	1
8	Total Phosphorus ( P )	≤	0.1 (lake and reservoir 0.025)	0.2 (lake and reservoir 0.05)
9	Total Phosphorus (lake and reservoir,N)	≤	0.5	1
10	Cu	≤	1	1
11	Zn	≤	1	1
12	Fluoride(F)	≤	1	1
13	Se	≤	0.01	0.01
14	As	≤	0.05	0.05
15	Hg	≤	0.00005	0.0001
16	Cd	≤	0.005	0.005
17	Cr6+	≤	0.05	0.05
18	Pb	≤	0.01	0.05
19	Cyanide	≤	0.05	0.2
20	Volatile phenolic compounds	≤	0.002	0.005
21	Petroleum oils	≤	0.05	0.05
22	An-ionic surfactants	≤	0.2	0.2
23	Sulfide	≤	0.1	0.2
24	Coliform bacteria ( number per Liter )	≤	2000	10000

(3) Environmental assessment on underground water in the proposed project construction areas adopt standard III in *Standard of Underground Water Quality* (GB/T14848-93) and as to items that standards of underground water do not possess, *Standard of Sanitary of Drinking Water* (GB5749-2006) is regarded as a reference. Details are in Table 2-4,

**Table 2-4 Standard of Underground Water Quality (GB/T14848-93)**

Assessment Targets	Standard (mg/L)	Assessment Targets	Standard (mg/L)	Assessment Targets	Standard (mg/L)
Total dissolved solids	1000	Fluoride	1.0	Lead	0.05
Ammonia nitrogen	0.2	NO <sub>3</sub> <sup>-</sup>	20	Chromium	0.05
Permanganate Index	3.0	NO <sub>2</sub> <sup>-</sup>	0.02	Arsenic	0.05
Total hardness	450	Manganese	0.1	Mercury	0.001
Chloride	250	Zinc	1.0	Petroleum *	0.3*
Sulfate	250	Copper	1.0	Benzene*	0.01*
Volatile penols	0.002	Selenium	0.01		

“\*” is the limiting value in *Standard of Sanitary of Drinking Water* (GB5749-2006) of Table 3.

(4) According to the *Integrated Pollutant Discharge Standard* (BG8978-96), sewage discharged to water body of GB3838III (except delimited conservation and swimming areas) should adopt standard I. No new drain outlet should be set in conservation delimited in water bodies of I, II and III by GB3838. The current drain outlets should control total discharge amount according to request of the function of water body in order to guarantee that the quality of receiving water can meet the quality standard of prescriptive use.

The standard I of *Integrated Pollutant Discharge Standard* (BG8978-96) is in Table 2-5.

**Table 2-5 Integrated Pollutant Discharge Standard (BG8978-96)**

Unite: mg/l

Item	PH	SS	COD <sub>Cr</sub>	BOD <sub>5</sub>	Ammonia Nitrogen	Petroleum
Standard I	6~9	70	100	30	15	10

## 2.2 Ambient Air Quality Standard (AAQS)

The compartmentalization of atmospheric environment function is not adopted in areas involved in the proposed project. According to the research, the construction areas are rural ones, belonging to Class II. The schedule shows that the construction period of the proposed project is from 2014 to 2019, and new *Ambient Air Quality Standard* (GB3095-2012) will be put into effect on January 1, 2016. This EIA suggests that during the early stage of construction (from June, 2014 to December 31, 2015), new standard should be adopted for good environmental quality. The ambient air quality of the proposed project areas will adopt standard II, and details are in Table 2-6.

**Table 2-6 Standard Unit of Assessment on Current Ambient Air Quality: mg/m<sup>3</sup>**

Standard	No.	Assessment Factors	Annual Average	Daily Average	Hourly Average
GB3095-2012 Standard II	1	SO <sub>2</sub>	0.06	0.15	0.50
	2	NO <sub>2</sub>	0.08	0.012	0.2
	3	PM10	0.10	0.15	-
	4	TSP	0.20	0.30	-

Air pollutant emission standard during the construction period adopts standard II in *The Integrated Emission Standard of Air Pollutants* (GB16297-1996) as to sensitive spots such as main villages and schools; as to asphalt fume, standard II is adopted in *The Integrated Emission Standard of Air Pollutants* (GB16297-1996). Details are in Table 2-7.

**Table 2-7 The Integrated Emission Standard of Air Pollutants**

Pollutant	Maximum acceptable emission concentration (mg/m <sup>3</sup> )	Maximum acceptable emission rate (kg/h)		Unorganized emission monitoring concentration limit (mg/m <sup>3</sup> )
		Emission pipe height (m)	Standard II	
Particle	120	15	3.5	Highest concentration out of perimeter is 1.0
		20	5.9	
		30	23	
		40	39	
Asphalt fume	75	15	0.18	The producing facilities should not have obvious unorganized emission.
		20	0.30	
		30	1.3	

### 2.3 Compartmentalization of Acoustic Environmental Function and Assessment Standard

According to *Environmental Quality Standard for Noise* (GB3096-2008), standard 4a is adopted in areas 35m within both sides of arterial traffic and boundary lines of the roads during the operation period. Villages of 35m beyond (i.e. regions outside those where standard 4a is applied) and standard II in *Environmental Quality Standard for Noise* (GB3096-2008) needs to be adopted. Details are in Table 2-8 and 2-9.

**Table2-8 Environmental Quality Standard for Noise (GB3096-2008)**

Standard	Regions	Standard Value LAeq(dB)	
		Day	Night
II	Mixed zone of residence, business and industry	60	50
4a	Both sides of arterial routes of urban roads	70	55

**Table 2-9 Emission Standard of Environment Noise for Boundary of Construction Site (GB12523-2011)**

Standard Value LAeq(dB)	
Day	Night
75	55

## 2.4 Solid Waste

Relevant standard in *Standard for Pollution Control of Storage and Disposal Site of General Solid Industrial Waste* (GB18599-2001) will be adopted for solid waste.

Waste asphalt fume will be used as material of road base, so no discharge of asphalt to the outer environment is allowed.

## 2.5 Assessment Standard of Water and Soil Loss

Water and soil loss assessment standard will refer to *Soil Erosion Classification Standard* (SL190-2007). Details are in Table2-10.

**Table2-10 Classification Standard of Intensity of Hydraulic Erosion**

Classification	Erosion Modulus( $t/km^2 \cdot a$ )	Classification	Erosion Modulus( $t/km^2 \cdot a$ )
Low	< 500	IV Serious	5000 ~ 8000
Mild	200 , 500 , 1000 ~ 2500	V Intense	8000 ~ 15000
Medium	2500 ~ 5000	VI Severe	> 15000

## 2.6 Safeguard Policy of the World Bank

(1) Investigation Process of the Project

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Accompanied by the staff from office of World Bank, the EIA group of Lanzhou University has visited relevant bureaus such as the Bureau of Religious Affairs, Bureau of Land and Resources and Agriculture and Animal Husbandry Bureau, exchanging ideas with people in charge. Areas that may be affected by the project construction are investigated one by one, such as natural reserves, relics of ancient Great Wall protection zone, places of interests and places of worship. At present, all lines in adjusted plan will not affect natural reserves, relics of ancient Great Wall and other cultural heritage on the ground.

## (2) Policies Involved

The project construction involves urban and rural roads and no natural habitats; it involves no problem of dam safety or management of diseases and pests. Therefore, this EIA mainly includes such security policies as environmental assessment, involuntary migration and information transparency. Since cultural heritage may be buried underground and cannot be found before construction, if any cultural relics are discovered during construction, *Contingency Procedure of Discovering Tangible Cultural Heritage* must be referred to.

The project is located in areas which have been disturbed by intensive human activities. In Wuwei approximately 56.6% of the total land affected (235ha) are farmland, residential land, and existing roads; while the rest 43% is in desert area (equivalent to 100ha). Wuwei is a city facing desertification problem with 39% of its land being desert. To minimize the acquisition of farmlands, the project (mainly roads A1, A2, A7 in Wuwei) will occupy 100ha wasteland which accounts of 0.05% of the total desert area in Wuwei. The EA confirms that there are no endangered species in the project area that could be affected by project interventions.

The proposed 15 bridges in Wuwei will be crossing low lying areas or dry stream beds. The EA shows that if no mitigation measures taken, project construction in Wuwei may increase soil erosion by 92,172 tons during the five year construction phase and three years after the construction. But streams in the project area in Wuwei are dry in about 10 months each year, project construction, if managed well, will not likely bring about significant impacts on the water quality, nor influence people in the lower stream.

The project will affect 29,969 trees in Wuwei. The affected trees are largely timber trees or fruit trees planted by farmers in the land close to their villages or houses, or green belt along the existing roads. Compensation for the trees has been specified in the RAP. The project will not have any impacts on the health and quality of forests, nor affect the rights and welfare of people and their level of dependence upon or interaction with forests. Forests policy (OP4.36) is not deemed triggered.

Business policies of the World Bank involved in this project are in Table2-11.

**Table 2-11 Business Policies of the World Bank and EHS**

Business Policies of the World Bank		Involved or not	Instruction
OP4.01	Environmental Assessment	√	EIA is needed for the construction and operation period of the project will affect ambient environment.
OP4.04	Natural Habitat	√	The project is located in areas which have been disturbed by intensive human activities. The EA confirms that there are no endangered species in the project area that could be affected by project interventions. Construction activities for bridges are expected to affect river systems-seasonal streams or perennial streams. Though the Rivers have been influenced by human activities, Natural Habitats policy (OP4.04) is deemed triggered by taking a precautionary approach.
OP4.09	Management of Diseases and Pests		The project is about road construction. Two sides of the roads will be planted with trees of local species. Climate in northwest China is dry and with a little rainfall, so plants disease incidence rate is low and pesticide is not needed. Thus this policy is not involved in this area.
OP4.10	Ethnical Groups		There are no ethnic communities in construction areas.
OP4.11	Cultural Heritage	√	Tomb moving is involved, but it includes no ancient tombs. There is no cultural heritage protection unit in the projected area. However, the <i>Procedure of Discovering Tangible Cultural Heritage</i> must be adopted.
OP4.12	Involuntary Migration	√	National Research Center for Resettlement of Hehai University takes the responsibility of formulating resettlement plan.
OP4.36	Forests		The project will not have any impacts on the health and quality of forests, nor affect the rights and welfare of people and their level of dependence upon or interaction with forests. Forests policy (OP4.36) is not deemed

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			triggered
OP4.37	Safety of Dam		No dam is involved.
OP7.50	International Waters		The construction sites are located in China without international waters involved.
OP7.60	Disputable Places		No Disputable places involved, for all construction sites are located in Wuwei City.
BP17.50	Information Transparency	√	At Least two information publishing and public consultations must be conducted in the EIA.

## 2.7 Environmental protection targets and environmental sensitive sites

### 2.7.1 Protection targets on atmospheric and acoustic Environmental

According to the detailed investigation of the project, the proposed project includes 10 sub-projects and 18 roads, involving various environmentally sensitive sites including 45 villages and 6 schools.

The environmentally sensitive sites are shown in Table2-12. The distribution of environmentally sensitive sites is shown in Figure 2-2. The detailed information of environmentally sensitive sites is shown in Table 2-13

**Table 2-12 Statistic Table of sensitive sites along traffic lines in the project area**

Names of roads		Environmental sensitive sites	statistics	
A1 Golden Avenue to Fengle Town Road Construction Project	section from Liujiagou Village, Hongxiang Town to Shatan Village, Fengle Town	/	0	
	link section of Golden Avenue	Lijiacizhuang Village	1	
A2 Golden Avenue to Yongchang Town Road construction Project	section from Golden Avenue to Xiazhai Village Wuhe Township	Shatan Village	1	
	section from Xiazhai Village, Wuhe Township to Liupei Village	/	0	
A3 Yanjia Village, Gaoba Town to Liujia Village Road construction Project		Caijiazhuang Village, Shisanlipu Village, Liuwa Village	3	
A4, Golden Avenue to Nanwu Town Road construction Project		Shengjiaxiazhuang Village, Shengjiaxizhuang Village, Shengjiadongzhuang Village, Lujiazhuang Village	4	
A5 Golden Avenue to Huangyang Town Road construction Project		Weijiazhuang Village, Yangjiapu Village, Liujiazhuang Village, Xiejiazhuang Village, Lijiazhuang Village, Yanjiazhuang Village, Guangchang No.1 Primary School	7	
A6 Road Construction Project in Huangyang Town	North Section of Weiqi Road	Manzhuang Village	1	
	South section of Weiqi Road	Gansu Institute of Animal Husbandry Engineering	1	
	Jingyi Road	Weijiazhuang Village, Xujiadongzhuang Village	2	
	Muxiao Road	/	0	
A7 road project in Tumen group,		section from Xingfeng to Wangfuying	Heshang Village, Xitan No.1 villagers' Group, Jiazhuang Village,	4

core zone of urban and rural integration development		Xitan Primary School	
	section from Shuangfeng to Yuandunzi	Shuangfeng Village, Xitan No.4 villagers' Group, Xitan No.3 villagers' Group	3
A8、Second-class Highway Reconstruction Project from Tumen Town, Gulang County to Huanghuatan Village		Erdun Village, Northeast Tumen Village, Hanshihetai Village, Huanghuatan Village	4
A9、Third-class Highway Reconstruction Project from Xiaoshanzi Village to Dajing Town		Shangyuan Village, Santai Village, Shilabatai Village, Dujiazhuang Village, Tuanzhuang Village, Zhaojiawan Village, Hongqi Village, Xiakou Village, Xiaoshanzi Village, Minquan Middle School	10
B. New Downtown District Road Construction Project of Dajing Town	B1、Weisan Road	Anjiazhuang Village	1
	B2、Weisi Road	Liangjiadazhuang Village, Pulic Rental Housing District of Dajing Town, Residential Building of Gulang No.3 Middle School, Residential Building of Power Supply Bureau, Beiguan Village, Central Kindergarten of Dajing Town, Middle School of Dajing Town	7
	B3、Quancheng Road	Dazhuang Village, Shuangcheng Village	2
In total			51

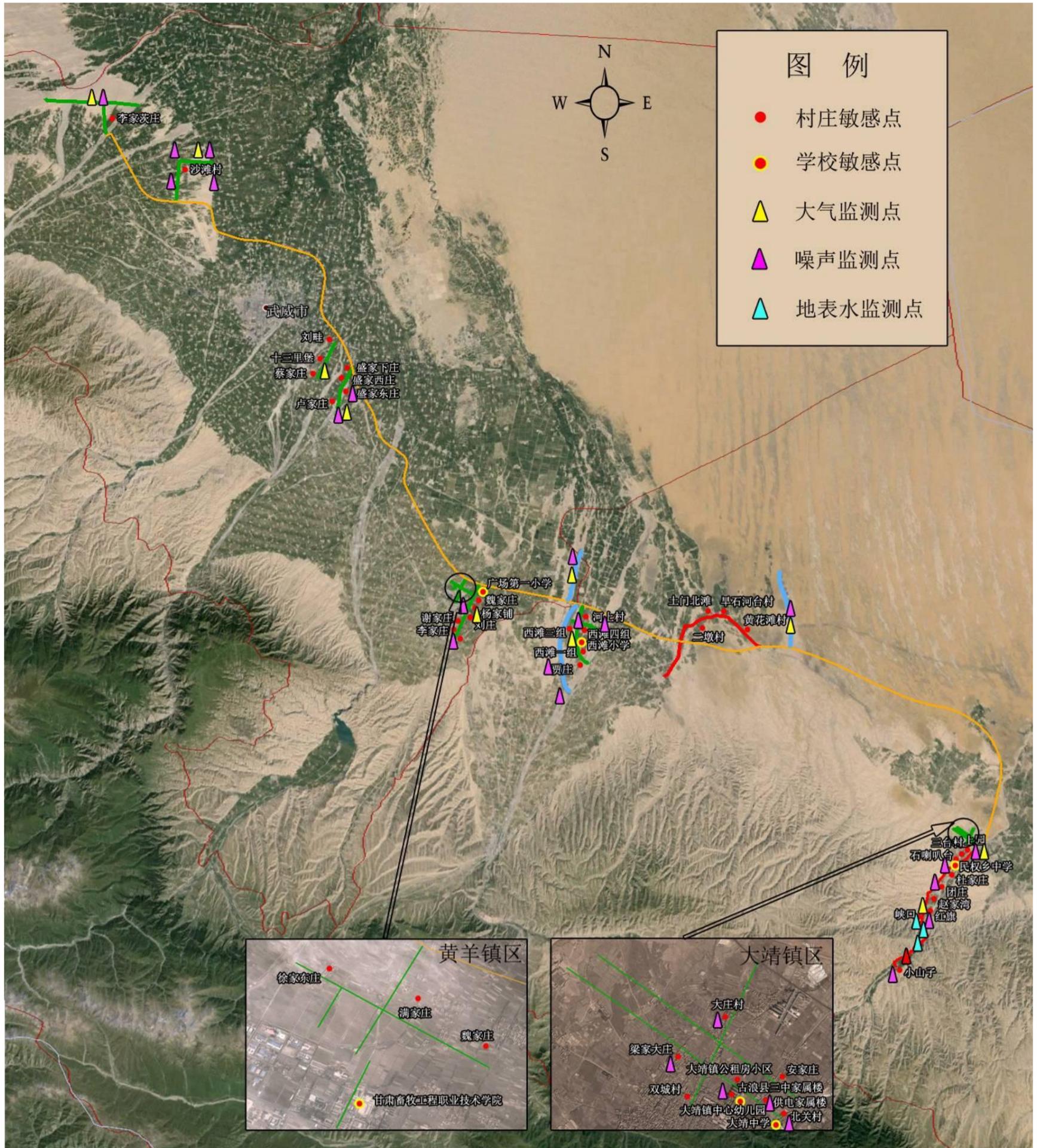
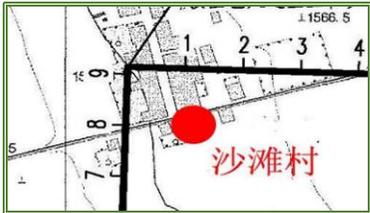
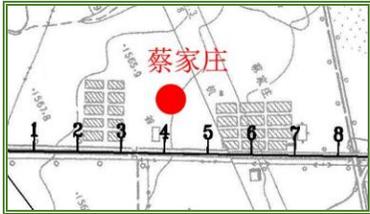
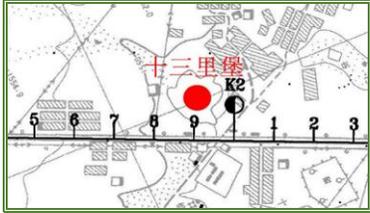
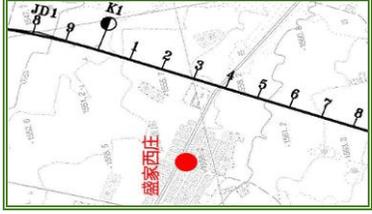
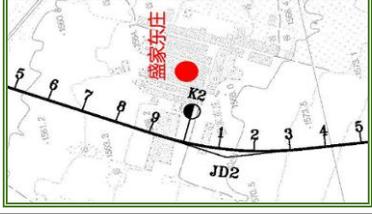
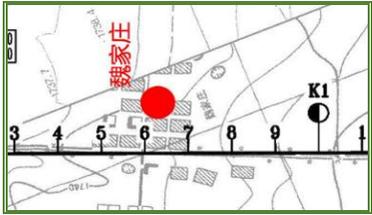
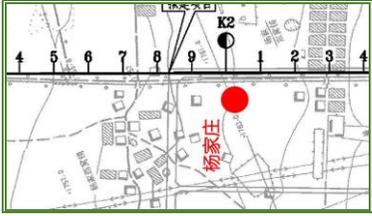
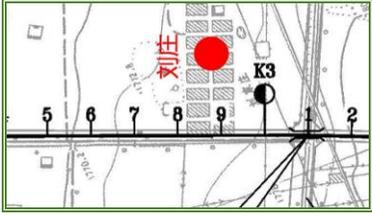
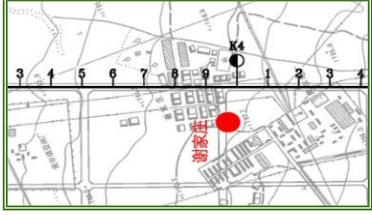
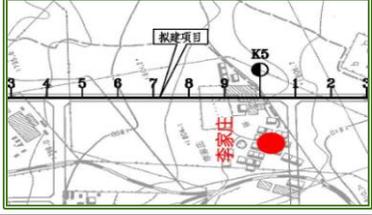


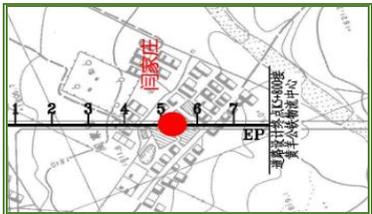
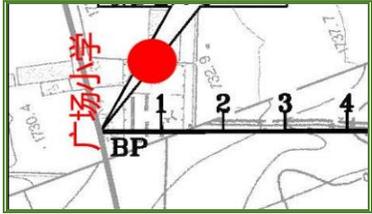
Figure2-2 Distributions of environmentally sensitive sites and surveillance sites

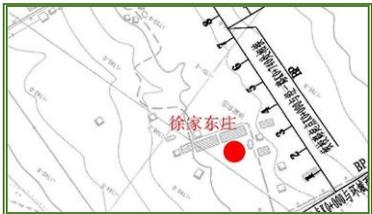
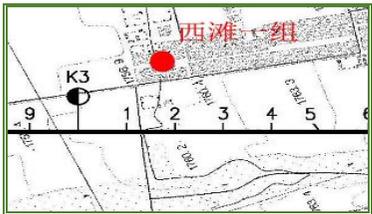
Table2-13 Images of environmentally sensitive sites

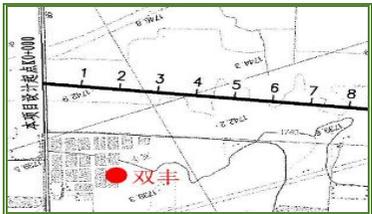
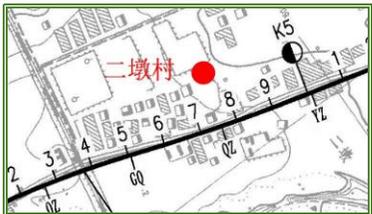
Sequence Number	Names of environmental-ly sensitive sites	Distance to the center of the road (m)	Altitude Difference from the road (m)	Location Diagram	Photos	Environmental Features	Numbers of potentially affected population within 200 meters
1	A1 Lijiacizhuang Village	160	0			Rural area, the road crosses from the west of the village, directly facing the brick-concrete structured houses.	10 households, 40 people
2	A2 Shatan Village	24	0			Rural area, the road crosses from the center of the village, directly facing the brick-concreted structure houses.	70 households, 280 people
3	A3 Caijiazhuang Village	25	0			Rural area, the road crosses from the center of the village, directly facing the brick-concrete structured houses.	30 households, 120 people
4	A3 Shisanlipu Village	20	0			Rural area, the road crosses from the center of the village, directly facing the brick-concrete structured houses.	50 households, 200 people

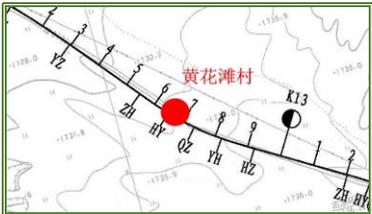
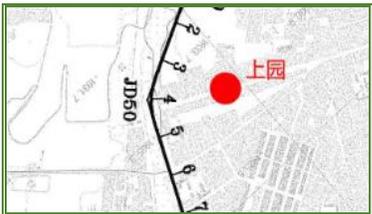
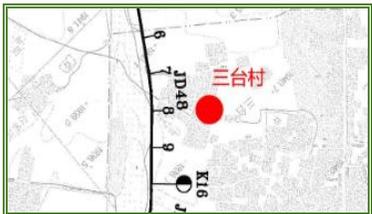
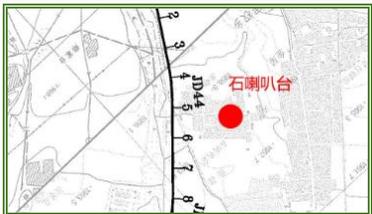
5	A3 Liuwa Village	22	0			Rural area, the road crosses from the south of the village, facing the brick-concrete structured houses broadside on.	35 households, 140 people
6	A4 Shengjiaxiazhuang Village	120	0			Rural area, the road crosses from the east of the village, facing the brick-concrete structured houses broadside on.	15 households,60 people
7	A4 Shengjiaxizhuang Village	120	0			Rural area, the road crosses from the east of the village, facing the brick-concrete structured houses broadside on.	10 households, 40 people
8	A4 Shengjiadongzhuang Village	17	0			Rural area, the road crosses from the west of the village, facing the brick-concrete structured houses broadside on.	30 households, 120 people
9	A4 Lujiazhuang Village	120	0			Rural area, the road crosses from the east of the village, facing the brick-concrete structured houses broadside on.	10 households, 40 people

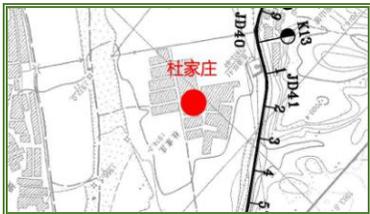
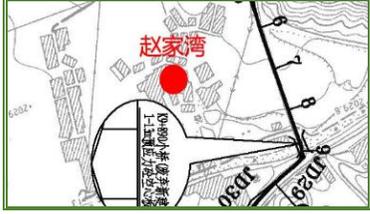
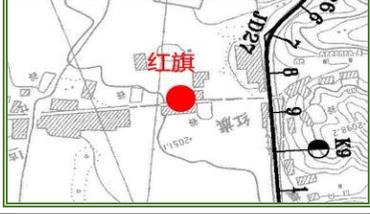
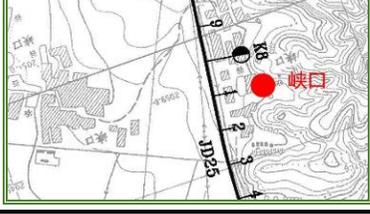
10	A5 Weijiazhuang Village	25	0			Rural area, the road crosses from the center of the village, directly facing the brick-concrete structured houses.	25 households, 100 people
11	A5 Yangjiapu Village	25	0			Rural area, the road crosses from the center of the village, directly facing the brick-concrete structured houses.	20 households, 80 people
12	A5 Liujiashuang Village	30	0			Rural area, the road crosses from the east of the village, facing the brick-concrete structured houses broadside on.	20 households, 80 people
13	A5 Xiejiazhuang Village	25	0			Rural area, the road crosses from the center of the village, directly facing the brick-concrete structured houses.	25 households, 100 people
14	A5 Lijiazhuang Village	20	0			Rural area, the road crosses from the center of the village, directly facing the brick-concrete structured houses.	20 households, 80 people

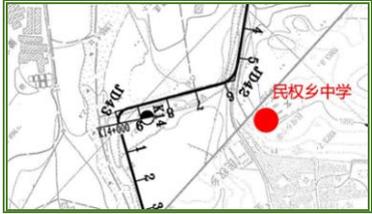
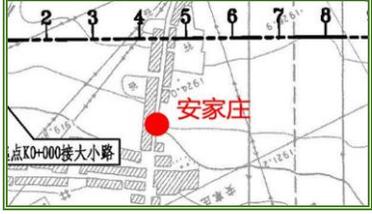
15	A5 Yanjia Zhuang Village	25	0			Rural area, the road crosses from the center of the village, directly facing the brick-concrete structured houses.	35 households, 140 people
16	A5 Guangchang No.1 Primary School	20	0			Rural area, the road crosses from the west of the village, facing the brick-concrete structured houses broadside on.	150 people
17	A6 Manzhuang Village	60	0			Rural area, the road crosses from the east of the village, facing the brick-concrete structured houses broadside on.	25 households, 100 people
18	A6 Gansu Institute of Animal Husbandry Engineering	15	0			Urban area, the road crosses from the west of the school dormitory, directly facing the brick-concrete structured houses.	450 people
19	A6 Weijia Zhuang Village	110	0			Rural area, the road crosses from the east of the village, facing the brick-concrete structured houses broadside on.	20 households, 80 people

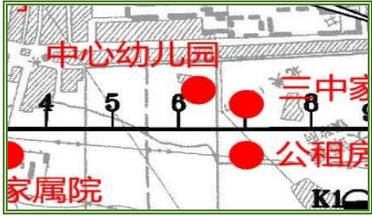
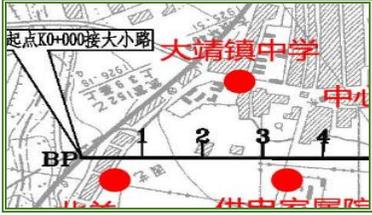
20	A6 Xujiadongzhuang Village	50	0			Rural area, the road crosses from the east of the village, facing the brick-concrete structured houses broadside on.	25 households, 100 people
21	A7 Heshang Village	50	0			Rural area, the road crosses from the south of the village, directly facing the brick-concrete and soil reinforced structured houses.	45 households, 180 people
22	A7 Xitan No.1 villagers' Group	60	0			Rural area, the road crosses from the south of the village, directly facing the brick-concrete structured houses.	45 households, 180 people
23	A7 Jiazhuang Village	50	0			Rural area, the road crosses from the north of the village, facing the brick-concrete structured houses broadside on.	35 households, 140 people
24	A7 Xitan Primary School	70	0			Rural area, the road crosses from the northwest of the school, facing the brick-concrete structured houses broadside on.	6 grades, about 150 people

25	A7 Shuangfeng Village	120	0			Rural area, the road crosses from the south of the village, facing the brick-concrete structured houses broadside on.	30 households, 120 people
26	A7 Xitan No.4 villagers' Group	20	0			Rural area, the road crosses from the northeast of the village, facing the brick-concrete structured houses broadside on.	20 households, 80 people
27	A7 Xitan No.3 villagers' Group	20	0			Rural area, the road crosses from the northeast of the village, facing the brick-concrete structured houses broadside on.	20 households, 80 people
28	A8 Erdun Village	15	-0.5			Rural area, the road crosses from the center of the village, directly facing the brick-concrete structured houses.	45 households, 180 people
29	A8 Northeast Tumen Village	15	-0.5			Rural area, the road crosses from the center of the village, directly facing the brick-concrete structured houses.	15 households, 60 people

30	A8 Hanshihetai Village	15	-0.5			Rural area, the road crosses from the center of the village, directly facing the brick-concrete structured houses.	15 households, 60 people
31	A8 Huanghuatan Village	30	-0.5			Rural area, the road crosses from the center of the village, directly facing the brick-concrete structured houses.	40 households, 160 people
32	A9 Shangyuan Village	12	0			Rural area, the road crosses from the east of the village, directly facing the brick-concrete structured houses.	30 households, 120 people
33	A9 Santai Village	30	0			Rural area, the road crosses from the east of the village, directly facing the brick-concrete and soil-reinforced structured houses.	40 households, 160 people
34	A9 Shilabatai Village	40	0			Rural area, the road crosses from the east of the village, directly facing the brick-concrete and soil-reinforced structured houses.	20 households, 80 people

35	A9 Dujiazhuang Village	25	0			Rural area, the road crosses from the east of the village, directly facing the brick-concrete structured houses.	25 households, 100 people
36	A9 Tuanzhuang Village	8	0			Rural area, the road crosses from the center of the village, directly facing the brick-concrete and soil-reinforced structured houses.	35 households, 140 people
37	A9 Zhaojiawan Village	80	0.5			Rural area, the road crosses from the west of the village, directly facing the brick-concrete and soil-reinforced structured houses.	20 households, 80 people
38	A9 Hongqi Village	12	0			Rural area, the road crosses from the center of the village, directly facing the brick-concrete and soil-reinforced structured houses.	25 households, 100 people
39	A9 Xiakou Village	15	0			Rural area, the road crosses from the east of the village, directly facing the brick-concrete and soil-reinforced structured houses.	45 households, 180 people

40	A9 Xiaoshanzi Village	9	0			Start point of the project, rural area, the road is located at the end of the village, directly facing the brick-concrete structured houses.	10 households, 40 people
41	A9 Minquan Middle School	26	10			The road crosses from the southeast outside the school, directly facing the brick-concrete structured houses.	400 people
42	B Anjiazhuang Village	25	0			Rural area, the road crosses from the center of the village, directly facing the brick-concrete structured houses.	15 households, 60 people
43	B Liangjiadazhuang Village	10	0			Rural area, the road crosses from the center of the village, directly facing the brick-concrete structured houses.	30 households, 120 people
44	B Public Rental Housing District of Dajing Town,	20	0			Urban area, the district under construction is located at the north side of the road, directly facing the road	/

45	B Residential Building of Gulang No.3 Middle School,	15	0			Urban area, the building is located at the south side of the road, directly facing the road	240 households, 960 people
46	B Residential Building of Power Supply Bureau,	12	0			Urban area, the brick-concrete structure buildings are located at the north side of the road, directly facing the road	100 households, 400 people
47	B Beiguan Village	15	0			Rural area, the road crosses from the center of the village, facing the brick-concrete structured houses broadside on.	20 households, 80 people
48	B Central Kindergarten of Dajing Town	40	0			Urban area, the brick-concrete structured building is located at the south of the road,	/
49	B Middle School of Dajing Town	22	0			Urban area, the brick-concrete structured building is located at the south of the road,	/

50	B Dazhuang Village	15	0			Rural area, the road crosses from the center of the village, directly facing the brick-concrete structured houses.	20 households, 80 people
51	B Shuangcheng Village	15	0			Rural area, the road crosses from the center of the village, directly facing the brick-concrete structured houses.	50 households, 200 people

## 2.7.2 Surface Water Environmental Protection Targets

The proposed highway is located in Wuwei city, Gansu province. The evaluation zone belongs to the Shiyang River drainage. There are two large bridges, six medium bridges and seven small bridges along the project. They walk along or across the nearby water bodies including Jiehe Dam, Sha Ditch, the third main canal of Huangyang, Gulang River, Hanshi River, Datu Ditch, Dajing River, Xigan Canal, and Dajingxia Reservoir. The surface water environmental protection targets are listed in table2-14.

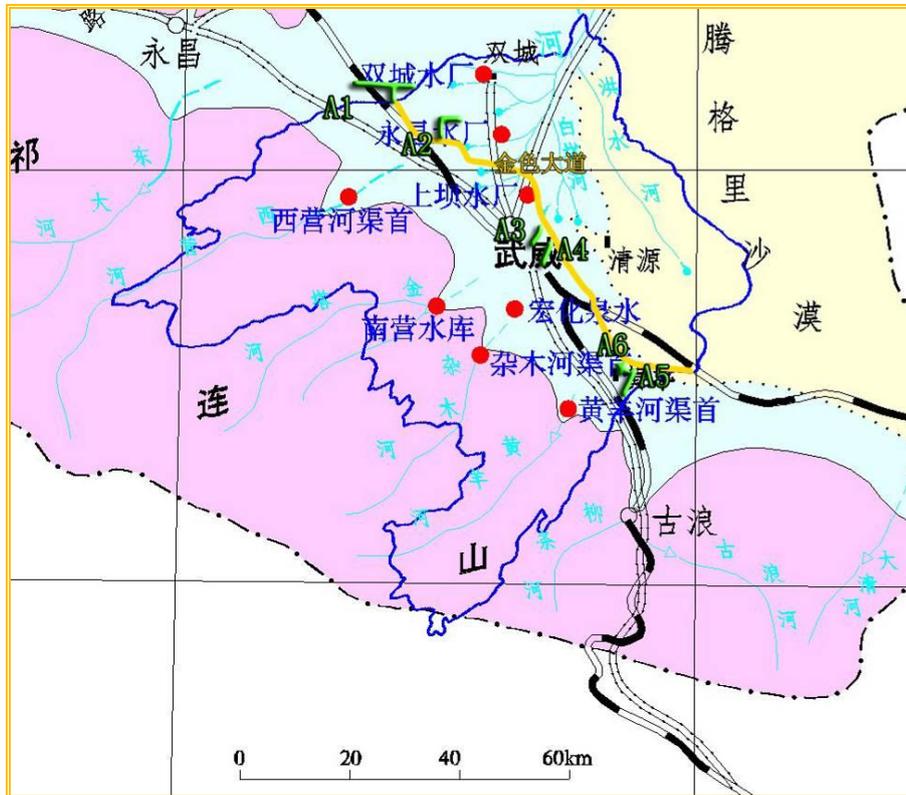
**Table 2-14 Surface water environmental protection targets of the proposed project**

No.	Name of the road		Stake mark on the bridge	Related rivers	Functions of the affected section of the river	Name of the bridge	Length of the bridge (m)	Width of the bridge (m)	Remark
1	Golden Avenue to Fengle town road project		K6+700	Jiehe Dam	Flood discharge	Jieheba Bridge	130	20	Newly built large bridge
2			K7+600	Sha Ditch	Flood discharge	Shagou Bridge	70	20	Newly built medium bridge
3	Golden Avenue to Huangyang town road project		K3+100	The third main canal of Huangyan	Irrigation	Sangan Bridge	18	24	Newly built small bridge
4	Urban-rural integration on core zone—Tumen	Road from Xinfeng to Wangfuying	K6+700	Gulang River	Seasonal river, no perennial drainage	Gulang River Bridge	126.5	16	Newly built large bridge
5	grouping road project	Road from Shuangfeng to Yuandunzi	K1+150			Gulang Main Canal River Bridge	40	16	Newly built medium bridge
6	Reconstruction project of the secondary road from Tumen town to Huanghuatan Village in Gulang county		K6+200			Hanshi River (Tributary of Gulang River)	Hanshi River Bridge	70	12
7			K8+910	Datu Ditch (Tributary of Gulang River)	Datu Ditch Bridge	105	12	Newly built medium bridge	
8	Reconstruction project of the tertiary road from Xiaoshanzi to Dajing Town		K0+158.8	Dajingxia Reservoir	Irrigation, drinking		70	7.5	Newly built medium bridge
9			K0+460					23	7.5

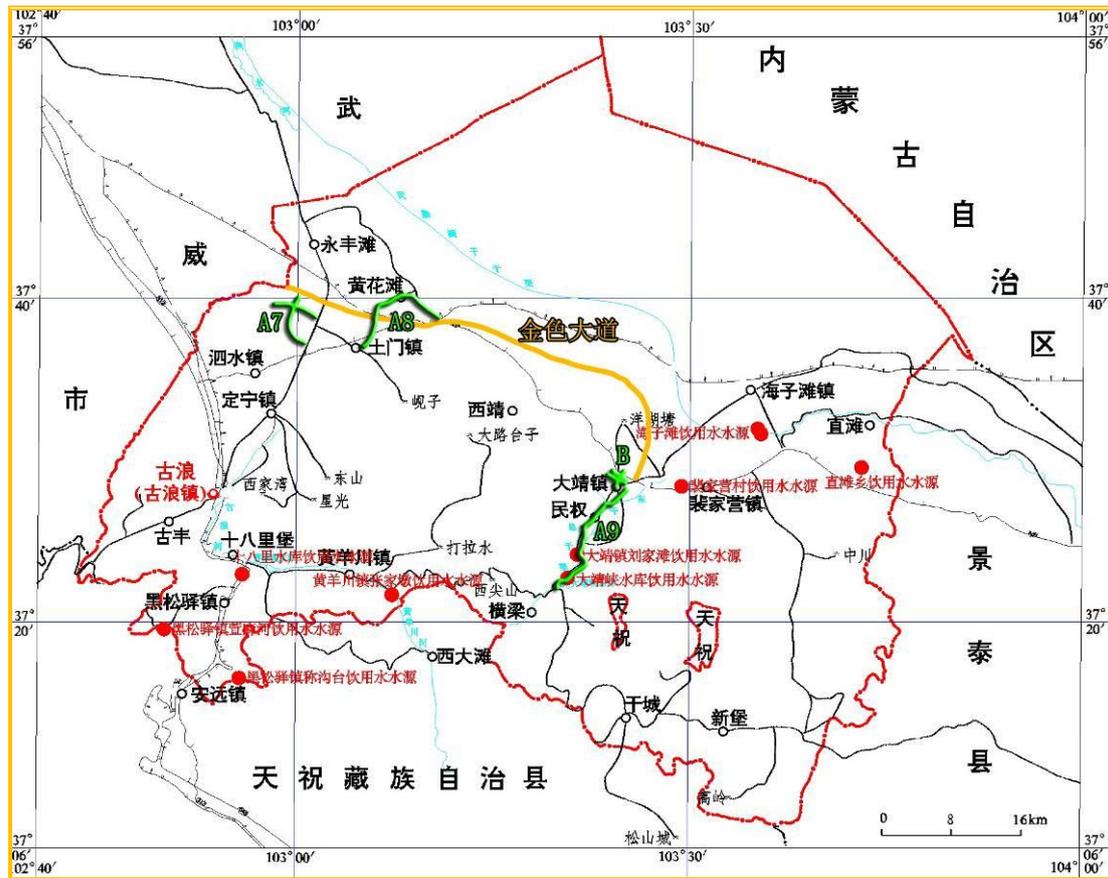
10		K1+225				23	7.5	Newly built small bridge
11		K2+200				23	7.5	Newly built small bridge
12		K4+580	Dajing River	Located in the downstream of the reservoir with function of irrigation, river way near Dajing Town runs dry		23	7.5	Newly built small bridge
13		K6+520				70	7.5	Newly built medium bridge
14		K7+560				23	7.5	Newly built small bridge
15		K9+890				23	7.5	Newly built small bridge
					Xigan Canal	Irrigation		

**(2)Water source sites of drinking water and drinking water wells along the project**

The proposed project passes through Liangzhou District of Wuwei city, Gulang County. The water resource sites in cities and towns along the project are listed in figure2-3 and figure2-4.



**Figure 2-3 the distribution of water resource sites and their positional relation with the proposed project in Liangzhou District**



**Figure 2-4 The distribution of water resource sites and their positional relation with the proposed project in Gulang County**

According to the listed figures, the proposed A9 project passes through two drinking water resource sites at township level. (The technical report on water resource sites protection zone partition has been finished and approved.) Detailed information is listed in table2-15. The positional relation between roads and two water resource sites are listed in figure2-5 ~ 2-8.

**Table2-15 Positional relation between proposed project before and after construction and the passed drinking water resource sites**

Name of water resource sites	Positional relation between project and water resource site (first class protection zone)		Positional relation between project and water resource site (second class protection zone)	
	Current project	After rebuilding	Current project	After rebuilding

Dajingxia Reservoir drinking water protection zone	No	No	Road starts from K0+000 ~ K2+500 and passes through the second class protection zone of the water resource site covering a length of 2500m. Section K1+500 ~ K2+400 is near the edge of the first class protection zone covering a length of 900m.	Rebuild along the original line; Road starts from K0+000 ~ K2+500 and passes through the second class protection zone of the water resource site covering a length of 2500m. Section K1+500 ~ K2+400 is near the edge of the first class protection zone covering a length of 900m.
Dajing town Liujiatan drinking water protection zone	No	No	Section K2+500 ~ K6+600 passes through the second class protection zone of the water resource site, covering a length of 4100m. Section K5+300 ~ K6+400 is near the edge of the first class protection zone covering a length of 900m.	Rebuild along the original line; Section K2+500 ~ K6+600 passes through the second class protection zone of the water resource site, covering a length of 4100m. Section K5+300 ~ K6+400 is near the edge of the first class protection zone covering a length of 900m.



**Figure2-5 Positional relation between proposed road A9 and Dajingxia Reservoir water resource protection zone**



**Figure2-6 Positional relation between proposed road A9 and Liujiatan Reservoir water resource protection zone**

# 大靖峡水库饮用水水源保护区划分图

比例尺: 1: 25000

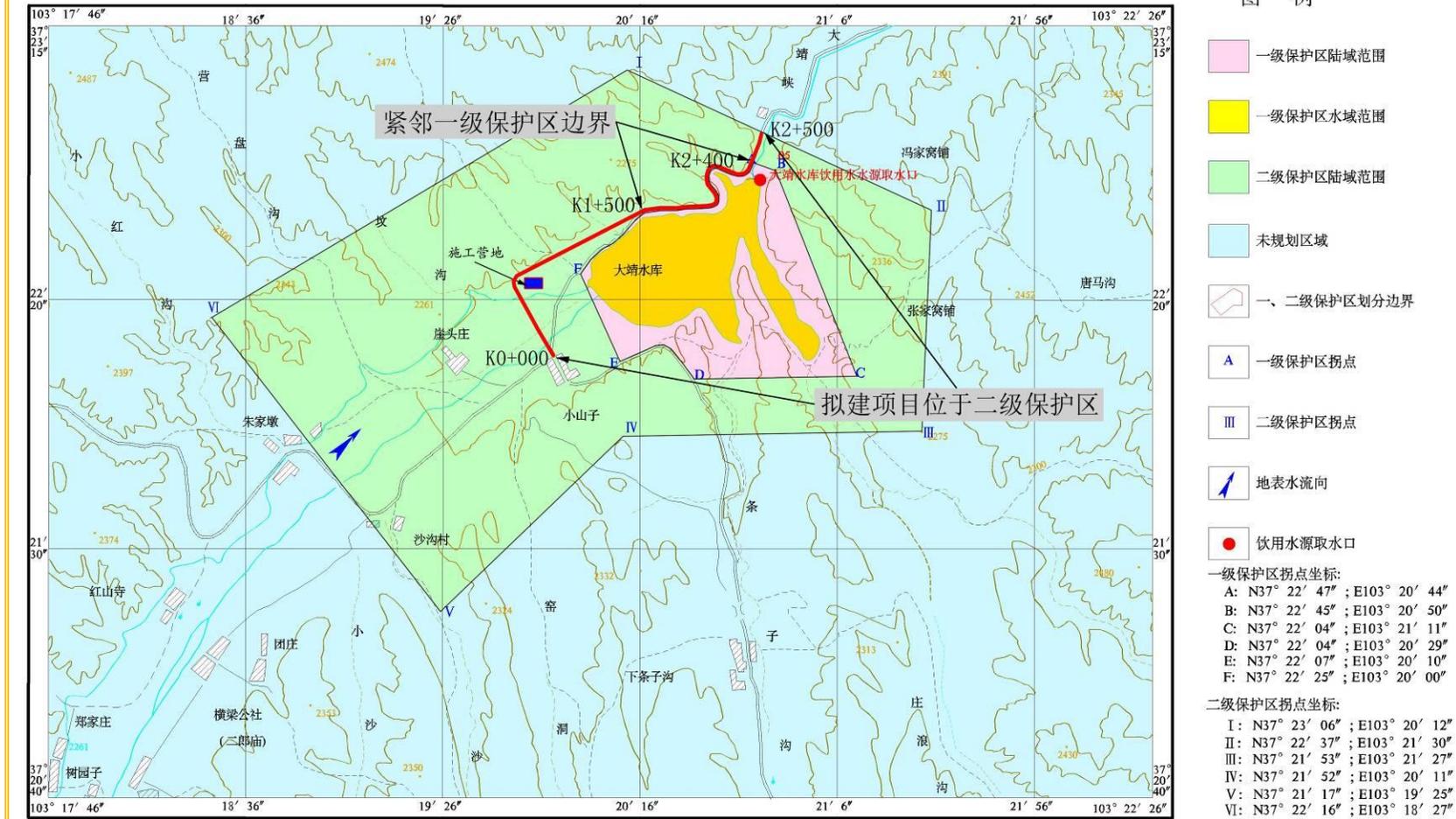


Figure2-7 Positional relation between proposed road A9 and Dajingxia Reservoir drinking water resource protection zone

# 大靖镇刘家滩饮用水水源保护区划分图

比例尺: 1:25000



Figure2-8 Positional relation between proposed road A9 and Liujiatan Reservoir drinking water resource protection zone

### 2.7.3 Ecological Environmental Protection Targets

The project-related region is located in Liangzhou District and Gulang County of Wuwei city. Ecological environmental protection targets of the project aim at water and soil conservation of the farmland, forestland, natural vegetation, high-fill and deep-cut section and reclaim or waste slag field in lands used for road construction. Specific ecological protection targets are listed in table2-16.

**Table2-16 Main ecological environmental protection targets of the areas along the proposed project**

Name of targets	Features of environment and specific protection	Correlativity	Major influences and the influenced phase of construction
Farmland	Irrigable land, dry land etc.	Distribution along the route, occupied	Permanent lands are limited, thus the effects of them are limited; influenced phases are construction and operation period
Natural vegetation	Relatively lack in plant community with sole species, certain plant communities with single species are superior	Cover the project-related areas, occupied	Land occupancy leads to the loss of vegetation, influenced phases are construction, operation period
Earth-borrowing, earth-spoiling field	Most of the provisional lands are wastelands, a few of them dry lands	Occupied	Disturb the land surface, land occupancy, damage existed vegetation; influenced phases are construction, operation period

### 2.7.4 Social Environmental Protection Targets

The main social environmental protection targets of the project are the affected villages and villagers with land expropriation and house demolition. The social environmental protection targets of the project are listed in table 2-17.

**Table 2-17 social environmental protection targets and contents of the proposed project**

<b>Number</b>	<b>Targets of protection</b>	<b>Main protection contents</b>
1	Villages, schools and hospitals under influence	Construction will bring inconveniences to villagers' daily life. Noises and smoke dust during construction period will influence their living environment. Construction of road will inhibit the road; noises during operation period etc.
2	Villagers influenced by land expropriation and house demolition	Life quality of villagers influenced by land expropriation and house demolition; implementation of resettlement; demands of the residents being resettled etc.
3	Cultural relics	Many cultural relics are located in Liangzhou District and Gulang County in Wuwei, such as the heritage of the ancient Great Wall. According to the previous investigation, the plan that might influence the ancient Great Wall has been adapted. The new plan has gained approval of the local department of cultural relic preservation. And the region related to the project is beyond the protection scope of other departments of cultural relic preservation. However, the construction may go with the digging of the cubic of earth and stone. Cultural relics might be discovered during construction period and corresponding preservation plan needs to be formulated.
4	Yingshuang highway	Pass through at 2
5	Golden Avenue	Pass through at 1
6	Ganwu railway	Pass through at 2

### 3. Institutional Arrangements

#### 3.1 Environmental Management Institutions

In the environmental management system of an environmental purification project, environmental management institutions are composed of project management agency, implementing agency, supervision agency, consulting agency and monitoring agency. All those agencies constitute a complete environmental management system of the project, with each agency having different tasks and responsibilities. Projects will be carried out under the guidance of the Project Management Office (PMO) so that the construction of a project conforms to the regulations of China and World Bank with regard to working procedures and pollution prevention measures. See Table 3-1 for the details of the institutional framework for the project environmental management.

**Table 3-1 Agency Composition of Environmental Management System**

Nature of Agency	Name of Agency	Main Responsibilities
Management Agency	Municipality Project Management Office	To be responsible for the implementation and management of the project, designating people for the environmental protection during the planning, design, and construction stages; To ensure the working procedures meet the regulations of China and World Bank for environmental assessment and environmental management; To be responsible for supervising the implementation of the environmental management plan and ensuring the measures taken to mitigate environmental negative impacts are included in the bidding documents and construction contracts.
	County Project Executive Office	To be responsible for the implementation of the subproject; to designate environmental protection personnel to take charge of the environmental protection check and acceptance and routine environmental supervision and management in construction stage to reduce the negative environmental impacts to a minimum or an acceptable level and make full use of environmental benefits of the project; to raise and distribute rationally the fund for the

		environmental protection measures and to be responsible for collecting and archiving relevant data.
	Transport Bureau of Gulang County	To be responsible for the routine road maintenance after the implementation and operation of the project.
	Transport Bureau of Liangzhou District	To be responsible for the routine road maintenance after the implementation and operation of the project.
	Housing and Construction Bureau of Gulang County	To be responsible for the routine maintenance of road network after operation.
	Housing and Construction Bureau of Liangzhou District	To be responsible for the routine maintenance of road network after operation.
Supervision Agency	Environmental Protection Bureau of Wuwei City	As an administration department for supervision, it is to supervise and inspect whether the working procedures meet the regulations of China's environmental management and whether the pollution prevention measures in the implementation process meet the regulations of environmental protection in China.
Consulting Agencies	Consulting Unit of Environmental Assessment	To be entrusted with the writing of an environmental impact assessment report.
	Design Consulting Unit	To develop feasibility reports, design and construction schemes, ensuring the implementation of all measures and schemes in the environmental management plan.
	Environmental Supervision Unit	To supervise the routine construction activities of the construction unit
Implementing Agency	Civil Works Contractor	To set supervision engineers at the construction sites; to implement the regulations of environmental protection and water and soil conservation in the contracts and bidding documents; to meet the requirements of World Bank and the local administrative department for environmental protection; to write and submit monthly environmental report during the construction period.
Monitoring Agency	Environmental Supervision	As a qualified environmental supervision agency, it is to be responsible for monitoring environment during the

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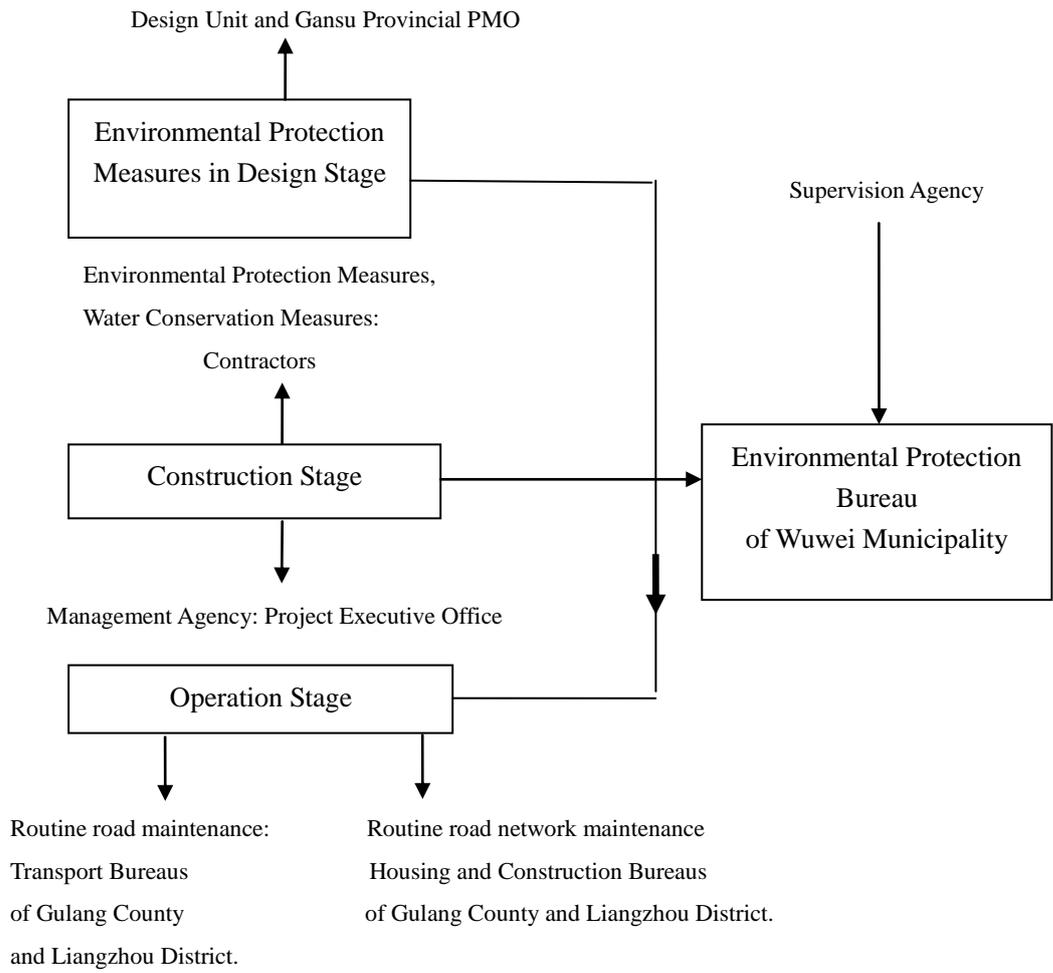
	Agency	construction and operation period.
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### **3.2 Plan for Environmental Protection Management**

The implementation of the project can be divided into three stages: the feasibility study and design stage, construction stage and operation stage. The environmental protection measures and institutional arrangements in those stages are shown in Table 3-2 and Figure 3-1.

**Table 3-2 Environmental Management Plan in the Project Implementation**

Project Name	Project Category	Environmental Protection Measures in Design Stage	Executive Agency	Environmental Management Plan in Construction Stage	Executive Agency	Environmental Management Plan in Operation Stage	Executive Agency	Supervision Agency
The World Bank Loan Project of Infrastructure Construction for the Urban and Rural Overall Development in the Core Area of Wuwei Experiment District.	Road construction	To see <i>Environmental Protection Regulations in the Design Stage</i>	Design unit, Gansu Provincial PMO	To see <i>Environmental Protection Regulations in the Construction Stage</i>	Construction unit	To see <i>Environmental Protection Regulations in the Operation Stage</i>	Transport Bureaus of Gulang County and Liangzhou District, Housing and Construction Bureaus of Gulang County and Liangzhou District	Environmental Protection Bureau of Wuwei City



**Figure 3-1 Environmental Protection Measures and Institutional Arrangements in Each Stage**

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## **4. Specific Environmental Protection Measures**

### **4.1 Environmental Protection Regulations in Design Stage**

See Appendix 1

### **4.2 Environmental Protection Regulations in Construction Stage**

See Appendix 2

### **4.3 Environmental Protection Regulations in Operation Stage**

See Appendix 3

### **4.4 Protection Regulations for Environmental Risks**

See Appendix 4

### **4.5 Environmental Protection Regulations for Water and Soil Conservation**

See Appendix 5

### **4.6 Environmental Protection Measures for Drinking Water Source Area**

See Appendix 6

### **4.7 Environmental Protection Regulations for Tomb Area**

See Appendix 7

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## **4.8 Social Management Plan and Implementation Regulations**

See Appendix 8

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## **5. Personnel Training**

### **5.1 Purpose**

The environmental management training aims to ensure a smooth and effective implementation of environmental management; acquaint relevant personnel with the content and procedures of environmental management; increase environmental management staff's capability in this respect and ensure effective implementation of protection measures. The environmental capability construction is targeted at environmental managers and environmental supervisors, the training of whom is part of the technical support of the project. During the implementation of the project, training courses are also provided to the construction party and staff. Before commencement of the project, all the construction and management units and construction supervisors are required to participate in trainings in compulsory environment, health and safety.

### **5.2 Trainees**

The trainees include the staffs in Gansu Provincial PMO, County Project Executive Office and representatives of contractors.

### **5.3 Contents**

(1) World Bank's environmental policies, Chinese environmental protection laws and regulations and environmental standards;

(2) The environmental management mode of the World Bank loan project and environmental stipulations in the loan agreement;

(3) Environmental management plan for the project;

(4) Duties of environmental management personnel, environmental supervisors,

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environmental supervision personnel and contractors as well as the relationship between them;

(5) Drafting of environmental management reports, environmental supervision reports, environmental supervision reports, contractors' logs, monthly, interim and annual reports, etc., which are to be checked against the standards of "three simultaneousnesses" (i.e. simultaneousness of the designing, of the constructing and of the operating of pollution treatment infrastructure with the project construction).

## **5.4 Training Plan**

Considering the main adverse effects of the project towards the environment, relevant environmental protection personnel must be trained to improve their technical quality of environmental management. See Table 5-1 for the details of the trainees involved in this project and the expenses.

**Table 5-1 Training Plan of the Proposed Project**

Trained Units	Organizational Units	Population	Stage	Time	Duration	Expense (1,000 Yuan)	Training Method	Training Objectives and Contents
Wuwei PMO	Wuwei PMO	2	Pre-construction	Pre-construction	One week	5	To invite environmental protection experts to provide unified and intensive training	Objective: to execute environmental protection measures of the EMP. Contents: (1) environmental protection laws, regulations, standards and environmental management of the project; (2) basic knowledge of environmental supervision; (3) relevant regulations of environmental supervision and law enforcement; (4) supervision skills of environmental project; (5) training for environmental management standard system and management personnel' routine tasks;
Project Executive Offices of Liangzhou District and Gulang County	District and County PMOs	6				10		
Contractors	District and County PMOs	16				8		
Training plan for constructors	Contractors	All constructors				20, 000 Yuan for bidding, to be incurred on the contractors, and should be included in construction contracts		

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## 6 Complaints Settlement Mechanism

A public complaint agency is to be set up for all the stages of the project, including resettlement of emigrants, supervision of disturbances on residents during the construction and operation periods.

**(1) Public complaints for resettlement:** If emigrants have any problems, they can lodge a complaint to the County Project Executive Office, which shall deal with the complaint within two weeks.

If the emigrants are dissatisfied with the decision made by the County Project Executive Office, they can lodge a complaint and file a plea for arbitration to the upper-level jurisdictional administrative unit, in accordance with the Administrative Procedure Law of the People's Republic of China.

Upon receiving the arbitral decision, if the emigrants are still dissatisfied with, they can file a suit to the civil court in accordance with the civil procedure law.

**(2) Public complaints during the construction period:** The construction unit of the proposed project should pay attention to the progress of the project in a timely manner, and understand the inconvenience brought upon the residents by the construction; a reception channel for people should be provided and managed by the specially designated persons and their contact information should be disclosed to receive people's opinions timely; a masses' opinions-accepting book should be prepared for people consulting through the phone or coming to the office to complain and their names, contact details and the complaints incurred by the project construction should be recorded and timely reported to the superior departments. The construction unit should give a reply to the questions raised by citizens within three workdays and propose solutions and implement them within ten to fifteen workdays depending upon the difficulty in processing. The process and result of the negotiation should also be recorded in the masses' opinions-accepting book. In order to deal with the inconvenience to the citizens brought about by the project construction, the construction unit should submit the masses' opinions-accepting book to the

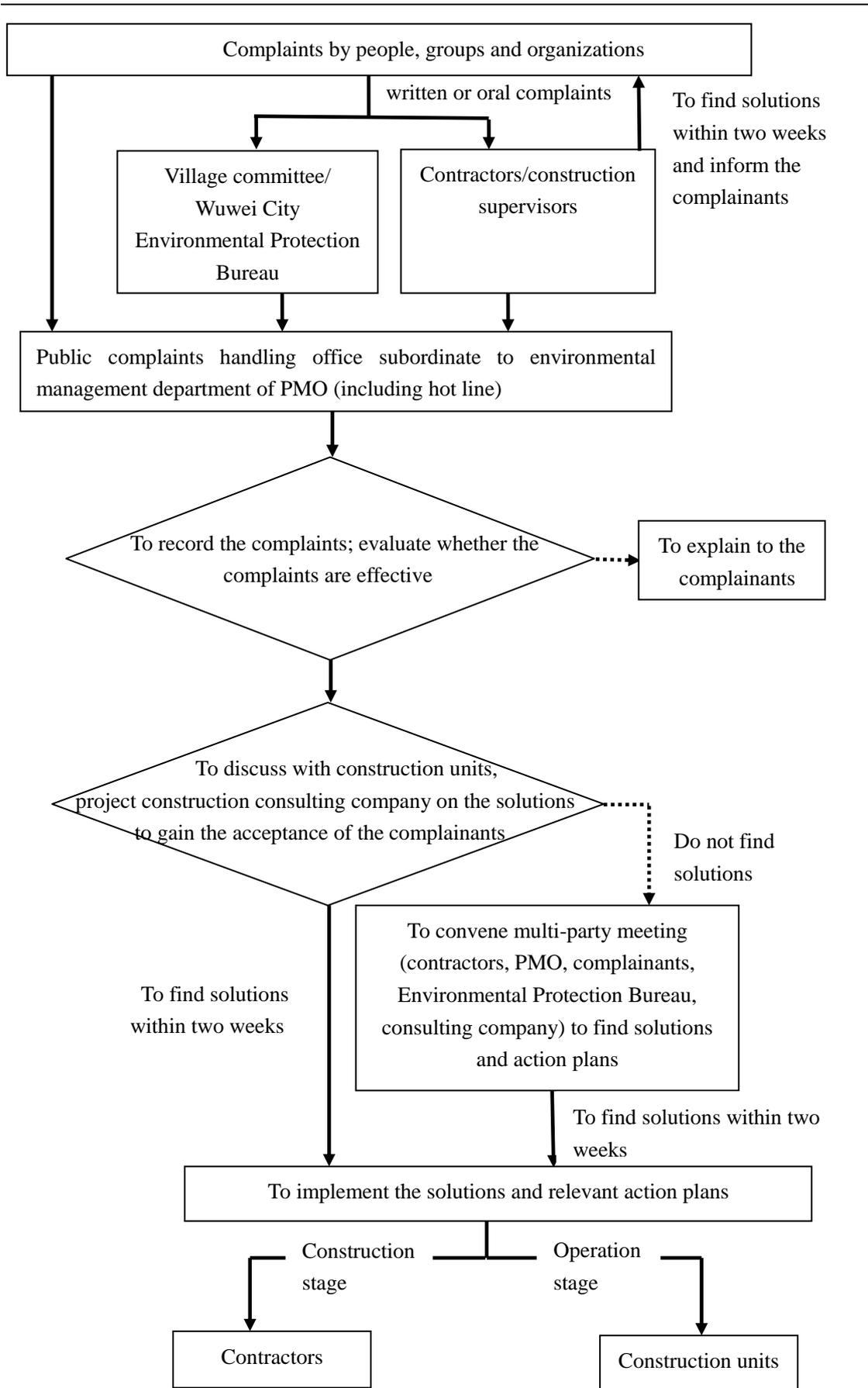
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Environmental Protection Bureau of Wuwei city at the end of every month for its supervision and management

**(3) The supervision during the operation period:** If people have any problems during the operation of the project, they can directly report them to the County Project Executive Office. Project Executive Office shall record and discuss the problems, and reply to those people within three workdays, and propose solutions and implement them within ten to fifteen workdays depending upon the difficulty in processing. PMO shall submit the masses' opinions-accepting book to Environmental Protection Bureau of Wuwei city at the end of every month.

Environmental management department of PMO shall establish a tracking and record-keeping system for the public complaints, to: (1) establish tracking lists and tracking procedures by collecting information from project personnel and complainants; (2) assign people to update database information regularly; (3) establish information analysis system to recognize the causes of complaints, enhance transparency of complaint handling procedures and evaluate overall operation of this mechanism regularly; (4) establish the procedure of informing the relevant party of handling information; (5) report the complaint handling information to PMO, construction unit and the WB regularly.

The detailed complaining mechanism implemented in this project is shown in Figure 6-1.



**Figure 6-1 Diagram for the Complaints Settlement Mechanism of the Proposed Project**

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The complaint settlement mechanism is accessible to local residents, including disadvantaged groups such as women. Any affected people, group or organization can make complaints via media including telephone, letter and e-mail. Before the commencement of the project, people to handle complaints should be determined (such as cadre of a village committee, contractors, environmental management staff of construction unit and officials of local environmental protection bureau etc.), and their contact information (telephone number, address, e-mail address, etc) will be posted on the information portal at construction sites or local government websites.

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## 7. Reporting Mechanism

The Project Executive Office and the environmental supervision units should record the progress of the project, the execution of EMP (Environment Management Plan) and the results of environmental quality monitoring during the implementation of the project, and make timely report to the departments concerned. Specifically,

- (1) The monitoring unit should submit timely reports to the County and District Project Executive Offices and the environment supervision engineer after the completion of each monitoring task.
- (2) The environment supervision engineers of the project shall make a detailed weekly and monthly record of the execution of EMP, and submit weekly and monthly reports to the County and District Project Executive Offices respectively. The reports shall include execution of the environmental protection measures, performance of the environmental supervision and the monitoring data.
- (3) The County and District Project Executive Offices shall make a detailed record of the project progress and the EMP execution quarterly, and submit it to the Municipal PMO and a copy to the Environmental Protection Bureau of Wuwei municipality.
- (4) The Municipal PMO shall submit the EMP execution report to the World Bank semiannually. The EMP execution report may include the following items:
  - a. The implementation progress of the project;
  - b. In the current schedule, the EMP execution condition specifically includes the following contents:
    - 1) The institutional arrangements;
    - 2) Implementation of the environmental protection measures;
    - 3) Implementation of the training plan for enhancing the capability of the personnel;
    - 4) Implementation of the monitoring plan;
    - 5) Performance of the supervision work;

- 
- 6) Whether there are any public complaints or not; recordings of the solution and claimants' feedback towards it if there is;
- c. Any other environmental problems.
- (5) In case of any violation of regulations with respect to environmental protection, the environment supervision engineer and the staff of the Municipal PMO shall report to the local administrative department of environmental protection and shall report to superior departments, if necessary.

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## **8. Monitoring Plan**

### **8.1 Monitoring Objectives and Principles**

During the construction period, the adverse impacts on environment will involve domestic pollution from construction camps, noise produced from construction machines, water and soil erosion produced by excavating earth and stone and dust produced by paving roads and other pollutions. During the operation stage, vehicles will produce exhaust, dust and traffic noise, etc. In addition, it should be considered that unexpected pollution accidents cause serious pollution in local areas. Therefore, environmental supervision of the construction project is in demand to fully and promptly grasp the dynamic pollution conditions of the project, understand changes in the environmental quality in neighboring areas, so as to facilitate environmental management in construction areas.

Formulating an environmental supervision plan is to supervise the implementation of those measures, to adjust the environmental protection action plan in accordance with the monitoring results and to provide a basis for the implementation time and scheme of environmental protection measures. The monitoring plan is to be developed in accordance with environmental impacts in different stages (construction stage or operation stage) and possible road sections that may exceed the standard and those indexes above the standard (with an emphasis on major sensitive areas).

Environmental quality in the construction areas of the project can be analyzed by implementing the environmental supervision plan, which will help analyze the environmental impacts caused by project construction. The responsible parties can then take mitigation measures to ensure minimized adverse impacts on the environment, people's life and natural environment. The environmental supervision plan can be entrusted by the County Project Executive Office to an agency that is qualified in monitoring and whose responsibility is to collect, analyze the monitoring data, and issue environmental analysis report and submit it to the entrusting unit, which will then submits a copy to the WB. The organizational responsibilities for the monitoring plan of the project are shown in table 8-1.

**Table 8-1 Organizational Responsibilities for the Monitoring Plan**

<b>Project to be Implemented</b>	<b>Responsible Units</b>
Collection of monitoring data	To be entrusted to the qualified local environmental supervision station
Data analysis	The monitoring unit is responsible for collecting and analyzing data
Preparation for environmental reports	The monitoring unit issues analysis reports based on monitoring data
The monitoring plan can be entrusted to the supervision station by the Municipal PMO. In accordance with the monitoring plan, the environmental supervision station interprets and analyzes the monitoring data quarterly and issues an environmental analysis report and submits it to the entrusting unit, who then submits a copy to World Bank.	
Management plan	After submitting the environmental analysis report, Municipal PMO shall archive into the compiled documents of environmental impact in construction stage in preparation for the acceptance of the project.

## **8.2 The Monitoring Agency**

It is recommended that management agency entrust the local qualified station to implement monitoring plan and take charge of monitoring the impact of unexpected pollution incidents on environment. On the one hand it can take advantage of sufficient professional personnel, sound monitoring facilities; on the other hand, the management agency of the proposed project can reduce investment expenditure of monitoring facilities and save labor. Before delivering the project, the construction unit shall sign monitoring contracts with monitoring stations in construction and operation stages.

## **8.3 The Environmental Supervision Plan**

The project monitoring plan during the construction and operation periods is shown in Table 8-2.

**Table 8-2 The Project Monitoring Plan ---- A Checklist**

Phases	Elements	Contents	Sites	Time and Frequency	Codes	Expenses (10000 Yuan)	Routine Monitoring Agencies	Regular Supervision Agencies
Pre-construction	Water environment	pH, CODCr, SS, BOD5, DO, LAS, Cr6+, petroleum, phosphate, NH3-N, Sulfide, total bacterial count , coliform group, SS	Dajing river reservoir, cross-section of Dajing river	Once per month before the construction	<i>Environmental Quality Standards for Surface Water</i> (GB3838-2002)	1.0	The entrusted monitoring station	Environmental Protection Bureau of Wuwei City
During Construction	Atmospheric environment	TSP, PM10	Shatan village, Caijia village, Shisanlipu village, Liuqi village, Lijia village, Guangchang No. 1 primary school, Lijia village, Xiaoshanzi village, Dazhuang village, Shengjiadong village, Dajing town middle school	Once per quarter	Category II in <i>Ambient Air Quality Standard</i> (GB3095-1996)	4/year		
	Acoustic environment	LAeq		Once per quarter	Category II <i>Acoustic Environment Quality Standard</i> (GB3096-2008) and WBG EHSG for residential, institutional, educational at 45 dBA and 55dBA for night and day time, respectively.	4/year		

	Water environment	pH, CODCr, SS, BOD5, DO, LAS, Cr6+, petroleum, phosphate, NH3-N, Sulfide, total bacterial count, coliform group, SS	Dajing river reservoir, cross-section of Dajing river	Once per month during the road construction along Dajing river	<i>Environmental Quality Standards for Surface Water</i> (GB3838-2002)	2.0		
Operation	Atmospheric environment	SO2, NOx, TSP, PM10	Shatan village, Caijia village, Shisanlipu village, Liuqi village, Lijia village, Guangchang No. 1 primary school, Lijia village, Xiaoshanzi village, Dazhuang village, Shengjiadong village, Dajing town middle school	Once per month in the first year, then once per quarter in the second year, if the items not exceeding the standard	Category II in <i>Ambient Air Quality Standard</i> (GB3095-1996)	20/year		
	Acoustic environment	LAeq	Shatan village, Caijia village, Shisanlipu village, Liuqi village, Lijia village, Guangchang No. 1 primary school, Lijia village, Xiaoshanzi village, Dazhuang village, Shengjiadong village, Dajing town middle school	Once per month in the first year, then once per quarter in the second year, if the items not exceeding the standard	Category II <i>Acoustic Environment Quality Standard</i> (GB3096-2008) and WBG EHSG for residential, institutional, educational at 45 dBA and 55dBA for night and day time, respectively.	3.2/year		

	Water environment	pH, CODCr, SS, BOD5, DO, LAS, Cr6+, petroleum, phosphate, NH3-N , Sulfide, total bacterial count, coliform group	Dajing river reservoir, cross-section of Dajing river	Once per quarter	<i>Environmental Quality Standards for Surface Water</i> (GB3838-2002)	2.0		
	WWTPs linked to the sewers financed under the project	To collect the effluent quality and sludge disposal of the WWTP.	WWTPs	Once every quarter				

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## **9. Environmental Supervision Plan**

### **9.1. Environmental Supervision during Construction Period**

Environmental Supervision, as an environmentally protective measure taken during construction period, shall be entrusted by the constructor to qualified construction monitoring and administrative agencies that are manned by supervision engineers specialized in environmental protection. The engineers are responsible for environmental supervision in the construction period.

The supervision party shall set up an environmental supervision team in order to fulfill specific monitoring tasks.

This team shall, based on adequate considerations of the environmental supervision baselines mentioned in Environmental Impact Assessment and the standing situation, propose environmental supervision plan, which will then be submitted to the corresponding administration of environmental protection and the constructor.

### **9.2. Environmental Supervision Scope**

#### (1) Environmental Supervision Scope

The scope includes construction sites and areas under direct impact of the construction. Specifically, those are the sites of major and temporary projects in the vicinity, construction roads and the local roads open to the traffic of the construction.

#### Supervision Coverage

The supervision covers all the aspects of environmental protection such as ecological protection, greening, pollutant prevention and control, and social environment protection.

#### (2) Project Scope

Construction sites, roads functioning in construction and any areas polluted by construction conducted in locations mentioned above.

#### (3) Supervision Stages

The environmental supervision in this project shall be divided into three phases: preparation phase, construction phase, and acceptance & defects liability phase.

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### 9.3 Specific Methods for Environmental Supervision

Environmental supervision team, as an economically independent third-party, shall function in a just and independent manner as stated and regulated by the contract and relevant environmental protection laws, safeguarding the legitimate interests and rights of the proprietor, as well as those of the contractor. Environmental supervision, though closely connected with project monitoring and administration, has its own specific missions and functions. Henceforth, the following methods for environmental supervision are to be adopted:

(1) To check whether the environmental protection measurements proposed in the preliminary project design and the construction drawing design are able to substantiate the principles stipulated in the approved Environmental Impact Assessment.

(2) To assist the constructor with the environmental protection training for the construction, design and administrative personnel.

(3) To check relevant regulations of environmental protection mentioned in bidding documents and project contracts.

(4) To afford suggestions aiming at improvement of the construction organization design, construction technique programs and schedules, censoring environmental index of project facilities such as in-site construction equipment.

(5) To monitor on protective and compensational measures taken to reduce any negative impacts on the atmospheric environment, water environment and noise abatement, and to sign upon documents of periodic inspection.

(6) To maintain routine supervision and inspection on construction sites in order to systematically record environmental impacts of construction, effects of environmentally protective measures and the quality of environmentally protective construction.

(7) To make on-the-spot records on environmental problems and verbally or with written remarks, requiring contractors to make timely rectifications

(8) To require proprietors to monitor on major pollution sources of construction sites, and suggest them to hire specialists and qualified institutes to conduct the monitoring, reminding contractors to take proper measures to check pollutions if necessary; if serious environmental problems exist, the supervisor shall issue *Environmental Problem Rectification Notice* upon the proprietors' consent, demanding a timely solution of the problems.

(9) To report to the environmental supervision team any unpredicted problems in

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environmental protection design and construction and to put forth practical proposals for the solution.

(10) To make the draft of the working plan and summary of project environmental supervision.

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## **9.4 Guidelines on Environmental Supervision**

As the nature of project requires, a dynamic supervision shall be adopted. The routine inspection need to be supplemented with requisite environmental monitoring to reinforce the supervision. An overall monitoring is required on major pollution-generating procedures to ensure contractors' observance of concerning laws, regulations and articles as contracted.

### **(1)Preparation Phase**

The implementation of articles concerning environmental protection shall be checked, and the environmentally protective measures in contractor's construction design shall be examined jointly by the construction client, designers, the supervision team and the constructor for the on-spot verification, optimization and examination. The monitoring scheme is shown in Table 9-1 as follows:

**Figure 9-1 Environmental supervision in preparatory phase**

Construction Activity	Focuses	Ways and means	Methods
Biding and Tendering	Drawing up plan of environmental supervision		
	Rechecking the environment protection articles in the construction contract	Documents reviewing	
	Rechecking sensitive spots and protection targets on construction sites	Inspection tour	On-the-spot recording
	Reevaluating the contractor's environment protection measures	Document reviewing	
	Examining and approving the contractor's in-construction environment protection plan	Document Reviewing	
	Reevaluating the contractor's schemes and environment protection measures in sub-projects	Document reviewing	

(2) Construction Phase

In-construction environmental supervision focuses on river channel cleanout, dike reinforcement, pump station construction, and etc.. Guidelines on the supervision are shown in Table 9-2 as follows:

**Table 9-2 Major Contents of In-construction Environmental Supervision**

Venue	Supervision Tasks and Requirement
Drinking water resource area	To check whether in-construction operation are conducted in strict accordance with environmental protection requirements stipulated in “Drinking Water Sources Reservation Management Guidelines”.
	To check whether road construction materials are stacked on borrow areas, or construction sites and camps are set up within reserves; to check whether rain- and seepage-proofing measures are taken in any stacking sites.
	To check whether unauthorized operations of well and spring digging, stream division and diversion are banned; whether illegal approaches such as discharging or pouring contaminative water and other wastes by the misuse of sink, seepage well, crevice, karst cave are banned
	To check whether construction-generated domestic garbage and pollutant water, solid and liquid waste are banned to be dumped and discharged within reserves or to rivers in the vicinity
	To check whether strengthening processes are conducted on the enclosure rails along road sections throughout drinking water source areas; whether speed limit signs and caution boards for vehicles are set up with well-marked phone numbers of alarm calls

Venue	Supervision Tasks and Requirement
	To check whether masonry-processed seepage-proofing measure has been conducted on gutters along all road sections mentioned above; whether collecting tanks are set up in different sections with seepage-proofing process
Biological Environment	To check whether protection, drainage and greening projects in various forms are implemented as planned in highway design
	To check whether the framework of original drainage system has been reserved in order to reduce partitions among farmland irrigation facilities, roads functioning for agricultural machinery transportation, and farmland
	To check the reasonability of location and quantity selection of culverts and passages
	To check whether road construction-caused damage on forest land has been compensated by efforts on land greening
	To check whether land greening measures are taken around revetments, slope base, medial divider, and interchanges
	To check whether protective and land greening measures are taken on borrow, spoil grounds and other lands undergoing temporary construction
Accident Risk	To check whether regulations of “Emergency Treatment Plan on Hazardous Goods Transportation” are applicable
	To check whether safety marks, including caution boards, speed limit signs, etc., are set up at both ends of road sections throughout areas of drinking water resources, with alarm phone number clearly shown
	To check whether sewage collection systems are set up on bridges with accidental pools built up at both ends of the bridges
	To check whether caution boards and speed limit signs for vehicles loading hazardous goods are set up at both ends of bridges
	To check whether emergency call numbers lists with arresting titles, including those of highway administrative departments, fire-fighting stations, and environmental protection departments, are placed along the roads in the vicinity of bridge
	To check if the local highway administrative department has drawn up “Emergency Treatment Plan on Hazardous Goods Transportation”
Sound Environment	To check whether construction is suspended from 22:00 to 6:00, with exceptions to be made due to emergency repairs and technologically required continuous operations which, nonetheless, shall be certificated by local government at or above the county level and concerned departments, and made known to residents.
	To check whether adequate consideration is given to local residents’ welfare during construction on the environmental maintenance; to check whether night shifts are avoided and construction is suspended during the intervals when local students sit for their examinations
Wild Animal Protection	To check whether caution boards and no honking signs are set up on both sides of the road.

Venue	Supervision Tasks and Requirement
Borrow Areas	To examine if the locations of borrow areas are suitable; any shifts of locations are to meet concerning requirements in EIA; explicitly set up locations and volume of earth borrowing
	To strictly check and regulate borrow depth and scope; to conduct top-down digging operation instead of abusive or excessive excavations
	To check implementation of the gravel pavement and compression as well as wire enclosure after earth borrowing
Side Roads	To confirm the establishment of fixed side roads, including checking whether side roads areas are specified by enclosure; to check the accuracy of rut record along side roads
	To check implementation of the gravel pavement and compression after construction
Casting and mixing grounds	To check the legalization of locations of mixing stations and material stacking grounds, ex. if the sites are located in the downwind direction 300m away from residential areas
	To check the transportation route and methods of powdery construction materials and mixed materials, ex. if such materials are barreled, bagged or stacked with felt cover.
	To examine the disposal methods of the waste generated after asphalt mixing, ex. if such wastes are collected and transported to required areas in time
Construction Campus	To check the disposal of solid waste, the establishment of latrine pits, and specific labor arrangement for garbage disposal
Roadbeds Construction	To check if blockings of side slopes are set in time, and the slope protection construction is conducted as designed
Bridge and culvert project	To check if the pollutant water generated during bridge construction are properly processed and sedimentation tanks are set up

### (3) Project Acceptance and Flaw Accountability Phase

Major tasks in this phase are the collection of relevant data for the environmental inspection and acceptance upon the completion of the project, the execution of environmental protection, and monitoring on the restoration of temporary construction plants, etc.

## 10. Cost Estimate

Investment in environmental protection of the project is shown in Table 10-1 as follows:

**Table 10-1 Investment Estimation for Environmental Protection**

Serial Number	Items	Missions	Cost Estimate (10000 CNY)	Remarks
1	Water and soil conservation		3939.22	Restoration in temporary construction sites, and water and soil conservation
2	Noise abatement	Sound insulation windows (600 plates)	120	environment protection for local residents
		Noise Barriers (700m)	91	
		No honking and speed limit signs (102 plates)	51	
3	Water pollution prevention	Sedimentation tanks to dispose construction-generated waste water (16 x 30,000 CNY)	51	Water environment protection
		Latrine pits (16 x 5,000) and garbage disposal sites (16 x 5,000) in construction camps	17	
4	Air and noise pollution prevention	Retaining walls around construction sites (4000 m x 4 )	20	Living environment protection for local residents
5	Solid waste prevention	Disposing hazardous and waste goods, including construction-generated waste engine oil	15	Proper disposal of hazardous and waste goods to avoid environmental pollution
4	Pollution prevention in Water Resource Areas	seepage-proofing accident pools (22 x 50000 CNY) in A9 project K0+000-K6+600, guardrails within water source protection areas, caution boards and speed	200	Safeguarding water source areas against pollution

		limit signs at both ends of roads crossing water source protection areas, deceleration strips, etc.		
5	Accident risk prevention	Caution boards, speed limit signs for vehicles loaded with hazardous goods at both entries of the bridge, and list of alarm telephone numbers (30 x 2000 CNY)	6	Water conservancy
6	Administration expenditure	Supervision	50	In-construction Supervision
		Labor charges	15	Labor cost
		Equipment purchase and material expenses	5	Administrative expenditure
7	Monitoring expenditure	Construction Phase	24	5 years
		Operation Phase	460	20 years (estimated)
8	Training		23	
9	The unpredictable		254.36	5 % (estimated)
10	Total		5341	/

The total cost of environmental administration is 53.41 million CNY, with details shown in Table 10-2.

**Table 10-2 Administrative Budget**

Item	Water and soil conservation ( 10,000 CNY )	Environmental monitoring ( 10,000 CNY )	environmental mitigation measures ( 10,000 CNY )	Personnel Training ( 10,000 CNY )	Total ( 10,000 CNY )
World Bank Loan Project of Infrastructure Construction for the Urban and Rural Overall Development in the Core Area of Wuwei Experiment District, Gansu Province	3939	484	895	23	5341

# 11. Requirements for Acceptance Inspection of Environmental Protection

Schedules of Acceptance Inspection of Environmental Protection are shown in Table 11-1.

**Table 11-1 Schedules of Acceptance Inspection of Environmental Protection**

Environmental Elements	Sensitive Spots		Environmental Protection Facilities	Contents of Acceptance Inspection	Purposes
	Stake Mark	Item			
Sound	Sensitive Spots around Construction Sites		Sound-proof windows for standard-exceeded houses and schools	Sound environment protection measures	To meet environmental standards
			Sound barriers around standard-exceeded houses		
			Enclosures around standard-exceeded houses and schools		
			“Slow Down” signs around standard-exceeded houses		
Surroundings	Borrow Areas		Land consolidation and vegetation restoration	Restoration measures in borrow areas	To avoid wind erosion and desertification, improve ecological environment along construction sites
	Spoil Grounds		Retaining wall and drainage ditch	Restoration measures in spoil grounds	
	Temporary earth-stacking grounds		Earth sheltered plantation	Restoration measures in temporary earth-stacking ground	
	Construction Sites and Side Roads		Land consolidation and vegetation restoration	Restoration measures in temporary projects	
Drinking Water Reserves	Road Sections within or in the boundary of Protection Areas		caution boards, sewage collection systems and reservoirs at both ends of the bridge; executing measures to protect	Protective measures on drinking water source	To protect drinking water sources

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		drinking water sources, according to EIA requirement in A9 Project that will be launched along water source area.		
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## Appendix 1:

# The Environmental Protection Regulations in the Design Stage

## 1.1 Design of the main route

According to the topography, geology, hydrology, rivers and other natural conditions along the highway, the principles below should be followed in the design processes of the road network layouts, interchanges, the alignment design standards to be complies with, and considerations to be taken into for the balance between the natural environment along the route and the line layouts:

(1) To ensure the road safety, select a good geological route location, reasonable layouts, and to follow the principles of “avoiding the areas of complicated engineering geology” f according to the engineering geological conditions.

(2) To make full use of the favorable terrain and minimize the destruction of forest vegetation, necessary measures should be taken to occupy less land, especially the occupation of farmland.

(3) To protect the environment and reduce soil erosion, the balance of subgrade earthwork, earth borrowing, and waste soil site location should be well-planned.

(4) To take a reasonable selection of network interface setting interchange, attention should be paid to both local economic development and to making the project conducive to the public production and livelihood.

(5) To avoid large dug filling and ensure the safety of the highway facilities of the project, the traffic signs, interchanges and service areas should be set up based on the terrain with horizontal and vertical technical indicators.

(6) To gain the social and economic benefits of the project and to meet the requirements of the national and Gansu provincial road network planning, the "near but not into, far but not away" design principle should be considered when planning road layouts of the main towns, regional impoverished areas and tourist economic resources, such as the residential areas along the Jiutiaoling Mountain and Sunan District. To reduce demolition and occupation of farmland and to avoid producing geological disasters, the crossing areas of villages and towns, the environmental protection of sensitive sections, and the intensive mineral sections should be taken into account as well.

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(7) To maintain a harmony between the main body of highways and the natural landscape as well as the social environment, the “nothing to be destroyed is the best protection” principle should be followed through the possible use of plants to protect the embankment slopes of the roads, through the reasonable selection of bridge sites, and other engineering measures. To maintain a close harmony between the artificial systems of highways and the natural systems, the environmental protection and greening facilities, sound insulation and noise reduction facilities, and sewage treatment facilities should be constructed so as to reduce the impact on the ecological environment and to meet the requirements of beautifying the roads and constructing landscape for ecological tourism, based on the environmental sensitivity analysis results.

Overall, the simulation of highway line selection should take full account of the project terrain, geological conditions, environmental protection, demolition, land to be occupied, cultural relics and minerals, construction conditions and other factors, try to avoid contact with the residential intensive zone along the concentration area, school premises and other environmentally sensitive areas, and pay attention to reducing the impact on the water and power communication facilities along the lines, reduce the scale of building demolition, occupy as less cultivated land as possible, and combine the choices for the overall project plan as well as other line selection along major urban areas, in order to coordinate with the development of local area.

## **1.2 Design of reclaimed fields, residue fields**

See “the Environmental Protection Regulations for the Dreg Sites of Borrowing Earth”

## **1.3 Design of construction pavements**

See “the Environmental Protection Regulations for Construction Pavements”

## **1.4 Design of drainage systems**

See “the Environmental Protection Regulations for the Drainage Systems”

## **1.5 Design of construction sites**

See “the Environmental Protection Regulations for the Construction Sites and Spot Construction”

## **1.6 Design of bridges**

(1) According to the actual situation of the highway bridges, through an investigation into and analysis of the bridges, such as bearing corrosion, expansion joints and bridge pavement diseases, combined with an experimental research, the design method to prevent diseases was put forward, in order to completely solve the problems with concrete bridges.

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(2) During the design it is necessary to adhere to the concept of safe and smooth construction, including construction security, material security, geological safety, location security, design safety, functional safety and usage safety, etc.

(3) Give full consideration to the development to the local situation, and design the load and width of the bridge with the appropriate principles to improve the bridge capacity and operation requirements.

(4) As for the selection of bridge positions, mountain shapes, landforms, river and trench flow patterns and characteristics should be taken into consideration, as well as highway subgrade causeway and bridge mechanical characteristics, adverse hidden geological dangers, etc.

(5) To scientifically determine the style of a bridge, give priority to selecting a bridge structure with mature and widely used technology that is of easy maintenance.

## **1.7 Design of pipe culverts**

### **1.7.1 Culvert layout principles**

(1) Culvert layouts should be designed according to the local topography, geology, hydrology, the route drainage systems, and other conditions in order to adapt to farmland irrigation.

(2) Culverts should be built at places in the spanning of gutter troughs, through the farmland irrigation channel, and the longer low-lying or mire districts and where the flat routes pass, through the mountain-adjacent routes or the routes along the streams where the runoff is easy to focus when there is a rainstorm, and through places where a side ditch drainage is needed. Merging gutters into culverts can also be considered with available technology when the terrain conditions are permitted.

(3) The location and direction of culvert layouts should be consistent with the flow direction, otherwise improper culvert layouts will lead to the rising of the water levels in the upstream, the farmland, villages and roadbeds. The downstream flow rate will be so big as to exacerbate the erosion of ditches and roadbeds.

(4) In the culvert layouts, the demands for construction and maintenance should be taken into consideration comprehensively to reduce the cost of construction and maintenance.

(5) The culvert density alongside the constructed line should be designed according to the topography, landform, hydrology, farmland irrigation and other natural conditions. But the culvert spacing should not be less than 50m for the convenience of the roadbed construction.

(6) Usually one culvert should be built in one ditch at mountain areas. The areas with heavy rainfall or rainstorm, sparse vegetation in the hillside are not suitable for the building of culverts. When the collection area is very small and when two streams are very close to each other, we can combine culverts after making technical comparison. Yet attention must be paid to the construction of necessary protective engineering.

(7) The culvert layouts should be set up in line with the water flow, and culverts cannot be built in a quadrature in order to shorten the lengths of culverts. When the flow rate or discharge is large, or the transverse slope of both sides of the narrow and deep ditches is large, the flow directions of ditches are not perpendicular to the route, we should skew-lay the culverts. The slopes should not be more than 45°.

(8) The culverts should be set up at the outlets of the drainage ditches to keep the water flowing too long along the side ditches from eroding the pavements.

(9) The culverts should be set up near the curves when the route angles are larger than 90°, the curve radii are smaller, the longitudinal slopes before the curves are greater than 4%, and the slope length is within 200m and when no other culverts nearby.

(10) From steep ( $\geq 5\%$ ) segments to glaxis ( $\leq 3\%$ ) segments, when there are no other culverts in this 200m, culverts are to be set up near the grade change points.

(11) The water flow direction of the upstream and the downstream entrances should be a concern in the culvert layout along the streams in order not to endanger the farmland and villages.

### 1.7.2 Culvert design and technical norms

(1) The design of flood frequency, vehicle load and safety grades should meet the relevant requirements at all levels of roads. The requirements are shown in Table 1-2.

**Table 1-2 The design of flood frequency, vehicle load and safety grade of culverts**

Highway classification	Express Way	First rank highway	Second rank highway	Third rank highway	Fourth rank highway
Design of flood frequency	1/100	1/100	1/50	1/25	not specified
Vehicle load grade	highway- I	highway- I	highway- II	highway- II	highway- II
Design safety grade	level 3				

(2) Newly built culverts should be zero-pressure ones, but when water accumulation in front of the culverts is acceptable, pressure or semi-pressure culverts can also be applied.

(3) The bore diameters of culverts should be designed according to the measurement of

the design flood discharge, riverbed section morphology and geology, the reinforcement form of exit and entrance ditch beds and so on. Then the bore diameters should be determined by hydraulic checking.

(4) The standard span of newly built culverts should be 0.75m, 1.0m, 1.25m, 2.0m, 2.5m, 3.0m, 4.0m and 5.0m respectively, the first of which is only applicable in irrigation canals without siltation areas. The drainage culvert span should not be less than 1.0m.

(5) The inside diameters or the net height of culverts should not be less than 0.75m. It is no less than 1.25m when the culvert length is between 15m and 30m. It is no less than 1.5m when the culvert length is more than 60m.

(6) The small diameter pipe culverts and the inverted siphon pipe culverts should be used in the frozen regions. If it is needed for the farmland irrigation, we should exclude the ponding in the pipes before freezing, and seal the exit and entrance on both ends.

(7) The standards in Table 1-2 should be applied in the net clearance of non-pressure culverts from their tops to their maximum water surface. The depth of water in front of the culverts should be less than or equal to 1.15 times of the culvert net height, and the impact of ponding in front of the culverts on the design water flow can be neglectable.

**Table 1-3 The headroom of non-pressure culverts**

Type	Pipe culvert	Arch culvert	Rectangular culvert
The culvert entrance net height $h_d$ (m)			
$\leq 3$	$\geq h_d/4$	$\geq h_d/4$	$\geq h_d/6$
$> 3$	$\geq 0.75$	$\geq 0.75$	$\geq 0.5$

(8) To determine the flow rates, water depths in the culverts and the backwater levels in front of culverts, a calculation of the bore diameters of non-pressure culverts can be made after an initial design of the ditch section morphology.

(9) The culvert location should follow the requirements of the linear layouts, and places where there are favorable terrains, better geological conditions, higher foundation bearing capacity, and stable riverbeds should be chosen to build culverts when there is no limitation of the linear layouts.

(10) End walls should be set up at culvert exits and entrances, and should be separated from the culvert body with a gap, and waterproof material should be used to fill in the gap.

(11) The culvert body and the entrance and exit within a range of ditch beds, roadbed slopes, and cone fillings should be strengthened by paving, and the paved plane-forms of the entrance and exit should be determined by the ditch types. For places where there are no obvious channels, the exit planes should be of an isosceles trapezoid and the paved angles

can be 20o. The paving materials should be determined by the maximum flow rates on the paved courses and, at the end of the paving, cut-off walls must be set up.

Riverbed paving is not necessary when the ditch beds are covered by rocks or big stones and boulders that cannot be moved by flood.

In the vertical steep and large flow rate riverbeds, the chutes, hydraulic drops and corresponding energy dissipation measures should be taken if necessary, and cut-off walls should be set up at the bottom of outside the end walls. The cut-off walls should be set up at the end of riverbed paving.

(12) The foundation of a base culvert can be designed as an integral or non-integral form according to the structure, geology conditions of the culverts and the ground treatment.

(13) The baseless culvert can be applied when the bases of the pipe culverts and other closed section culverts are in line with the requirements in Table 12.2-3, and when the soil is uniform and the sinkage is not big. However, the foundation should be set up at the entrance and exit of culverts and the seepage control role should be considered in order to avoid the differential settlement and water leakage of the joint between the pipe sections.

**Table 1-4 The processing forms at the end of baseless culvert pipe section**

Name of base soil	Form	Cushion course thickness or compacted layer thickness (m)
Rock	Concrete-wiped cushion	----
	Sand cushion	Not less than 0.4m
Gravelly soil, land pebble	Filling the gaps by sand and consolidate	Not less than 0.4m
Gravelly sand, coarse sand, medium sand and fine sand	Surface layer tamping	Not less than 0.4m

(14) At the entrance and exit of culverts, end walls or wing walls are to be set up, and their types and sizes should be designed to endow the culverts with corresponding discharge capacity and to guarantee the stability of embankment of the culverts.

(15) A calculation of the post-construction settlement should be made, and it should not be more than 100mm. When it is more than 100mm, ground treatment is needed.

**1.8 Design of road planes**

Main control factors for planar lines: the geometric design of roads should be taken as a stimulus to improve the environment on the basis of the overall road network planning. It focuses on the match of routes with landform and environment as well as its own spatial effect. Further, it should have beautiful four-dimensional time space with smooth, consecutive and foreseeable appearance.

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(1) In case of any residential areas on the two sides of roads, demolition should be reduced in road wiring and a safe net distance should be kept between roads and residential houses.

(2) Bridge location and bridge type have great influence on lines when spanning Daxia River.

(3) How to rationally connect the roads of Xinji Town and Yinji Town to the fast channels. Middle and small-sized bridges should be built on the channels with a large span so as to relieve the constraints on the lines.

(4) Slope protection treatment: The location of Yak Road is affected by the course of Daxia River. There should be slope protection along such roads.

After the site investigation and careful comparisons, the planning lines provided this time are basically identical to the site conditions except several limited control points. Therefore, the plane directions this time are basically arranged on the planning lines.

### **1.9 Design of road profiles**

Profile design principles: In order to ensure safe and comfortable driving, longitudinal slopes should be as flat as possible and ups-and-downs should not be frequent. The profile design should follow the overall layouts of vertical planning and take comprehensive consideration of landform, underground pipelines, geology, hydrology and climate, etc. to meet the requirements of Wuwei for road transportation, river course dredging and floodwater drainage, and to make full use of natural landforms and rationally transform natural landforms, and to take comprehensive considerations of the planned terrace elevation to integrate and rationally design the road elevation and the planned terrace along the lines. The design should enhance the subgrade elevation to guarantee the subgrade stability when the lines pass those areas with bad hydrogeological conditions. Longitudinal grade and minimum slope length of roads should meet the stipulation requirements and make the lines on cross sections rational, smooth and beautiful. The minimum longitudinal grade of roads is  $\geq 0.3\%$ ; maximum longitudinal grade of major roads is  $5.5\%$ ; and maximum longitudinal grade of collector roads is  $6\%$ .

### **1.10 Cross section design of roads**

Cross section design of roads is to determine the road cross sections on the basis of the traffic volume of each road, comprehensive pipeline burying width and urban planning landscape within the major road network of Wuwei as well as the principles of saving construction land. Cross section design should be in a long-term sense to make the recent

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projects as an integral part of long-term projects. Pipeline locations should be reserved. Road width and elevation should have room for future enlargement.

### **1.11 Design of roadbed engineering**

Roadbed design should be made as per national technical standards and specifications on urban roads engineering on the basis of the hydrogeological and landform conditions and local materials along the lines. Roadbed design should adapt to local conditions and rationally make use of local building materials to make roads solid, uniform and stable.

If the roads are located in residential areas, construction wastes must be removed. If roads are located in farmlands, surface humus of 30~50cm must be removed and such areas should be backfilled with gravel soil to remove the silt seam and backfill ditches and canals with gravel soil and different layers should be milled one by one. Organic humus removed on farmland can be used for greening in order to save earth-moving costs and maintain earthwork balance. The backfilled soil should be grounded layer by layer. The roadbed should be compacted layer by layer to make it solid as is required in the relevant regulations.

### **1.12 Design of culvert layouts**

In order to improve the drainage system and allow the surface water on one side of the subgrade to pass the subgrade, necessary culverts should be built to remove surface water. Besides, irrigation culverts should be arranged to meet the irrigation needs of villagers. Culvert layouts should take considerations of the sludge and mud flows. The hole diameters are not to be contracted too much. The affiliated stream guidance facilities in upstream and downstream areas should be such as to keep the water flow smooth. Bridge culvert holes should be determined on the basis of hydrogeological conditions and the stipulation requirements when ditches and canals are spanned. Hydrogeological explorations should be recorded in details.

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**Appendix 2:**

## **Code of Practice for Environmental Protections during Construction Period**

### **2.1 Code of Practices for Site Construction Environment**

#### **2.1.1 Code of practices for site environment**

Sites mainly include construction camps, concrete mixing stations, and asphalt mixing stations and so on. According to different functions, construction camps can be divided into three categories: living, operation and living/operation campsites. The living campsites are used for constructors' board and lodging; operation campsites are mainly used for placing building materials, concrete mixings, fabrication of precast bridge parts, etc.; living/operation campsites integrate living and operation as a whole, suitable for contractors' board and lodging, building materials placing and fabrication of precast bridge parts. Asphalt mixing stations are mainly used for mixing asphalt required by pavement laying.

##### **2.1.1.1 Requirements of site selection**

The requirements of site selection are shown in the Table 2-1.

**Table2-1 Requirements of site selection**

Not to be selected	To be selected
<ul style="list-style-type: none"><li>• Main sensitive points, such as residence areas and schools, and the land within 200m from upwind</li><li>• Basic farmland</li><li>• House sites</li><li>• Forest land</li><li>• The land within 200m from a river course</li><li>• The land within upstream 1,000m or downstream 500m from the intake of drinking water source so as to avoid water conservation area, as well as sensitive environmental areas, such as scenic spots and forest parks</li><li>• Marshland or paddy field</li><li>• The land well-covered by vegetation</li><li>• Dangerous collapsible and landslide areas</li><li>• Areas susceptible of debris flow</li><li>• The land for special use</li></ul>	<ul style="list-style-type: none"><li>• Renting local civilian houses</li><li>• The land within the scope of permanent use for road</li><li>• Uncultivated land</li><li>• Abandoned land</li><li>• Land parcel with a higher terrain</li><li>• Other poor lands</li></ul>

As the EIA shows, one construction site with its sidewalk (GL-SG13#) planned along the proposed road A9 has to be re-planned in a new location before the implementation of the project since it lies within the Liujiatan class II water source conservation of Dajin town, failing to meet the standards of location. The new location must meet the regulations put forward in table 2-1. Among the most important standards are: the site must be located 1 kilometer off the upper reaches or 0.5 kilometer off the lower reaches of a class II water

source conservation; the construction of any temporary projects is forbidden within the water source conservation, such as construction sites, borrow pits, debris fields and mixing stations, etc.

The Executive Office of the World Bank Loan Project (Executive Office) needs to supervise the responsible affiliations over the location of the construction site in order to prevent the water source from being negatively affected.

### 2.1.1.2 Analyses of site impact on environment

Site impact on environment mainly includes noise from construction machinery, drainage of industrial wastewater and domestic sewage, construction dust, cooking oil fume, construction waste and domestic garbage. See Table 2-2.

**Table2-2 Site impact on environment**

Site category	Environmental elements	Impact on environment
Operation campsite	Water	Impact of industrial wastewater on water environment
	Air	Impact of construction flying dust on ambient air
	Noise	Impact of construction machinery on sound environment
	Solid waste	Impact of construction waste on environment
Living campsite	Water	Impact of domestic sewage produced from constructors' board and lodging on water environment
	Air	Impact of constructors' residential heating and cooking oil fume on ambient air
	Noise	Impact of constructors' shouting on sound environment
	Solid waste	Impact of domestic garbage on environment
	Society	Impact of constructors' access to local social environment
Asphalt mixing station	Air	Impact of asphalt fume gas on ambient air
	Sound	Impact of mixer noise on sound environment

### 2.1.1.3 Code of practices for site environment

According to the requirements of site selection and combining them with the actual conditions of the project, site selection should abide by the following requirements:

(1) For the project civilian houses should be rented along the line as much as possible; collecting stations or garbage cans are to set up and to gather domestic garbage; electric energy or other clean energies to be used for residence and heating.

(2) Constructors should abide by local village regulations and non-governmental agreements, practice civilized construction and get along well with local residents.

(3) Pit toilets and sedimentation basins should be arranged in operation campsite. After settling, the industrial waste water can be recycled for operation, not to be discharged to the outside. The domestic sewage (from constructors' toileting) disposed in pit toilets (to be buried after construction) can be carried out by the hired local farmers for agricultural

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irrigation. Construction waste in the camps should be recycled as far as possible, or transported to the appointed places at regular intervals. Random littering will be prohibited.

(4) Barren slope, brushwood land and poor land should enjoy a priority for operation campsites. Cultivated land is prohibited to be occupied. If it is inevitable to occupy cultivated land, the occupation of basic farmland is prohibited. Before construction, it is required to strip the cultivated surface soil and temporarily stack it on a flat ground, protected with soil-filled bags, temporary drainage ditches and desilting works, and dust screens. After construction, the soil can be used as cover earth for second farming or green planting.

(5) Special concrete mixing stations and asphalt mixing stations are not to be set up for this project; all of concrete and asphalt will be purchased from outside.

## **2.1.2 Environmental code of practices for site construction**

### **2.1.2.1 Provisions for construction time**

(1) Construction time: from 6:00-22:00; no work to be done during 22:00-6:00 and 12:00-14:00. The access time of construction vehicles must comply with local government's requirements.

(2) Night construction is restricted. If unavoidable, the surrounding residents should be informed by public announcement. At the same time relevant formalities must be handled and it is necessary to take measures to reduce the impact on the surrounding residents.

### **2.1.2.2 Management of building materials**

Building materials for this project mainly include sand, stone, cement, etc. If the management is improper in transportation, storage and application, these materials will have impact on the environment to varying degrees. So it is required to take corresponding environmental protection measures to minimize the impact.

The measures to be taken for the building materials in transportation, storage and application are as follows:

(1) Vehicle should be low-noisy and transportation of day shift must be strictly executed, so as to strengthen management and reduce night transport times in abnormal working conditions.

(2) The speed of transport vehicles must be restricted. When passing through environmental protection objects (e.g. hospital, residential area, school), vehicles go slowly.

(3) Vehicular access signs should be set up; drivers should control their vehicles in a civilized way to ensure safe transportation.

(4) Powdery materials, such as cement and lime, should be canned or bagged, prohibiting bulk transportation. Trucks for aggregate and other construction materials must be equipped

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with anti-falling devices, covered by felt, and not overloaded to prevent the materials from being blown off. Transport routes and time should be planned to reduce the impact on sensitive environmental spots as far as possible.

(5) The stacking place of powdery materials should be selected at 300m from the downwind sensitive environmental spots. It is needed to reduce the stack volume and consume it in time; in addition, wind-proof and rain-proof measures should be taken, fences built up if necessary, water sprinkled at regular time to prevent flying dust, and the materials to be covered by felt in severe weather.

(6) Construction trucks must be inspected at regular intervals and damaged truck beds should be repaired in time to avoid building materials or construction waste falling from the trucks when on road.

(7) Surface of access roads should be hardened or treated by sprinkling water, so as to control the impact of rolling compaction of motor vehicle wheels and reduce flying dust pollution.

(8) During construction period, it is required to strengthen the management of powdery (or granular) materials transport and use, and to sprinkle and clean the working surface, where re-entrainment of dust is easy to occur.

### **2.1.2.3 Management of construction equipment**

Construction equipments mainly include loading machines, road rollers, excavators, blenders, vibrators, tampers, and so on. During construction period, these equipment will generate noise, tail gas and possible leakage, which may do harm to the environment of project areas. In order to minimize the harmful influence, the following management measures are to be taken:

(1) Construction equipment should be placed in the specified construction area, not to be arbitrarily parked outside the construction sites to occupy other land and destroy vegetation and soil.

(2) It is better to use low-noise equipment.

(3) Mufflers will be installed in the noise source of equipment, that is, in the proper positions of various exhaust or unloading devices, e.g. air inlet/outlet; in addition, damping foundation or damping support can be used.

(4) Fuel oil machinery and vehicle must be in normal conditions, ensuring waste gas emission up to the standard.

(5) Equipment should be properly used, maintained and repaired to prevent them from leakage and doing harm to surface water environment and soil environment of the project

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areas.

## **2.2 Environmental Code of Practices for Site Cleaning**

### **2.2.1 Contents of site cleaning**

Site cleaning include vegetation, surface soil, old roadbed, side ditch, pavement concrete, concrete structure, garbage, waste and other barriers pointed out by supervisors. And the scope covers the surface of all areas of construction site to be cleaned, such as permanent or temporary work area, stock ground, storage area and waste disposal area.

### **2.2.2 Environmental code of practices for site cleaning**

(1) Vegetation cleaning of construction site surface of main works must be extended to the max excavation sideline shown in the construction drawing, or at least 5m from the outside of the building foundation sideline.

(2) As with vegetation cleaning of main works, the scope of tree stump excavation must be extended to the max excavation sideline or filling line shown in the construction drawing, or at least 3m from the outside of building foundation.

(3) Attention is to be paid to the natural vegetation protection around the cleaning area. The damage of forest resource around the cleaning area as well as the harmful impact on environment protection resulting from improper construction should be compensated by the contractor.

(4) Within the scope of site cleaning, the sawn lumber or the materials with business value obtained by the contractor are the employer's property. Contractors should stack them at an appointed place in accordance with the supervisor's instruction.

(5) All unworthy combustibles should be burned down as quickly as possible, during which, the contractor, responsible for combustion results, should take necessary fireproofing measures.

(6) All debris removals, which cannot be fully burnt out or will impact environment severely, must be buried in the areas directed by the supervisor. It is not allowed to obstruct natural drainage or pollute rivers.

(7) The cultural relics and historical sites found in site cleaning should be treated in accordance with the regulations for the protection and control of cultural relics.

(8) Surface soil cleaning should be in accordance with the excavation depth specified by the supervisor. The excavated organic soil must be transported to a specified stack area, preventing the soil from being washed out. The stacked organic soil can be used for environmental protection of the project. According to the contract requirements and

employer’s overall environmental planning, organic soil should be used properly.

(9) Waste and organic residue within roadbed scope, as well as humus, grass sods, tree stumps and crop roots on the original soil pit surfaces (100-300 mm deep) should be cleared away and put together in places specified by the supervisor or stacked on spoil ground. After site cleaning, the pits within the roadbed scope should be backfilled and compacted entirely, making the density up to the specified standard.

(10) When explosion or other operations are needed for the removing structures or barriers, it must be finished before new work to avoid the possible damage of new structures. In order to avoid unnecessary losses, all utilizable materials should be stacked properly in the specified places. All potholes should be backfilled and compacted, making the density up to the specified standard.

(11) Demolition of side ditches, culverts, pavements and other barriers is made only after properly arranging normal transportation and drainage. As for the underground part of original structures, both excavation depth and scope should comply with the supervisor’s requirements.

**2.3 Environmental Code of Practices for Access Roads**

**2.3.1 Site selection requirements of access roads**

If an access road is required, site selection should follow the principle shown in Table 2-3:

**Table 2-3 Site selection requirements of access road**

Not to be selected	To be Selected
<ul style="list-style-type: none"> <li>• Basic farmland or other farmland, paddy field and economic crop field</li> <li>• Sensitive areas, such as water conservation area, scenic spot, forest park, etc.</li> <li>• House sites</li> <li>• Forest land</li> <li>• The land within 200m from river course</li> <li>• Marsh or paddy land</li> <li>• The land well-covered by vegetation</li> <li>• Dangerous collapsible and landslide areas</li> <li>• Area susceptible to debris flow</li> <li>• The land for special use</li> </ul>	<ul style="list-style-type: none"> <li>• Roads at county/town/village levels</li> <li>• Uncultivated land</li> <li>• Abandoned land</li> <li>• Other poor lands</li> </ul>

**2.3.2 Environmental impact analyses on access roads**

Environmental impacts from access road construction are mainly reflected in:

- (1) Road dust pollution generated from vehicle driving and equipment operation;
- (2) Noise pollution generated from vehicle driving;
- (3) Destruction of ground vegetation and consequent soil erosion, generated from

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temporary land occupation.

### **2.3.3 Environmental code of practices for access road construction**

(1) The existing roads at county/town/village levels can be used as access roads as much as possible; at the same time, the roads at town/village levels should be reconstructed.

(2) If a new access road is required, high-fill and deep-cut should be avoided as far as possible, for better conservation of water and soil, so as to reduce water and soil loss and ecological damage. When a new access road is built, it should be hardened. Recycled load-bearing bricks (construction member) can be used for the pavement for heavy trucks, while recycled water-seepage bricks can be used for general pavement.

(3) Before a new shortcut is constructed, it is required to strip the surface soil and temporarily stack it on a flat ground, sided with bagged earth, temporary drainage ditches and desilting works, covered with dust screen. After the construction, the soil can be used for ecological restoration of the shortcut.

(4) Access road can be combined with construction campsite shortcuts to reduce the number of shortcuts.

(5) Access road should be maintained and cleaned at fixed time every day; dust-generating road section should be sprinkled to suppress dust.

(6) The impact of noise on environment will be relieved by controlling vehicle speed, no honking and no transportation from 12:00 to 14:00 in the day and from 22:00 to 6:00 at night.

(7) Before the construction is finished, the ecological status of new access roads should be recovered at least as what it was before.

(8) The occupied or damaged local roads will be maintained or rebuilt, and the pavement recovered and greened after construction. At the same time, it is required to pay local government damages to safeguard the legitimate interests of local government and residents.

## **2.4 Environmental Code of Practices for Quarries and Borrow Pits**

### **2.4.1 Environmental Code of Practices for Borrow Pits**

#### **2.4.1.1 Site selection requirements for borrow pits**

Generally, construction stock grounds include quarry and borrow areas. Site selection of quarry and borrow area should follow the principle shown in Table 2-4.

**Table 2-4 Site selection requirements of quarries and borrow pits**

Not to be selected	To be Selected
<ul style="list-style-type: none"> <li>• Basic farmland or other farmland, paddy field and economic crop field</li> <li>• House site</li> <li>• Forest land</li> <li>• The land within 200m from river course</li> <li>• The land within sensitive areas, such as scenic spot, water conservation area, forest park, etc.</li> <li>• Marsh or paddy land</li> <li>• The land well-covered by vegetation</li> <li>• Dangerous collapsible and landslide area</li> <li>• Susceptible area of debris flow</li> <li>• The land for special use</li> </ul>	<ul style="list-style-type: none"> <li>• Uncultivated land</li> <li>• Abandoned land</li> <li>• Other poor land</li> </ul>

**2.4.1.2 Analyses of the impact of borrow pits on the environment**

(1) Destruction of vegetation; acceleration of loss of water and soil erosion

Vegetation diversity of a slope is higher than that of a flat area, including bushwood, grass cluster and dry crop. After excavation, surface vegetation disappears. With the addition of certain gradient (height difference), soil erosion modulus of local scope will be increased. In this case, if quarry and borrow areas are not re-greened in time, water and soil will be lost easily.

(2) Impact on landscape

Quarry and borrow areas will destroy vegetation and change original terrain, landform and natural landscape.

(3) Impact of quarrying and borrowing machinery noise on sound environment.

(4) Impact of quarry and borrow area dust on ambient air.

(5) Quarry and borrow area excavations lead to water and soil loss, if stockpiling is improper.

**2.4.1.3 Environmental code of practices for borrow pits**

According to the site selection requirements and the impact on environment, quarry and borrow areas should abide by the following requirements:

(1) Nearby quarrying is to be made and the spoil of the project itself fully used; local and legal existing quarries and borrow pits should be used as much as possible to relieve the impact of quarrying and borrowing on ecological environment.

(2) In case of quarrying, it is required to build rain side ditch to avoid geological disasters such as water and soil loss, land slide and debris flow resulting from quarrying in rain season.

(3) Deep excavation should be avoided in construction, to achieve a balance between excavation and filling. Borrowing can be done from the spoil of other construction project in this project area through coordination, avoiding independent borrow areas, which can

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fundamentally eliminate the impact of borrow areas on environment.

(4) Concentrated quarrying and borrowing will be adopted for the project to reduce quarry and borrow areas.

(5) Attention needs to be paid to water sprinkling and dust suppression in quarrying and borrowing operation, so as to reduce the dust pollution resulting from earth excavation.

(6) In order to prevent water and soil loss, cut-off ditch and drainage ditch should be arranged in quarry and borrow areas, which can avoid the sediment directly flowing into surface water along with the runoff in the drainage ditch to impair water quality.

(7) In the operation of excavation, topsoil should be retained for land rehabilitation. The topsoil will be temporarily stacked on a flat ground, protected with earth-filled bags, temporary drainage ditches and desilting works, and dust screens. After the construction, the soil can be used for ecological restoration of the borrow areas.

(8) The principle of simple and easy conservation will be observed, and the greening can be a combination of trees, bushes with grass, thus to produce a pleasing plant community landscape, recover the natural ecology of quarry and borrow areas, and reduce water and soil loss.

(9) Working hours must be controlled strictly. If there is any sensitive object, such as a residence within noise effect scope, quarrying and borrowing operation should be prohibited from 12:00 to 14:00 in the day and from 22:00 to 6:00 at night.

#### **2.4.2 Environmental Code of Practices for Quarries**

The proposed project does not choose specific quarries, and all the sand, gravels and stones are bought from the surrounding quarries. The requirements are as follows::

(1) The quarries should be legally approved by the relevant government departments.

(2) The quality of materials should meet relevant standards for road construction.

(3) The operation of quarries should conform to national environmental requirements such as site selection and water-soil conservation measures.

### **2.5 Environmental Code of Practices for Waste Ground**

#### **2.5.1 Site selection requirements of waste ground**

Site selection of waste ground should follow the principle shown in Table2-5.

**Table 2-5 Site selection requirements of waste ground**

Not to be selected	To be Selected
<ul style="list-style-type: none"> <li>• Basic farmland or other farmland, paddy field and industrial crop field</li> <li>• House site</li> <li>• Forest land</li> <li>• The land within 200m from river course</li> <li>• The land within sensitive areas, such as scenic spot, water conservation area, forest park, etc.</li> <li>• Marsh or paddy land</li> <li>• The land well covered by vegetation</li> <li>• Dangerous collapsible and landslide areas</li> <li>• Susceptible area of debris flow</li> <li>• The land for special use</li> </ul>	<ul style="list-style-type: none"> <li>• Uncultivated land</li> <li>• Abandoned land</li> <li>• Other poor lands</li> <li>• Cols or depressions</li> </ul>

**2.5.2 Analyses of environmental impact factors of waste grounds**

In the course of road construction, a certain amount of waste may be produced, mainly including surplus earth-rock, abandoned road materials, waste rock and sludge from site cleaning, etc. Improper disposal will bring about the following environmental impacts:

- (1) Exposed waste ground surface will result in severer dust pollution, if no measures are taken.
- (2) Water and soil will lose, if there are no retaining or waterproof works in waste grounds.
- (3) Ground vegetation will be destroyed, which will bring adverse impact to ecological environment.

**2.5.3 Environmental code of practices for waste grounds**

(1) As the first consideration, the surplus earth-rock should be used in local area, or used for other bidding sections of this project, or returned to borrow area for vegetation recovery; independent borrow areas should be avoided; this can fundamentally eliminate the impact of borrow areas on environment.

(2) In case of unavailability, it is required to investigate whether there is a specified place in the locality to accept the construction waste. If there is, the waste should be transported to the specified place after going through the formalities of spoil/waste transportation.

(3) Waste ground should be compacted layer by layer, which can effectively suppress the dust produced.

(4) The mode of water sprinkling and dust suppression can reduce the dust pollution resulting from earth surface explosion.

(5) In order to prevent water and soil loss, cutoff ditch and drainage ditch should be arranged at waste grounds, which can avoid the waste directly flowing into surface water along with the runoff in the drainage ditch to impair water quality, during construction period

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and operation period.

(6) Before waste grounds are put into use, the surface soil should be excavated out and used for land rehabilitation. The surface soil should be temporarily stacked on a flat ground, sided with earth-filled bags, temporary drainage ditches and desilting work done, and covered with a dust screen. After the construction, the soil can be used for ecological restoration of the waste ground.

(7) The principle of simple and easy conservation will be followed, and the greening can combine trees, bushes with grass, thus to form a plant community landscape, recover natural ecology of waste grounds, and reduce water and soil loss.

(8) Disorderly spoil stacking and discarding are to be prohibited.

## **2.6 Environmental Code of Practices for Drainage System**

### **2.6.1 The importance of drainage system to rural roads**

Without favorable drainage system, the road will be soaked in water. This may cause problems, ranging from upheaval, subsidence and potholes of roadbed and raveling and chuckhole of pavement to destruction of roadbed, threat to pavement and traffic interruption at worse. So the traffic capacity will be affected. However, if a rural road has a favorable drainage system, then the stable, solid and dense roadbed, smooth pavement, suitable road hump, traffic safety and comfort, long service life of rural road and high social efficacy can be ensured.

### **2.6.2 Environmental code of practices for drainage system**

#### **2.6.2.1 Roadway surface drainage scheme**

(1) Pavement surface drainage

a) Cross slope

To give full play to the design function of the road, reasonable road humps on the road surface must be designed to rule out gathered surface water. This may contribute to the reduction of water accumulation. Therefore, a gradient slightly higher than the lowest road hump should be implemented in the possible road section. The specific methods are as follows: a. for the mountain road, if ditches along both sides of the road are unavailable, then road humps should be applied to let the road surface lean to one side, so the water on the traffic lane can be drained to the side ditch; b. when the road is restricted with the designated lowest road hump on the ramp, the relatively suitable way is to make the road hump no less than 50% of the longitudinal gradient. This is very important to ensure that the surface gathered water flows to the road shoulder.

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b) Longitudinal slope

The longitudinal slope plays a role in letting drain the rainwater gathered on the road surface without strain, and can be applied to the internal drainage of the surface layer. The longitudinal gradient at 0.3% is suitable for the purpose of drainage.

(2) Slope surface drainage

a) Intercepting ditch of natural slope surface

When the surface runoff flowing from the natural cutting or bank slope to the roadway is larger, a ditch should be applied to intercept the surface water. For the roads in a township or county, there should be at least one roughly-paralleled intercepting ditch on the slope with long confluence as required. The intercepting ditch should be in accordance with the surrounding terrain and parallel with the contour line. The intercepting ditch should be about 5m from the cutting slope or 2m from the bank slope toe, but the former may be no less than 2m if the soil property is favorable and the cutting slope is not high.

b) Side ditch of side slope surface and drainage ditch

The side ditch of side slope surface is set up at the slope toe to contain the water from the road surface and slope surface. The sections of side ditches are usually in trapezoid, U shape, triangle and canal shape.

The drainage ditches, also known as outlet drains, are mainly used to drain the water beyond the side ditches, intercepting ditches, borrow pits or roadbeds to the depression or natural river beyond the bridge and culvert and roadbed. The cross section of the drainage ditch is generally trapezoid. The width and depth of the ditch should be no less than 0.5m long. The longitudinal gradient of the drainage ditch is usually 0.3% to 0.8%, no larger than 3% and no less than 0.12%; the drainage ditches should be shorter rather than longer, usually within 500m.

c) Vertical drainage ditch (suspended ditch)

On the slope surface of high-fill embankment and deep cutting, vertical drainage ditches (suspended ditches) are needed when the water is drained down from the slope crest or slope surface in a vertical and concentrated way. The suspended ditches are usually paved with mortar rubbles, with rectangular and trapezoidal cross sections composed of concrete members. The energy dissipation measures (such as drop wells and baffle bank) should be created at the exit of the drainage facility to prevent the rapid flow from scouring the side ditch of the roadbed.

d) Hydraulic drop and chute

For the low-grade mountain road, in the sections where the rain is heavier and the

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gradient of side slope is larger, the water flowing from the slope surface is liable to scour the vegetation on the surface. Even if protective measures are applied to the slope surface, sometimes the side slope is inevitably washed out, which may result in collapse and water and soil loss, and even has a greater impact on the surrounding ecological environment. The chutes, a kind of steep artificial gutter channel, are usually established in the entrance and exit sections of steep hillsides and culverts that are not allowed for geological washout. The purpose is to dissipate the energy of intensive water flow and slow down the flow after the drainage through the steep slope. When designing chutes, measures have to be considered like increasing the roughness of the bottom of channel for energy dissipation and slowdown of flow, or adopt a single-stage and multi-stage hydraulic drop to dissipate energy.

### **2.6.2.2 Roadway underdrainage scheme**

Main sources of ground water: retained water penetrating from the ground and not reaching the under layer; frequent phreatic water under the ground; fissure water flowing along the fissure of rock stratum; still interbedded fissure water in the broken sedimentary rock.

The underdrainage facility of roadbed is mainly to collect water flows by way of seepage and to drain from the roadbed nearby. For roads in a township or county, blind drain and underdrain are usually used. With the emergence of new materials, geotextiles may be used to drain the ground water from economic consideration.

#### **(1) Blind drains**

When the roadbeds confront some spring (spring welling up) and detour is unfeasible, ditches are to be built between the mouth of a spring and water outlet and blind drain or concealed conduit constructed to let the spring flow out of the fill slope toe or to drain it through digging a square side ditch. The blind drain is about 20cm high and 20-30cm wide. As for well depth, the depth of fill on the top of cover plate should be  $\geq 50$ cm, and the longitudinal gradient at the bottom of trench is suggested to be  $\geq 1\%$ .

#### **(2) Underdrains**

Seepage is used to collect ground water in the ditches and to drain the water to the designated place through channels at the bottom of trenches. Underdrains play a great part in dewatering the surface soil, increasing the slope stability, cutting off the ground water for diversion, lowering ground water and preventing the fine soil underground from being washed away. The rock-fill underdrains (blind drains) of longitudinal gradient 5% are frequently applied, and the groove width depends on the ditch depth. If the ditch depth is 2m, the width

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should be 0.6-0.8m; but if the ditch depth is 3-4m, the width should be  $\geq 1$  m. The gravel packing used for draining and water seeping in the ditch should be filtered and washed.

(3) Horizontal drain pipes (holes)

Horizontal drain pipes may be inserted into the water-bearing layer to release the hydrostatic pressure in the slope and increase the slope stability. Generally, a perforated plastic drainpipe with a diameter of 50mm is drilled into the slope with a gradient of 10%-15%. The circular aperture of the perforated drainpipe is 10mm and the longitudinal spacing is 75mm. They should be arranged evenly in three lines around the pipe. The plastic drainpipes without holes should be applied to the area 1-10m from the water outlets, and the gap between the drill holes and drain holes should be blocked up with clay within the area at least 60cm from the water outlets.

(4) Blind ditches

Horizontal and longitudinal blind ditches may be built inside the roadbed to avoid cutoff of ground water flow due to building of roadbed which may cause a difference of ground water level of side slope at both sides of the route, and to keep the seepage fields in the roadbed unchanged. At the time of setting up longitudinal blind ditches, inverted filters may be applied to one side of the upstream face and water-resisting layer may be applied to the other side, while a water-resisting layer is needed at both sides of the horizontal blind ditch to let the ground water flow through the route without affecting the roadbed stability.

### **2.6.2.3 Cross drainage**

Drainage facilities such as side ditches and intercepting ditches will be used to cut off the water flowing from the slope to and on the roadbed sectionally, i.e. letting the surface water on the upper side of the roadway (or roadbed) flow across the roadbed to the natural cleugh, wasteland, borrow pits or swales on the lower side of the roadway. If the water diversion is obstructed, the slope toe of roadbed will be washed out and the pavement destroyed. So the construction of a cross drainage device, e.g. a culvert, is necessary. The factors such as depth of fill on the top of the culvert, design flow, foundation status, vehicle load, existing waterway in the upstream and downstream regions, highway classification and terrain should be taken into consideration at the time of choosing and designing a culvert.

### **2.6.2.4 Drainage of road section passing through the town**

Reasonable drainage measures for the road section of the town will not only minimize the damage of the rainwater to roadbed and pavement, prolong their service life, but will also

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improve the traffic capacity greatly. According to the data, the main subgrade drainage facilities of the existing rural roads should include earthy side ditches, rectangular and trapezoid mortar side ditches. The decentralized drainage through road humps and cross slopes is applied to surface drainage. There are many drainage methods for the road section passing through a town, but those frequently used are side ditches with cover plates, side ditches with parapets, etc.

(1) The method of side ditches with cover plates

The method is to cover the side ditches at both sides of the road passing through the town with plates for fear of blockage of side ditches and for pedestrians' convenience. For surface drainage, drain opening may be applied to intensive drainage as needed, or make slotted holes on the cover plates for drainage. The top of the cover plates with slotted holes is usually flushed with the pavement, so the rainwater can flow to the cover plates along the road hump and then flow into the side ditch through the slotted holes on the cover plates. The cover plates without slotted holes are usually set up combined with kerbs. There is a drain opening every other 20m at the side of a kerb, and the surface water flows into the side ditches along the drain opening. The mortar rubbles and brick structure are usually applied to side ditches. This method is suitable for the road section passing through the town with a small traffic volume or small transverse interference.

(2) The method of using a side ditch with parapet

The method of using a side ditch with parapet combines a side ditch for drainage with parapet for isolation. Openings on the parapet and cover plates on the side ditch are needed accordingly at a certain distance, so pedestrians could walk through. This is one of the effective measures for the arterial highway passing through the town with a large traffic volume. Mortar rubbles, bricks and mortar surface are usually applied to brickwork like parapets and side ditches. The sign “«” is painted on the side of the parapet in red and white color to show the driving direction. In addition to parapets, hedges or metal barriers can also be applied for isolation. As the side ditch is not covered with a plate, maintenance should be strengthened and sundries and garbage in the side ditch should be cleared away timely, so as to ensure the drainage unblocked.

### **2.6.2.5 Cleaning, maintenance and inspection of drainage**

Whether the roadbed drainage system can work normally affects the stability of roadbed directly. Therefore, the strengthening of daily maintenance of the drainage facilities is a key point to ensure the stability of roadbed.

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Before the corn snow, especially before the flood season and in the rainy season, the drainage facilities such as side ditches, intercepting ditches and blind ditches must be dredged to keep the water flowing smoothly and prevent the rainwater from destroying the embankment intensively. Extensive inspection should be implemented after rainstorms. Timely repair and reinforcement are needed in case of washout or damage; and timely dredging is necessary in case of blockage.

As for earthy side ditches, a regular design section should be ensured to meet the requirement of drainage, and attention must be paid to outfall setting and unobstructed drainage. A longitudinal gradient of no less than 0.5% at the bottom of trench should be ensured, and no less than 0.3% for the road section in flat area with drainage difficulty. Crops can not be grown in the side ditches, not to mention using the side ditches as a channel for irrigation.

## **2.7 Environmental Code of Practices for Bridge Construction**

### **2.7.1 Management measures**

(1) Supervising organization of environmental protection. The employer should initiatively cooperate with the administrative department of environmental protection, and establish an environmental protection management office in order to be responsible for the inspection and supervision of environmental protection measures and the implementation of the employer at the construction stage.

(2) Monitoring of the environmental protection during the construction. The administrative department of environmental protection will conduct real-time monitoring of the deforestation, land occupation, water and soil loss, noise pollution, air pollution, water pollution and landscape devastation during the construction, and instruct the employer to rectify and reform in case of exceeding standard or any behavior adverse to environmental protection.

(3) Giving full play to the supervisory role of the supervising engineer. The supervising engineer should check whether the environmental engineering design is implemented, whether the quality meets the requirements and whether the environmental engineering funds fall into place; and should cooperate with the functional department of environmental protection in detecting and supervising the environmental protection during the construction.

### **2.7.2 Measures for reducing water and soil loss**

(1) According to the actual excavation-and-fill soil texture, reasonably setting the

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gradient of side slope and temporary drainage system at the excavation-and-fill construction site of earth and stone, and timely dredging the rainwater to relieve the washout of rainwater to the excavation-and-fill soil slope. The fill slope should be timely tamped and slope greening is needed. The place for borrowing or spoiling should be confirmed reasonably, the aggregate site should be exploited reasonably, and the dressed stones, discarded soil and waste should be sorted and disposed.

(2) When selecting places to stack earth and stones, the redundant earth and stones should be laid on the slop surface of the spot. If the earth and stones have to be taken out, they should be carted to a designated place without nature conservation value. The discarded soils should not destroy or cover ground flora.

### **2.7.3 Measures for preventing air pollution**

(1) The wastes on the construction sites should be cleared timely. Appropriate watering is needed to reduce flying dust. Littering at will should be prohibited. Coke buttons, brick rubbles or concrete may be paved on the surface of the temporary access road to reduce flying dust; meanwhile, the road surface destroyed by construction should be repaired at all times to prevent floating dust.

(2) Regularly sprinkling the construction site to shorten the time of flowing dust pollution, and reduce the pollution scope and minimize dust emission.

(3) The constructors suffer most from the environmental and air pollution in the process of construction, so the employer should take preventive and labor protection measures for the constructors emphatically, for instance, shortening working hours and providing dust masks, etc.

### **2.7.4 Measures for preventing water pollution**

(1) The sedimentation basin is necessary at the site where concrete and mortar are mixed. The waste water discharged into the sedimentation basin will be recovered after double sedimentation for dust suppression. The untreated muddy water can not be discharged into the river and sewage pipeline directly.

(2) The silt and top soil should be cleared away from the roadbed, and then recycled back to the road or shipped to the designated place for stockpiling; the discarded stones and soil should be shipped to a reasonable place, and should not be stacked at random or stagnate the river course; as for the cofferdam of a bridge, the cofferdam soil should be cleared away and

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shipped out after the completion of construction, for fear of blocking the river channel.

(3) Simple and effective oil separators are needed for sewage from the temporary canteen at the construction site. The sewage generated will flow through the oil separator through the sewer pipe. At ordinary times, people should strengthen management and dispose the oil regularly to prevent pollution.

(4) The construction of pile foundation works should be conducted in the dry season rather than flood season.

### **2.7.5 Measures for preventing noise pollution**

(1) The employer must use the construction equipment and transport vehicles up to the relevant national standards, and should try to use the construction machinery and technology with low noise. The vibration attenuation engine base should be installed on the fixed mechanical equipment that vibrates excessively, and the blimp should be applied to the fixed strong noise source (such as generator car). Meanwhile, the maintenance of various construction equipments should be strengthened for proper functioning, so as to fundamentally reduce the noise source.

(2) Loud construction machinery should stop working at night (22:00-06:00). For the construction site where continuous construction and operation are necessary, the employer must get in touch with the local environmental protection department in time according to the specific situation and to apply for the Night Construction Permit in accordance with the regulations, and should put up a notice to enlist support from the masses. If there are groups of residents within 50m around the site, then transportation of building materials on the service road at night should be prohibited.

(3) Processing and manufacture of finished products or semi-finished products, which will generate strong noise, should be finished in the factory or workshop, so as to reduce the noise generated from field processing and manufacture.

(4) The management of construction site should be strengthened, especially the noise from man-made beating and shouting should be eliminated to prevent the residents from being disturbed.

(5) In order to ensure the constructors' health, the employer should reasonably arrange workers to take turns to operate the construction machinery with intense radiation and strong noise, so as to reduce their time to contact noise. For constructors close to the intense

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radiation and strong noise source, their working hours should be shortened appropriately apart from the labor protection measures, such as wearing earplugs or helmets.

(6) The development unit should instruct the employer to announce a complaints hotline, and the employer should promptly get in touch with the local environmental protection department after receiving a report, with the aim of settling various environmental disputes without delay.

## **2.8 Environmental Code of Practices for Pipe Culverts**

### **2.8.1 Classification and applicable conditions of pipe culverts**

(1) Culverts are divided into stone culvert, concrete culvert, reinforced concrete culvert, steel corrugated culvert, etc. according to building materials.

(2) Culverts are divided into pipe culvert, slab culvert, arch culvert, box culvert, etc. according to structural patterns.

(3) Culverts are divided into open culvert and buried culvert according to the depth of fill. It is called open culvert when the depth of fill on the top of the culvert is less than 0.5m, and buried culvert when greater than or equal to 0.5m.

(4) Culverts are divided into three types according to the hydraulic properties, namely inlet unsubmerged culvert, inlet submerged culvert and outlet submerged culvert.

The reinforced concrete culvert has better adaptability to the roadbed and mechanical performance, with a simple structure. Generally, a single span is applied, but no more than three bores at most. The reinforced concrete culvert is suitable for the small-span buried culvert with enough depth of fill in the area lacking building stones; the reinforced concrete slab culvert is suitable for an area without building stones and open culvert or buried culvert with a large discharge area; the arch culvert is suitable for crossing a trench or high-fill embankment; the reinforced concrete box culvert is suitable for soft soil roadbed; the stone slab culvert is suitable for small culvert rich in building stones and with small discharge area; the inverted siphon pipe culvert is suitable for irrigation canal when the cutting excavation height can not meet the requirement of clearance of aqueduct, and not suitable for flood discharge channel; and the steel corrugated culvert is suitable for the roadbed with low bearing capacity of foundation soil or with obvious settlement and deformation.

### **2.8.2 Analyses of impact of pipe culvert construction on the environment**

(1) The unreasonable culvert design and unsatisfactory discharge capacity may result in flooding of roads, damage of pavements and roadbeds, etc.

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(2) The noise from construction machinery, dust, waste water, earth and stone, ground excavation, etc. may affect the environment.

(3) The ineffective or neglectful culvert maintenance may result in blocking and loss of discharge capacity of culverts, and, esp. destruction of a roadbed, flooding of roads, damage of pavements due to long-term immersion in water, etc.

### **2.8.3 Environmental code of practices during the pipe culvert construction period**

#### **2.8.3.1 General provisions**

(1) To evaluate work by regarding each culvert as a subdivisional work. The construction quality of each part and procedure must be strictly controlled in the process of construction.

(2) The requirement of filling on the culvert should be the same as the roadbed.

(3) For the channel whose span or overall length is up to the standards of culvert, the quality may be evaluated referring to the standards in this chapter.

(4) For the culvert with chute, the quality of culvert and chute may be evaluated respectively, and then an average will be taken.

(5) The quality evaluation of the precast concrete units (such as pipe joint and cover plate), pile foundation of culvert and reinforcement of box culvert should be conducted according to the relevant standards.

(6) The construction time should be strictly controlled. If there are residents living at the construction site, construction from 12:00 to 14:00 in the day and from 22:00 to 6:00 at night should be prohibited.

(7) Sprinkling at the construction site is needed to prevent flowing dust pollution.

(8) A sedimentation basin should be built at the construction site, and the industrial wastewater should be recycled after the sedimentation, instead of being drained off.

(9) The earth and stones generated should be removed as filling materials, and the redundant parts should be shipped to the designed place for stacking. Dumping and leaving about should be prohibited.

(10) The surface soils dug up should be stockpiled with a bumper plate, and should be backfilled after the construction, and then revegetation is necessary.

#### **2.8.3.2 Code for practice of pipe culverts**

(1) The bought-in reinforced concrete circular tubes, whose quality must meet the design requirements specified by the construction specifications, may be installed after the site acceptance. The precast pipe joints may be installed after being evaluated to be qualified according to the relevant standards.

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(2) The slit width of a pipe joint and choke materials should strictly meet the requirements of design and specifications.

(3) The bearing capacity of the foundation soil must meet the design requirements.

#### **2.8.3.3 Slab culverts and box culverts**

(1) Only the precast cover plates which have been assessed to be qualified may be installed. The concrete quality of a box culvert must meet the design requirements specified by the specifications.

(2) The settlement joint, waterproof layer and back filling behind an abutment should be constructed according to the construction specifications and design requirements.

(3) The culvert abutment's bearing capacity of foundation soil must meet the design requirements.

(4) When used as channel, its clearance must meet the design requirements.

#### **2.8.3.4 Arch culverts**

(1) The masonry or pouring of an arch ring should meet the code requirements.

(2) Only when the arch ring is up to the intensity required by the design, the shelf may be taken down and the soil may be backfilled. In case of a fissure in the arch ring, it must be dealt with after the cause is found out.

(3) The settlement joint, waterproof layer and back filling behind an abutment should be constructed according to the construction specifications and design requirements.

(4) The culvert abutments' bearing capacity of foundation soil must meet the design requirements.

#### **2.8.3.5 Inverted siphons**

(1) The waterproofing work should be applied to the pipe joints and seams of entrance and exit to avoid leakage. Water filling test should be conducted before the filling.

(2) The quality of pipe joints must meet the construction specifications and design requirements. Only the precast pipe joints which have been assessed to be qualified according to the requirements in section 6.13 may be installed.

(3) The bearing capacity of foundation soil must meet the design requirements.

#### **2.8.3.6 Bridges and culverts to which the jack-in method is applied**

(1) The foundation bottom should be solid with enough bearing capacity.

(2) Construction with water should be prohibited.

(3) The abutment walls of a working pit must be perpendicular to the axis of the bridge

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and culvert, and should have enough strength to bear the jacking force.

(4) Waterproofing work should be applied to the seams according to the design requirements.

## **2.9 Environmental Code of Practices for Preventing Water and Soil Loss**

The principles should be carried out of “combining soil and water conservation work with main work of road building; laying equal stress on the main work and ancillary work as well as temporary work; putting prevention first; treating comprehensively; treating both symptoms and root causes; integrating treatment with prevention ” when preventing water and soil loss in road construction project. Meanwhile, soil and water conservation facilities should be arranged reasonably according to local conditions with an emphasis on actual effect; soil and water conservation during the construction should be highlighted; afforestation and reclamation of the borrow area and spoil ground should be emphasized; and the spoil ground should be fenced before the spoiling.

### **2.9.1 Soil and water conservation measures and construction arrangement**

#### **(1) Arrangement of control measures**

Water and soil loss which may result from project construction mainly occur in roadbed area and spoil ground. As the construction time of the roadbed construction area is the longest, slope treatment and layout of drainage works should be the emphases of prevention; and the prevention measures of the spoil ground should focus on temporary blocking, drainage facility and vegetation recovery.

#### **(2) Arrangement of construction progress**

Water and soil loss which may result from project construction mainly occur in the project construction period. As water erosion predominate the types of erosions, prevention should focus on the drainage of rainwater. As the main work is designed with impeccable rainwater system, some rainwater system should be put into practice in advance through connecting the natural channels and existing drainage facility, for the purpose of giving a full play to the functioning of water and soil conservation.

### **2.9.2 Control area of the main project**

Water and soil loss which may result from project construction mainly occur in the periods from roadbed filling to the completion of pavement construction. A lot of soil and stones will be transported in the process of roadbed filling, and the loose soil may slip off easily; after the construction period, as the pavement is compacted by rolling, and the flow rate becomes larger, the road runoff will wash the roadbed slope. The gully erosion is the

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main type of soil erosion, accompanied by extensive surface erosion and rain splash erosion. Consequently, the emphases on preventing water and soil loss in this area include drainage of both sides of the roadbed, slope protection and temporary protective measures during the construction.

#### **2.9.2.1 Construction requirements:**

(1) Side ditches of roadbed should be prior to the roadbed filling, so as to reduce the influence of roadbed filling on both sides;

(2) Slope protection should be conducted in time after the roadbed forms;

(3) Drainage ditches and desilting basins should be dredged regularly in the rainy season, and the silt soils should be paved on the filling slope and then compacted;

(4) If an irrigation canal is occupied by the roadbed, it should be rechannelled and dredged as soon as possible to avoid an ill effect on normal agricultural production.

#### **2.9.2.2 Protective measures:**

(1) Stripping and protection of surface soil

Principles of piling up surface soil: Surface soil cannot be piled up at places where surface runoffs meet; where the construction may be affected or the road is unobstructed; where the vacant land is of high elevation, in order to reduce the work amount of protective measures. The surface soil piled up for a short time refer to those stripped from the farmland before the roadbed filling, and will be used for slope greening in a later period. The surface soils should be piled up temporarily within the scope of land acquisition at both sides of the roadbed. In order to prevent the soil from slipping off, woven earth bags should be employed around the mound for retaining purpose.

(2) Water retaining ridges at the road shoulders and temporary chutes

When the roadbed forms after filling, ridges should be built at the road shoulders and chutes on the side slopes. Then the road runoff will be led to the chutes to avoid washing the side slope. Ridges may be built with redundant soil from the road shoulder during roadbed filling, with a width of 0.2m and a height of 0.1m. A chute should be built every other 100m with a dishing section, and with a width of 0.3m and a depth of 0.15m. A mortar should be used to protect the surface in the range of 1m from the entrance, with a thickness of 0.05m and a gradient of 2%. As for the surface protection of chutes, mortar (3cm), color bar or woven bags may be used. Investigations show that the mortar top has the characteristics of simple construction, lasting protection, effortless removal, etc.; although the color bars cost less, they are difficult to stick to the ditches, and need maintenance due to the unstable

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protecting effect; it's difficult to use woven earth bags to protect the surface, and woven bags are easy to be weathered and then lose the function of water proofing.

(3) Desilting measure

A desilting basin should be built at the exit of drain ditch of the roadbed.

### **2.9.3 Control area of concrete mixing stations**

#### **2.9.3.1 Construction requirements**

(1) A concrete mixing station should be built according to the principles of “less stationing and concentrated construction”, and the temporary occupation of land should be minimized;

(2) Land of a higher elevation should be chosen to build a concrete mixing station, in order to avoid the scouring of water outside;

(3) The ground of concrete mixing station should be hardened with cement;

(4) The necessary measures for prevention and suppression of dust should be applied to the concrete mixing station; for instance, the dust keeper should be applied to the cement container, etc;

(5) The concrete mixing station should be regularly sprayed to suppress dust on sunny days (dry days);

(6) The desilting basin should be dredged in time, and the silt soils can not be piled up around the desilting basin at will.

#### **2.9.3.2 Protective measures:**

The prevention emphasis of a concrete mixing station is the surface water in the area. Because of the frequent passing vehicles and need of stockpiling, the area is suggested to be wholly hardened with cement. The area should be piled up with lots of gravel and the surface water contains more mud and sand on rainy days; besides, the waste water, which contains more cement after cleaning the cement tanker and mixing equipment, will pollute the water if discharged directly. Therefore, a desilting basin should be built at each concrete mixing station, and surface water in the area will be utilized comprehensively after sedimentation in the desilting basin.

The land will be reclaimed at a later stage of the engineering. The main tasks are to remove the construction facilities, to clear the building materials such as pebbles and sand spilled in the process of concrete mixing, and to afforest or reclaim the land where the project is located for recovery as far as possible.

### **2.9.4 Control area of access roads**

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The access roads of this project refer to the channels used for transportation of building materials and wastes. In case a new access road needs to be built, the waste land or dry land should be chosen preferentially. Meanwhile, the range of access roads should be narrowed as much as possible, so as to minimize the damage of temporary land occupation to vegetation and soil

#### **2.9.4.1 Construction requirements**

(1) The existing roads should be chosen as the access roads, and should be widened and hardened with the invested funds after consultation with the local department for a win-win result;

(2) Heavy excavation and land along the river should be avoided when building a new service road;

(3) Sprinkling is regularly needed for dust suppression on sunny days and windy days.

#### **2.9.4.2 Design of protective measures:**

Drainage ditches should be built at both sides of an access road, and the trapezoidal cross-section of type II should be selected.

#### **2.9.5 Temporary waste control ground**

(1) The site selection of spoil ground should be emphasized; when the waste ground destroys the existing vegetation or change the original gradient and result in a bare slope, afforestation and reclamation are needed.

A swale, waste ravine, waste land or other fields, rich in reserves and with a low elevation, and not to be scoured by water flow, should be selected as a temporary waste ground, which should not be built on a piece of basically farming land, forest land or other fields that may result in geological disasters or roadbed problems. The temporary waste ground should not be built in a debris flow gully, or above a sliding mass, etc.

(2) Temporary waste grounds should be afforested, reclaimed or utilized comprehensively in time after their functions have been performed. The renovation requirements are as follows:

The surface soil should be stockpiled somewhere before the the place is used for dumping mud and debris, and then re-put into place; and the place will be reasonably utilized thereafter according to the land quality, irrigation conditions, climatic characteristics, production function and planning conditions.

(3) Waste and slope protection works for the waste ground should be reasonably

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confirmed according to the location, nature and estimated height of dumped debris, etc. A waste dam should be built when the dumped debris or soil is piled up in the trench.

(4) The drainage system for a waste ground should be set up after the overall consideration of the terrain, geology and hydrologic conditions of the borrow area, and of facilities such as canal and farmland irrigation, so as to avoid the water flow scouring the soil mass or changing the conditions of surface runoff, and to avoid the scouring of farmland and sloping field. The spoil ground located in a ravine or sloping field must have impeccable drainage facility; when there is a confluence around the spoil ground, the water flow may be channeled and discharged through interception and drainage.

In addition, when recovering the vegetation of the control area of main work, control area of an access road, control area of concrete mixing stations and temporary waste ground after the completion of the project, native species rather than alien ones should be replanted.

## **2.10 Protective Measures for Social Environment Impact**

The negative social interference during the project construction refers to the impact on the production and life of the residents nearby. The impact is mainly from the connectivity of water conservancy, connectivity of branch lines, construction noise, dust, construction waste and household garbage, etc.

### **2.10.1 Connectivity of water conservancy system**

The project involves rural roads, along which a large number of water conservancy facilities such as farmland irrigation canals are distributed. Therefore, during the project construction, the connectivity of water conservancy facilities such as farmland irrigation canals along the roads must be fully considered to ensure that they will not be affected by the project, and the following measures should be taken.

(1) For the road sections where the project and the farmland irrigation canals intersect, buried closed conduits or slab culverts should be applied to ensure the connectivity of the farmland irrigation canals.

(2) For the road sections where the farmland irrigation canals parallel the road, the farmland irrigation canals should be hardened. Thus the roadbed can be protected and, on the other hand, the water for farmland irrigation will not leak to the road due to the project construction.

(3) After the completion of construction, the employer should repair the rural roads and canals damaged during the construction, or compensate the local government appropriately, in order to protect the legitimate interests of the local government and residents.

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### **2.10.2 Connectivity of branch lines**

This project is for the convenience of the people nearby to move around and for cargo transportation. Therefore, the connection between the main line and branch lines covering the surrounding villages should be earnestly considered in the design. When the technical standards are met, smooth and safe connection between the branch lines and main line could be ensured.

### **2.10.3 Organizational planning of construction transportation**

A reasonable construction scheme should be worked out during the project construction period, and a half-range construction scheme is applicable. A warning sign should be set up at the construction section, and two traffic wardens should be arranged to disperse the traffic so as to minimize the adverse impact of road construction on the traffic capacity along the road. Meanwhile, the impact of all-over road construction on the transportation should be avoided. If the construction of a whole road section needs to be conducted, a temporary passage should be built before the construction.

### **2.10.4 To Restore Water Supply by Affected Wells**

Water cellars are of the most severely affected among the water supply systems distributed along the project in Liangzhou District. The EIA investigation discovered as many as 50 cellars had been demolished.

Rural drinking water projects are presently under progress in Liangzhou District to take place of the cellars and wells to provide water to the residents. Running water will run through pipelines to each administrative village.

The construction of the planned drinking water systems will last for quite a long period of time. It may not be fully completed before this project starts. Therefore, the EIA requires that the responsible affiliations should make transitional plans, excavating wells near the demolished ones to provide water to the local residents.

Compensation for the relocated wells has been specified in the Resettlement Plan made by Hohai University.

## **2.11 Environmental Code of Practices for Noise Control**

The noise sources will have different effects on the acoustic environment quality of the project area at different stages of the construction, so the management should be strengthened and corresponding environmental prevention measures taken to minimize the effects.

- (1) Advanced and reliable low noise equipment should be selected.
- (2) The construction should start from 6:00 in the morning to 22:00 in the evening, and

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should be prohibited from 12:00 at noon to 14:00 in the afternoon during the noon break period. Meanwhile, construction at night should be restricted. If continuous construction at night is really necessary, a certificate should be issued by the administrative department of construction after the approval of local environmental protection department of, and the residents nearby should be notified.

(3) The construction period should be arranged reasonably. Large machineries with loud noise can not be operated in the same time at the same construction site. Construction progress should be accelerated against time, and the time of noise effect should be shortened to minimize the impact of construction noise on the operating personnel.

(4) Basic shock absorption or shock mount should be applied to the mechanical equipment with strong noise through wrapping it with some damping material.

(5) The noise from vehicle transport may have a certain influence on the acoustic environment of the sensitive points along the road. Therefore, the employer should strengthen the constructors' awareness of environmental protection and of local folk customs and living habits, so as to arrange the transport time reasonably, with measures to limit the speed and prohibit the use of honing from the construction machinery in the environmentally sensitive section like a residential area, so that the results of preventing and mitigating the noise effect can be achieved.

(6) Mechanical equipment with a strong noise should be placed on one side of the construction sites far away from the residential areas. A screen with noise reducing function should be built at the construction site less than 5m from the dwelling houses or schools.

(7) The employer should reasonably arrange for the constructors to shorten the workers' time to operate machinery with a strong noise. The constructors may be provided with earmuffs to mitigate the effect.

(8) All mechanical equipment should be maintained and repaired regularly and effectively to achieve the aims of maintaining good condition, reducing noise and extending service life.

(9) The requirements should be strict for the management of construction, for operators of machinery and vehicles, and for operation specifications, etc..

## **2.12 Flying Dust Management Measures**

(1) Access roads should be paved with macadam and sprayed regularly to reduce flying dust.

(2) Granular materials piled up at the construction site should be sealed or covered; and

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the surface of material piles should be sprayed according to the material property to suppress the dust actively.

(3) A fence-type barrier should be applied when the road construction passes environmental sensitive points (areas).

(4) Construction wastes should be removed with closed container handling vehicles, and throwing about in the air should be strictly prohibited. Construction wastes should be stored by category and then cleared and disposed in time according to the relevant regulations for systematic management of urban wastes, and appropriate sprinkling is necessary before garbage removal.

(5) The management of transport vehicles should be strengthened, and the vehicles which generate flying dust during transport should be covered with tarpaulins.

(6) The measure for suppressing dust through water spray should be taken for dismantling operation; and the muck should be removed within 3 days from the date of completion of dismantling operation according to the relevant regulations on management of dismantling work.

(7) Measures such as baffle plate or watering should be taken to keep out and suppress flying dust at the construction field.

(8) The earth from construction sites should be piled up at one place and covered; vehicles should not be overloaded in order to avoid dust scattering from jolting in transit.

(9) Measures to ensure the cleanness of vehicles should be applied to the entrance and exit of the construction sites. The dirt adhering to the surface of the vehicles should be cleared before the vehicles leave the construction site.

(10) Areas for the storage of materials and large templates at the construction site must be flat and solid.

(11) The construction site should be sprinkled with water and cleaned in time.

(12) The predominant wind direction and surrounding environmental protection goals should be taken into consideration to position the storage yard of granular materials or other main dust sources at the downwind direction 300m from the surrounding environmental protection goals.

(13) Incineration of all kinds of wastes should be strictly prohibited.

## **2.13 Solid Waste Management Measures**

### **2.13.1 Solid Waste Management**

(1) Construction wastes should be comprehensively utilized, in connection with the

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simultaneous small civil construction projects and road work in progress; the rest of the wastes should be piled up at the designated storage yard of the construction site, and then removed in time to the refuse landfill for disposal according to the construction progress.

(2) Construction wastes should be removed with closed container handling vehicle, and throwing about in the air should be strictly prohibited. Construction wastes should be stored by category and then cleared and disposed in time according to the relevant regulations for systematic management of wastes.

(3) Construction wastes should be appropriately sprayed with water before the removal.

(4) Household garbage should be collected in the garbage cans or garbage bags at the construction sites, and then removed to the refuse landfill of the project site for disposal.

(5) Mellow soil from the dumped soil should be used for reclamation and afforestation of the wasteland at the project site, and the remainder may be used as roadbed filling and padding at both sides of a canal in the neighborhood.

(6) Poisonous and harmful substances should not be burned at the construction site, but should be disposed according to relevant regulations.

### **2.13.2 Regulations for the Use of Asphalt around Dajingxia Reservoir**

1) Mixing asphalt and parking asphalt mixers are strictly forbidden on the road sections within the water source conservation.

2) We need to strengthen the management of asphalt materials, forbidding the storage of asphalt slag by the roadside, particularly on the road sections within the water source conservation.

3) Asphalt materials have to be transported in perfectly closed vehicles which are cleaned before driving on the road so as to keep the materials from spilling.

4) The machines paving the asphalt road must be operated, parked and cleaned according to the rules and regulations.

5) To rebuild the road, the asphalt will be stripped off the road and crushed to pave the new roadbed. The crushing field must not be deployed in the road sections within the water source conservation. Besides, the field for stocking the crushed materials must be made hard, impermeable and rain-proof. Cofferdams need to be built around the stocking field. What's more, the crushed materials must be carried to the construction sections and rolled to pave the roadbed in a timely manner.

## **2.14 Code of Practices for Water Environment Protection**

### **2.14.1 Types of sewage from road construction**

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Waste water generated during the construction and operation of roads mainly includes industrial wastewater (such as wastewater in a foundation pit, and wastewater from flushing the machineries, vehicles, building materials and concrete mixing equipment), sanitary sewage, waste road runoff, etc.

#### **2.14.2 Code of practices for water environment**

(1) The construction of foundation engineering of a bridge pile should be carried out in the dry season instead of flood season as far as possible.

(2) The contract for a construction project should specify the clauses for the prevention of spilling or leakage of road-building materials (such as bitumen, oil materials and chemicals). The storage yard should not be set up at the road section near a river, in order to prevent the road-building materials from being washed into the river along with the rainwater, and to avoid pollution of surface water.

(3) The storage yard of harmful construction materials such as oily materials and chemicals should be fenced and covered with tarpaulin to avoid the pollution caused by rain wash.

(4) The boring residue of a pile foundation and construction wastes should not be discharged into the surface water; the construction site near a river should have a necessary drainage ditch for the dredging of construction wastewater, and the soil slope of drainage ditch should be tamped in time.

(5) The construction wastewater should be recycled after treatment in a sedimentation basin.

(6) Advanced equipment and machinery should be used to effectively reduce the amount of running, springing, dripping and leaking, to reduce the frequency of mechanical maintenance, and thus to reduce the amount of oily sewage. In the process of unavoidable running, springing, dripping and leaking, solid oil absorption materials (such as cotton yarn, saw dust and oil-absorbing sheet) should be used to absorb the waste oil into solid matter to avoid excessive oily sewage. Greasy dirt leaked into the soils should be collected promptly with scraping apparatus and be sealed up, and then shipped to a competent site for centralized processing.

(7) Maintenance of machinery, equipment and transport vehicles should be centralized at the maintenance point of each road section as much as possible, for the convenience of collection of oily sewage; if the maintenance can not be conducted at the same time, as the amount of oily sewage is normally not greater than 0.5m<sup>3</sup>/d, all the oily sewage can be

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absorbed by and mixed with solid oil absorption materials, and then sealed up and shipped out.

(8) A horizontal sedimentation tank should be built at the construction site and the mechanical maintenance site to collect the oily sewage. After a simple treatment like acid-base neutralization, sedimentation, oil isolation and residue removal, the concentration of oils and other pollutants will be lower. The sedimentation tank should be buried with earth after the completion of the construction.

(9) After being packed and sealed up, the waste oil absorption materials collected should be shipped out together with other dangerous solid wastes from the construction site to a certified site nearby for disposal.

(10) The construction site should be far away from where rivers and other water bodies are concentrated. A modified septic tank should be set up near the construction site to separately collect the fecal sewage and catering washing-up sewage. The excrement should be used to fertilize the soil, while the catering washing-up sewage, after being treated in an oil separation tank, should be disposed with the fecal sewage in the septic tank, and then applied to the farmland after meeting the water quality standard of farmland irrigation. The septic tank should be regularly dredged by the commissioned villagers nearby, and buried with earth after the completion of the construction. Construction camps should be built in the residential areas along the road as far as possible, and sewage prevention measures should be taken to prevent the sanitary sewage from flowing into a river.

(11) Centralized and unified management should be applied to the dining and washing of the constructors, to reduce the amount of sanitary sewage. The use of detergent in the washing process should be limited to reduce the content of detergent in the sewage.

(12) During the construction, a retaining wall and drainage facility should be set up around the water well along the road to prevent the waste residues and sewage from entering the well. Meanwhile, temporary storage yards for waste or construction materials should not be set up within 50m around a water well, in order to avoid the adverse impact of wastes and construction materials on the water quality of the well.

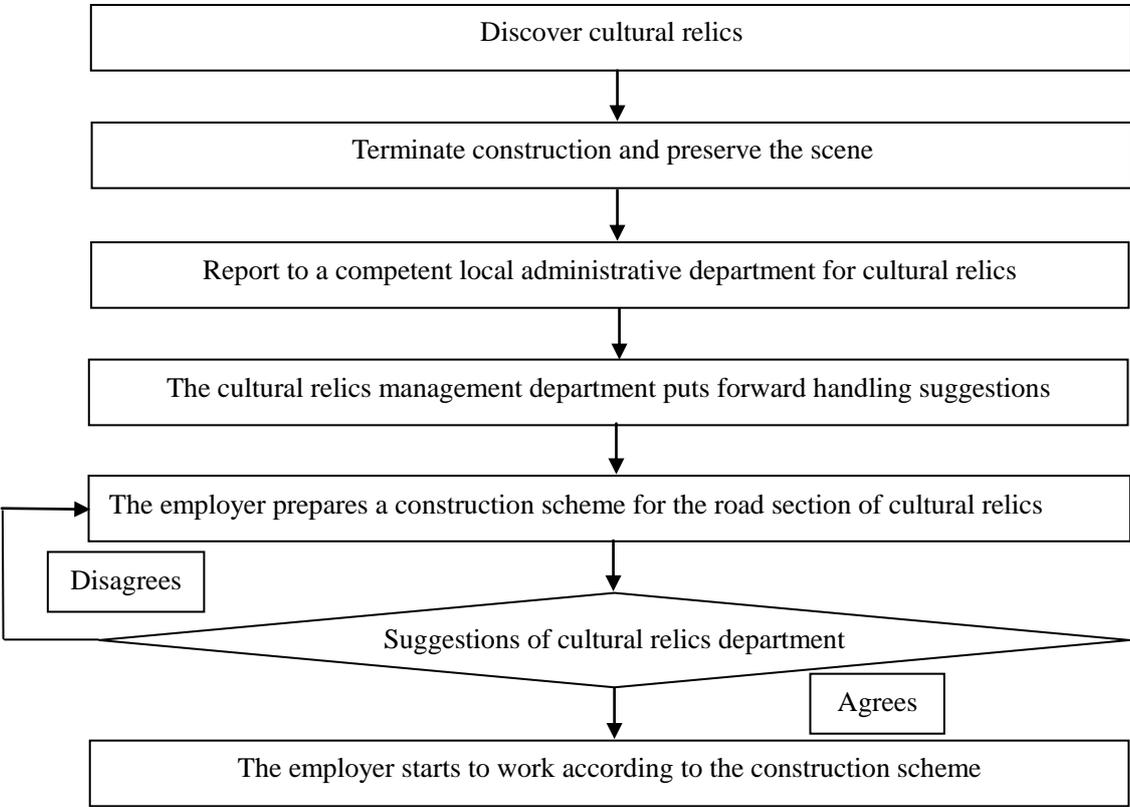
## **2.15 Code of Practices for Cultural Relics Protection**

In case cultural relics and historic spots are discovered or suspected to exist during the construction, the employer should immediately keep the scene intact according to the requirements of “Cultural Relics Protection Law of the People’s Republic of China” coming into effect on December 29, 2007 and chance-find procedure as per OP4.11 Physical Cultural

Resources. A report is to be submitted to the local cultural relics bureau, and construction can only be resumed after consultation with the cultural relics bureau. See Attached Diagram 2-1 for the reporting procedure for cultural relics.

In case cultural relics and historic sports are discovered or suspected during the construction:

- (1) The employer should terminate construction at the site where cultural relics are found and strengthen the protection of the scene;
- (2) The contractor should make a timely report to the police department and a competent department of cultural relics for identification and disposal;
- (3) The employer should delimit the scope of protection immediately once things are defined as cultural relics;
- (4) The employer should rescue and excavate the cultural relics due to the urgency of construction period or when facing dangers of natural destructions;
- (5) The rescue and excavation of cultural relics should be conducted by professionals with special equipment, i.e. the contractor should not excavate them without authorization;
- (6) Once it is confirmed to be a great discovery of cultural relics, demonstrations should be done on whether the project is to be constructed in another place.



**Figure 2-1 The reporting procedure of cultural relics.**

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## **2.16 Code of Practices for Safety and Health Environment**

### **2.16.1 Analyses of construction safety and health**

The employer and regulatory organization are responsible for taking all reasonable measures to ensure the personal safety of the workers and security of the buildings nearby, and to protect them from accidental harms from construction. The enterprise should employ a contractor that has the ability to manage the occupational health of employees and safety matters, and should also require the contractor to perform relevant risk management rules through a standard purchase agreement. The construction safety and health of this project include design and operation of general facilities, communication and training, personal risk supervision.

### **2.16.2 Measures for construction safety and health**

The employer has the responsibility to follow all national and local safety requirements and to take other measures which can avoid accidents, in order to ensure the constructors' safety and health.

(1) The integrity of all buildings within the construction site should be ensured; temporary buildings should be structurally safe and reliable enough to resist the hit of extreme weather of the region, and to isolate partial flying dust and noise, and to provide adequate lighting.

(2) The employer should make sure that it can give satisfactory first aid treatment. The construction site should be equipped with necessary first-aid tools; there should be written emergency procedures in a remote area, so patients can be transferred to a suitable medical establishment.

(3) Occupational health and safety training should be conducted for all new constructors, to introduce to them basic working rules, physical protection rules and ways to protect co-workers from injuries.

(4) Danger areas (such as switching room and compressor room), devices, materials, safety measures and emergency exits should be equipped with clear and correct signboards.

(5) If the workers' hands and arms suffer from vibration due to the use of manual tools or electric tools, or their whole bodies are being vibrated when standing or sitting on the vibratory surface, the vibration should be controlled through a selection and installation of an anti-vibration pad of damping devices, and exposure time should be limited.

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(6) The danger of nipping should be eliminated when designing a machine to make sure that the projecting part of machinery will not do harm to a human body under normal operational circumstances.

(7) Warning boards should be placed on all galvanical electric actuators and electric wires; all wires, cables, manual and electric tools should be checked to avoid frayed and exposed wires, and the allowable maximum working voltage of manual tools should be confirmed according to suggestions of the manufacturer; double insulation and earth connection should be applied to all electrical equipment used in a humid (or likely humid) environment.

(8) All operators participating in or assisting the welding should be provided with eye protection equipment (like welding goggles and/or masks).

(9) The protective barrier should be installed at the edge of fragile and dangerous area (one rod in the middle and baffle plate around); meanwhile, the constructors should use a fall prevention device (including safety belt and distance limit lanyard).

(10) The employer should determine and offer suitable personal protection equipment to the constructors to adequately protect the workers themselves, other workers and occasional visitors, and should avoid the inconvenience to the users.

(11) The employer should establish the procedure and system of reporting and recording occupational incidents and diseases, accidents and dangerous situation.

(12) The health education for constructors should be implemented, including implementing the strategy of information communication, strengthening face-to-face consultation, solving systematic problems affecting individual behaviors, encouraging individuals to take protective measures, such as using condoms, to avoid passing on diseases to others. In addition, the constructors should be encouraged to use anophelifuge's clothes, mosquito nets and other things to prevent the spread of diseases by mosquito bites.

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**Appendix 3:**

## **Regulations of Environment Management in Operation Stage**

### **3.1 Implementation Regulations of Environment Management in Operation Stage of Bridges**

(1) The main responsible subject shall be specified, and its responsibility shall be strengthened.

In the maintenance and management of highway bridges, the system of “unified leadership and management at different levels” is practiced, in which the administrative leaders and specific technical personnel in charge of the maintenance and management work shall be specified, and their respective responsibilities shall be determined properly, according to the principle of "consistent authority and clear responsibility" as well as to the division of departments responsible for supervision and departments responsible for maintenance. The concrete details are as follows:

a) The Transportation Bureaus of the city, district and county are the supervising subjects of all bridges and the maintaining subjects of bridges in the county roads and important country roads in their respective jurisdictions. They should be responsible for raising funds for bridge maintenance, supervising the highway maintenance and management of the bridges on the county and country roads by the maintaining and managing stations of towns, and providing technical guidance; and according to the rules, they should also be responsible for checking the technical condition assessments of the bridges of Class D and E, and working out technical schemes and countermeasures for major, medium repairs and reconstruction projects of the bridges in bad and dangerous conditions.

b) The township highway maintenance and management stations are the maintaining and managing subjects of the bridges on the rural roads in their respective jurisdictions. They are responsible for daily minor repairs and maintenance of these bridges, and disaster relief work, organizing frequent and periodic inspections, and reporting immediately the damages of the bridges caused by natural disasters and other factors under their jurisdictions without delay. At the same time, they should submit applications about the bridges for special inspections, establish a double post responsibility system of "responsible administrators and technical persons", and put up bulletin boards at the bridges judged in dangerous conditions.

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c) The department responsible for maintenance and management shall bear the main responsibility should any problem of bridge safety occur because it does not maintain and manage the bridge properly so as not to get the accurate information of the technical condition of the bridge according to the related regulations or does not take timely preventive measures.

(2) The effort of inspection shall be strengthened and the work of maintenance shall be done in time to ensure the bridge safety.

a) Frequent inspections refer to daily perambulations and inspections of the technical conditions of the deck facilities, superstructure, substructure, and attached constructions of the bridges. The inspections should be carried out with eyeballing and simple tools, usually not less than one time a month, and more frequent in flood seasons. (b) Periodic inspections refer to regular follow-ups and comprehensive checks of the technical conditions of main structures and affiliated constructions of bridges and the assessment of their technical conditions according to the rules. Such inspections should be carried out by manual eyeballing together with simple tools, and not less than one time every three years, and as for bridges with special structures, this kind of inspections should be done once a year.

Special inspections refer to evaluation of the technical conditions of bridges in specific circumstances, which aims to find out the causes of diseases, damage degree, load-carry ability or their resistance against natural disasters. In this kind of inspection instruments should be used to judge the bridges' damage degree, causes of diseases, load-carrying ability or resistance against natural disasters scientifically and clearly by means of tests and experiments combined with theoretical analysis. And then the corresponding maintenance and treatment measures are proposed according to the results of tests.

Minor repairs and maintenance to the bridges of Classes A and B should be strengthened to prevent obvious bridge diseases according to the results of inspections. Intermediate repairs should be carried out to the bridges of Class C to prevent the damages from getting worse and affecting the safety of bridges according to the results of inspections. For bridges of Classes D and E, types and numbers of necessary warning signs and management measures should be clearly decided according to the results of the special inspections, technical analyses and relevant regulations and rules of bridge safety, and then major repairs or reconstruction work should be arranged.

(3) Supervision should be strengthened and safety risks to the bridges should be eliminated in time.

a) As the supervising subjects of highway bridges in their respective jurisdictions, the municipal, district and county transportation bureaus should supervise and inspect the

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maintenance and management of bridges according to the relevant laws and regulations. Township highway maintenance and management stations shall conscientiously accept the supervision and inspection carried out by county transportation bureaus according to the law, and must not shirk and reject out of any reasons.

b) When supervising and inspecting the maintenance and management of bridges, the municipal, district and county transportation bureaus must get well down to the site of maintenance and management, ensure that the maintenance plans and the maintenance work are carried out, and assess the technical conditions of the bridges and eliminate safety risks in time through necessary technical measures. They should immediately instruct the units concerned to correct if any safety problems are found. After the inspections, they should feed back their opinions to the relevant departments in written form.

### **3.2 Regulations of Environment Management Implementation in Operation Stage of Pipe Culverts**

(1) Timely repair is necessary if the paving part at the bottom and entrance of the pipe culvert is damaged, out of shape or caves in. Besides, upstream and downstream grooves should be renovated to ensure a relatively smooth and appropriate gradient for the flow.

(2) Cracks at the junction between the outlet of the pipe culvert, the water drop and the steep slope can be filled with dry oakum saturated with asphalt so that they are connected tightly into a whole.

(3) Inverted siphons that are easy to crack and leak need careful checking in particular. Inverted siphons that have damp patches should be stopped using and excavated for repair. For example, change the softened subgrade filling and cracked pipes, anyway, the joint should be filled tightly.

(4) Dry oakum saturated with asphalt should be used to fill the cracks at the joint parts of pipe culverts and hinge points of four hinge culvert pipes and then filled tightly if the fillings peel off and could not be repaired with mortar.

(5) The leaking part of the ceiling of a masonry arch culvert should be excavated and filled with high-strength cement mortar and then a 10-15cm thick waterproof layer of cement or asphalt felt. The whole process of repairing must be carefully and meticulously conducted to prevent the ceiling of the arch culvert from leaking again.

### **3.3 Regulations of Water Environment Management**

(1) Drainage ditches and safety barriers must be constructed in drinking well areas during the operation period to prevent the initial rainfall and accident drainage from running

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into potable water wells and affecting the water quality.

(2) Vehicles of leakage and overload in bulk are forbidden on the road in order to prevent the scattered goods from polluting the drinking water; leaked oil caused by traffic accident should be collected as soon as possible in order to reduce the pollution of surface water, natural vegetation and crops.

(3) The facilities of soil and water conservation and drainage works along the line should be inspected and maintained regularly and the damaged parts should be repaired as soon as possible. The sediment deposit in the culverts should be checked periodically and the sediment should be desilted in time.

(4) Vehicles should be reminded of slowing down in cases of strong wind, thick fog and serious icy road to reduce traffic accidents.

(5) The work of checking, inspecting and monitoring the bridges to ensure the safety of the sections where there are important waters should be strengthened according to the requirements in "The Technical Specifications for Highway Maintenance" (JTJ073-96).

(6) The water quality monitoring plan should be carried out, and supplementary environmental protection measures should be taken according to the results of the water quality monitoring. The concentrate details are as follows:

a) Water on the bridge floor should be led into sewage pipes instead of directly into rivers. Warning signs should be set up to remind drivers to drive carefully.

b) Engineering protection measures of building guardrails on both sides of the bridges over rivers should be taken to avoid vehicles falling into rivers to pollute the water body when unexpected accidents happen.

c) Strict management measures should be taken for vehicles transporting hazardous articles, and the vehicles must have complete set of licensing documents and permission for transporting hazardous articles. The dedicated signs of hazardous articles should be attached to the vehicles transporting hazardous articles and such transportation on the highway is strictly forbidden in bad weather conditions such as snowy and heavily foggy days.

(7) the emergency response management system and the proposed emergency measures

To protect the water environment along the line, enough attention should be paid to the risks of the transportation of dangerous cargoes in sections where the proposed highways get across rivers and sensitive sections where there are drinking wells. Therefore, it is suggested that the governments at all levels along the highways take the contingency plans for hazardous chemical transportation into their emergency plans for the risks of highway

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hazardous chemical transportation. The plan should include its organizations, responsibilities and systems, emergency procedures and disposal principles etc. The leaders responsible for the subject in the transportation bureau, public security bureau, and environmental protection agency of the district should be coordinated together to form a united leading group in charge of the accidents of highway hazardous chemical transportation to deal with the accidents and coordinate the rescue and relief work. Their duties are mainly to formulate the security measures and policies for the highway transportation of hazardous chemicals in each district, to build profiles of all the specialized households, vehicles, and persons engaged in the highway transportation of hazardous chemicals in their respective jurisdictions, to make regular security inspections of the specialized households engaged, to hold regular meetings of the group members to notify the accidents in highway transportation of hazardous chemicals, to organized the professional trainings for the directors, drivers, supercargoes, and handling personnel and organize the exercise of the emergency plan regularly, to carry out actively various forms of propaganda and education activities to raise the safety awareness of the mass and staff in the profession, and to do work of statistics and reports about the accidents of transporting hazardous chemicals well. The procedures and principles for the emergency treatment are as follows:

a) Whenever there is an accident, anyone who finds it should report to the local coordinating group in charge of the accidents of highway hazardous chemical transportation by dialing the number of the maintenance person on the plate placed on the side of the highway or by other means of communication.

b) The local coordinating group should immediately arrange for the nearest local fire department to send their fire engines and fighters to rescue as soon as receiving the accident report.

c) If the hazardous articles are solid, then they can be cleared by sweeping, and the accident should be recorded in files.

d) The firefighters should wear gas masks when working, and if the leakage of hazardous articles is impossible to avoid, it is necessary to notify the environmental protection and public security departments immediately, and the personnel within the scope of pollution along the line should be evacuated to avoid casualties brought by poisonous articles when necessary.

e) If the dangerous cargoes are liquid and have gone into the public water body, notify the environmental protection agency immediately. The environmental protection agency should immediately send environmental experts and monitoring personnel to the scene to do

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monitoring analysis, and cooperate with relevant departments in the salvage of containers of dangerous cargoes that have fallen into the water body.

f) The design and installation of crash barriers on both sides of the bridge over the river should be improved to prevent the accident of vehicles transporting dangerous chemicals from impacting the water quality of the river.

### **3.4 Protection Measures for Ambient Air**

(1) The management of vehicles should be strengthened. Environmental protection agencies and traffic police departments should strengthen the supervision and monitoring, strictly carry out the inspection of emission standards of cars. Vehicles that seriously exceed the national emission standard should be prohibited from the road or their routes should be specified according to relevant regulations.

(2) The management of transport vehicles should be strengthened, and those without any coverings that can rouse dust should be prohibited on the road.

(3) The management of highway and maintenance of pavements should be strengthened so as to keep the roads in good conditions, and reduce the phenomena of traffic jams.

(4) Trees and grass should be planted on both sides of the highway so as to beautify the environment and improve the landscape along the highway as well as purify and absorb the pollutant in the vehicle exhaust.

(5) The plan for ambient air monitoring should be carried out so that corresponding environmental protection measures can be decided according to the monitoring results.

### **3.5 Protection Measures for Acoustic Environment**

#### **3.5.1 Management Measures**

(1) Strengthening traffic control and reducing noise sources.

Since traffic noise is one of the main sources of noise in urban areas, it is necessary to further tighten up the control of motor vehicles and road traffic, especially the strict control of the quality of annual vehicle examinations. At the same time, speed limits and no honking signs should be placed in sections of sensitive points (such as schools and villages near the road) to reduce the influence of noise. Roadblocks should be removed timely to ensure swift traffic flows on driveways and walkways, and maintain the smoothness of pavement and avoid the increase of traffic noise caused by jolt because of the poor conditions of the roads. Motor vehicles on the road should obey the rules of politeness and reduce traffic noise by decreasing their times of honking so as to reduce the negative influence of traffic noise.

(2) The general public should be encouraged by means of publicity and education to

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consciously take part in the prevention and control of environmental noise pollution.

The environmental protection department shall widely disseminate the Law of the People's Republic of China on Prevention and Control of Pollution From Environmental Noise, standards of acoustic environment quality, and the relevant laws, regulations and institutions through a variety of forms, and encourage the public participation in the prevention and control of environmental noise pollution with the help of public opinion. By means of publicity and education, the environmental protection department should raise the citizens' awareness of the harmfulness brought by noise pollution so that they can consciously reduce or resist sources of strong noise pollution.

(3) Trees should be planted in time on both sides of the road, and effective maintenance and management of the trees should be performed so that they form green barriers, which can beautify the environment as well as reduce the noise pollution effectively.

(4) When planning to construct houses on the two sides of the highway, it is necessary to consider the impact of the traffic noise caused by the proposed project so as to ensure that the project will not affect the lives of people along the line.

### **3.5.2 Engineering Measures for Noise Reduction**

Based on the traffic noise prediction, relevant noise reduction measures should be taken at all the sensitive spots where the traffic noise might exceed the standard in the near and medium-term future of the operational stage of the project according to the environmental characteristics and the degree of exceeding; and noise-monitoring measures should be taken during the medium and far future of the operational stage at the sensitive points where the traffic noise might exceed the standard in the long run; and relevant fund should be reserved for that purpose. The current engineering noise reduction measures commonly taken in China are sound barriers, relocation, sound insulation windows, and noise reduction trees. By analyzing and comparing the characteristics of these noise reduction measures, the suitable noise reduction measures for each of the sensitive points in this project have been specified according to the actual situation of each sensitive point. For the detailed comparisons of the measures, see table 3-1.

To minimize potential noise impacts, noise monitoring has been proposed in the ESMP. Noise abatement measures will be implemented based on the monitoring results. The noise standard should take into account relevant national standards and WBG IFC Guidelines (i.e. WBG EHSG for residential, institutional, educational at 45 dBA and 55dBA for night and day time, respectively.), and the public consultation to be conducted during project

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implementation.

Noise reduction measures in this project are listed in table 3-2.

### **3.5.3 Controlling Requirements for Planning and Construction of Villages along the Line**

Since the villages are rather scattered, it is suggested that when planning house sites, the local governments should consider the effects of traffic noise brought by the proposed project. The governments should refer to the distances shown in the ranges of noise prediction along the road in the fourth chapter of this environmental impact assessment report. It is suggested not to plan and construct sensitive buildings like concentrated residential districts and schools within the scope of over-standard to ensure that the traffic noise caused by proposed project will not affect the lives of people along the line. Houses built by residents themselves along the line should be away from the road as far as possible.

**Table 3-1 Comparison of Noise Prevention and Control Measures Commonly Taken**

Measure	Applicability	Noise reduction effect	Advantage	Disadvantage	Applicability to the project
Inhabitants relocate and the houses are used for other purposes	Households in seriously above-standard areas relocate to areas not affected by noise	Very good	Noise reduced completely and noise effects eliminated , but applicable only to sporadic residents in over-standard areas	High cost, limited applicability, and influence on lives of residents	Low graded highways, low traffic volume, not seriously over-standard, not applicable to the proposed project
Sound barrier	Seriously above-standard and concentrated sensitive points near the road	8~15dB	Good effect, applied to highway itself, easy to implement and benefit a large population	High investment, and some forms of sound barriers have an effect on scenery	The places that exceed the standard include Shengjiadong Village, No.1 Square Primary School, Dajing Town Middle School and Dazhuang Village.Dazhuang Village is located on both sides of the road and is not suitable for noise-proof barrier. And it is suggested that Shengjiadong Village adopt noise-proof barrier.
Building or heightening enclosing walls	Ordinary over-standard residential buildings and schools near roads	3~5dB	Limited effect, low cost	Limited noise reduction ability and small scope of applicability	Some villages exceed the standard not so much, applicable
Ordinary sound insulation window	Scattered villages that are seriously affected	About >20dB	Good effect, low cost, and good applicability	Unventilated, not applicable in summer, an effect on lives of residents	Summers in this region are very hot, applicable
Ventilation and sound insulation window	Scattered villages that are seriously affected	About >20dB	Good effect, moderate cost, good applicability, and small influence on lives of residents	Requiring good building structure, difficult to implement	Can be taken in villages with good building structures and over-standard schools along the line

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<p>Afforestation</p>	<p>Applicable to concentrated villages that exceed standards not very seriously and are suitable for planting trees</p>	<p>Seeded strip of 30m wide can reduce noise of almost 5dB</p>	<p>Purify air, beautify roads, and improve ecological environment as well as reduce noise</p>	<p>More time are needed to achieve a certain effect of noise reduction, there is marked seasonal changes in the effect of noise reduction, need to expropriate lands, restricted in areas where lands are valuable</p>	<p>Applicable in uncultivated lands between some sensitive points and highways</p>
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**Table 3-2 A list of noise control measures for particular sensitive spots along the highway**

Serial number	Road	Sensitive spots	Functional zone	Number of standard exceeding households	Predicted superscalar (dB(A))						Noise reduction measures planned to be taken	Expected effect of noise reduction	Investment (RMB Yuan 10 K)	Implementation time
					Year 2019		Year 2028		Year 2033					
					Day	Night	Day	Night	Day	Night				
1	A2 road from Golden Avenue to Yongchang Town	Shatan Village	Class 2 area	20	/	/	/	1.12	0.79	1.34	The superscalar is relatively small, and signs of no honking and slowdown are to be used.	3~5dB	1.0	In the later period of construction
2	A3 Road from Yanjia Village of Gaoba Town to Liuqi Village	Caijia Village	Class 2 area	15	/	/	/	1.54	0.57	2.45	The superscalar is relatively small, and signs of no honking and slowdown are to be used.	3~5dB	1.0	In the later period of construction
3		Shisanlipu	Class 4a	25	/	/	/	1.10	/	2.05	The superscalar is relatively small, and signs of no honking and slowdown are to be used.	3~5dB	1.0	In the later period of construction
4		Liuqi	Class 4a	10	/	/	/	0.99	/	1.96	The superscalar is relatively small, and signs of no honking and slowdown are to be used.	3~5dB	1.0	In the later period of construction
5	A4 Road from	Shengjiadong	Class	15	/	1.45	/	3.79	/	3.94	The village is on one	8~15dB	65.0	Sound barriers

	Golden Avenue to Wunan Town	village	4a								side of the road, and therefore sound barriers of 500*3m and signs of no honking and slowdown are suggested.			should be used in the early period of construction ,and signs should be installed in the later period of construction.
6	A5 Road from Golden Avenue to Huangyang Town	The First Primary School of the Square	Class 2	/	/	3.01	1.13	3.36	1.92	6.18	High walls are suggested in the school. Ten ventilated and sound-insulation windows are suggested for the side facing the road	about>20dB	5.0	In the early period of construction
7		Weijia village	Class 2	20	/	/	/	/	/	0.27	The superscalar is relatively small, and signs of no honking and slowdown are to be used.	3~5dB	1.0	In the later period of construction
8		Lijia village	Class 4a	10	/	/	/	0.35	/	1.21	The superscalar is relatively small, and signs of no honking and slowdown are to be used.	3~5dB	1.0	In the later period of construction
9		Yangjiapu	Class 2	25	/	/	/	/	/	0.32	The superscalar is relatively small, and signs of no honking	3~5dB	1.0	In the later period of construction

											and slowdown are to be used.			
10		Liujia village	Class 2	20	/	/	/	/	/	0.38	The superscalar is relatively small, and signs of no honking and slowdown are to be used.	3~5dB	1.0	In the later period of construction
11		Xiejia village	Class 2	15	/	/	/	/	/	0.35	The superscalar is relatively small, and signs of no honking and slowdown are to be used.	3~5dB	1.0	In the later period of construction
12		Yanjia village	Class 2	30	/	/	/	/	/	0.34	The superscalar is relatively small, and signs of no honking and slowdown are to be used.	3~5dB	1.0	In the later period of construction
13	A9 Reconstruction project of tertiary highway from Xiaoshanzi to Dajing Town	Tuan village	Class 4a	20	/	/	/	0.31	/	0.98	The superscalar is relatively small, and signs of no honking and slowdown are to be used.	3~5dB	1.0	In the later period of construction
14		Xiaoshanzi village	Class 4a	20	/	/	/	0.42	/	1.23	The superscalar is relatively small, and signs of no honking and slowdown are to be used.	3~5dB	1.0	In the later period of construction

15	B2 Weisi Road	Dajing Town Middle School	Class 2 area	/	/	/	/	1.59	/	3.48	Twenty ventilated and sound-insulation windows should be installed, and signs of no honking and slowdown should be set up.	/	5.0	Sound proof windows should be used in the early period of construction, and signs of no honking and slowdown should be set up in the later period of construction
16		Liangjia Big Village	Class 4a	10	/	/	/	/	/	0.41	The superscalar is relatively small, and signs of no honking and slowdown are to be used.	3~5dB	1.0	In the later period of construction
17		Courtyard of Power Supply Staff Households	Class 4a	50	/	/	/	/	/	/	0.51	The superscalar is relatively small, and signs of no honking and slowdown are to be used.	3~5dB	1.0
18	B3 Quancheng Raod	Dazhuang village	Class 4a	30	/	0.08	/	3.42	/	3.99	There are residents on both sides of the road, and the installment of sound barriers will cause inconvenience for their daily	about>20dB	7.0	Sound proof windows should be used in the early period of construction, and signs of no

											connection. Therefore, 30 ventilated and sound-insulation windows are suggested to be installed, and signs of no honking and slowdown to be set up.			honking and slowdown should be set up in the later period of construction
19		Shuangcheng village	Class 4a	20	/	/	/	/	/	0.53	The superscalar is relatively small, and signs of no honking and slowdown are to be used.	3~5dB	1.0	In the later period of construction
total													97.0	

The investments above are according to the following standards: RMB 2000 per sound insulation window, RMB2500 per sign of no honking and slowdown; RMB 150 per square of sound insulation wall.

Investigation shows the details of the specifications and prices of the commonly used sound barriers on the present market as in table 3-3 According to the distribution characteristics of the sensitive spots and the scope of excessive noise along the proposed projects, the vertical sound barriers, which are relatively cheap and have a wide application scope, are recommended in this environment assessment.

**Table 3-3 List of specifications and prices of sound barriers**

Type	Height (m)	Application scope	cost(yuan/linear meter )	Notes
Ecological type	3	Noise reduction 6~8 dB (A)	950	Plants Included
Earth embankment type	5	Noise reduction 4~6 dB (A)	300	50m wide
Micro-arc type	2.5	Noise reduction 4~6 dB (A)	1300	Applicable to bridges
Micro-arc type	3	Noise reduction 6~8 dB (A)	1500	Applicable to bridges
Micro-arc type	3.5	Noise reduction above 8 dB (A)	1700	Applicable to bridges
Folded plate type	4	Noise reduction 8~10 dB (A)	1600	
Folded plate type	5	Noise reduction above 10 dB (A)	1800	
Vertical type	3	Noise reduction 6~8 dB (A)	1300	
Vertical type	3.5	Noise reduction above 8 dB (A)	1500	

### 3.6 Measures for Solid Waste Treatment

(1) Laws and regulations should be made and disseminated so as to prevent the passengers and pedestrians from littering on the highway to ensure the driving safety and the sanitation and hygiene on the both sides of the highway.

(2) Refuse receptacles or dustbins should be placed at the bus stops and on the both sides of the highway to make it convenient for the passing passengers to dispose. Exposed garbage dumping constructions should be prohibited.

(3) The management of garbage disposal should be strengthened. The garbage should be moved away timely, and the collected garbage should be transported to the domestic waste landfill sites and disposed collectively. Arbitrary discarding should be strictly prohibited.

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### **3.7 Protection Measures for Road Safety**

(1) In the dangerous sections where are rivers, lakes, swamps as well as cliffs, barrancas and deep ditches on the roadsides, and serious traffic accidents might happen, roadside barriers or handrails shall be set up on the sides of the roads and bridges. Night retro-reflective markings shall be set up on the roadside barriers and handrails.

(2) Warning stakes shall be placed on the roadsides 10 meters beyond the bridge ranges where the ponds are more than 3 meters deep and the height differences of the embankments, scarps and shallow grooves are greater than 4 meters.

(3) Reflective convex mirrors should be set up at the sharp curves causing bad visibility because of mountains or structures.

(4) Speed humps or bumps should be set up in the road sections near towns, villages or schools to urge drivers to slow down so as to ensure the safety of pedestrians within towns and villages. Depending on the speed limits of the towns and villages the road gets through, corresponding signs of speed limit, yielding to pedestrian, paying attention to children, etc. can be placed before the speed humps or bumps.

(5) Signs of speed limit, lane lines, speed humps or stone pavements, etc. should be set up in the sections where the side aisles to schools, mosques, hospitals join to the roads, and traffic lights can be set up to control the traffic if necessary.

(6) Traffic safety warning signs and facilities should be set up so that drivers can be made aware in advance of the conditions of the highway ahead and sensitive spots such as villages and schools, and be concentrated on driving and slow down so as to avoid traffic accidents effectively or reduce the damages of the accidents. Therefore, it is necessary to set up traffic safety signs and facilities.

(7) The monitoring and controlling of the rural roads should be strengthened, and the transportation facilities should be perfected so as to eliminate potential safety risks. The traffic administrative departments should intensify their monitoring of the roads, troubleshoot and renovate carefully the road sections which are accident-prone and dangerous; perfect the traffic signs, markings and safety protection facilities, pay special attention to the work of setting up speed humps or bumps, etc. in school areas and village entrances. The traffic administrative departments should troubleshoot, count, report and close timely some road sections that do not conform to the safe

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operation of motor vehicles, and order the relevant departments to increase the number of traffic protection facilities and signs timely to alert drivers and pedestrians so as to eliminate potential safety risks.

(8) Traffic safety education should be carried out to raise the legal sense and safety awareness of the peasants through the media such as news, newspapers, periodicals, etc., explaining the laws and regulations on road safety and demonstrating relevant cases. In addition, the traffic police should get into villages timely and cooperate with the committees of towns and villages to organize the education of traffic laws and regulations and traffic safety common sense to the village drivers, so as to regulate the traffic behaviors of drivers and ensure the social stability in rural areas and the life and property safety of the rural mass.

(9) Traffic administrative departments should strengthen their efforts in management and service. Traffic administrative departments should make further efforts to crack down on law-violating behaviors which endanger the traffic safety and carry out timely all kinds of concentrative management activities of rural passenger transport safety, motorcycle traffic safety, unlicensed vehicles, and the rural market traffic safety, etc.; establish and perfect the unified management system of rural vehicles and drivers; establish a wholesome traffic safety management network, coordinate and integrate organically the powers of various departments such as traffic police, transportation administration and agricultural machinery supervision, etc.; win the support of the governments, form a work pattern of managing with concerted efforts, preventing and managing comprehensively; set up a rural mode of road traffic management with traffic police as its head, and complemented by villages and towns police stations, with rural primary-level organizations as positions, so as to ensure the rural road traffic safety effectively, construct a new transport mechanism that is adaptive to the new socialist countryside, and promote the development of the rural economy.

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**Appendix 4:**

## **Environmental Protection Regulations for Environmental Risks**

### **4.1 Measures for Hazardous Waste and Chemical Waste Management**

The construction process of the project involves the storage, transportation, etc. of some hazardous waste and chemical waste that might have a big impact on the environment if not properly handled. The measures for hazardous waste and chemical waste management are as follows:

- (1) Chemicals should be properly stored and labeled.
- (2) The storage of hazardous articles should conform to the requirements of storage types and data, etc. in storage certificate.
- (3) During the maintenance period of mechanical equipments, oil contamination, etc. should be collected with special containers.
- (4) Tools and materials used to absorb chemical leakage such as oil spill kits/sand/saw powder, etc. should be prepared.

### **4.2 Risk Prevention Measures and Emergency Plans**

#### **4.2.1 Risk prevention measures**

There are many rivers along the proposed highway. After the completion of the project, the vehicles which transport hazardous articles might cause certain risks to the water environment along the road. Therefore, corresponding measures shall be formulated to prevent them. To prevent the accident risks in the transportation of hazardous articles, firstly, the relevant laws and regulations of hazardous articles transportation issued by the state and relevant departments should be strictly enforced.

- (1) The education and training on the laws and regulations of hazardous articles transportation should be strengthened.

The drivers and managing staff engaged in hazardous articles transportation shall strictly abide by the relevant technical regulations and operating specifications of hazardous articles transportation safety, learn and master the relevant laws and regulations issued by the relevant state departments. The relevant laws and regulations mainly include:

- a) "Regulations on Safety Management of Hazardous Chemicals" issued by the State Council

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b) “Specifications for Automobile Transportation of Hazardous Cargo” (JT3130-88).

c) “Regulations on the Management of Radioactive Isotopes and Radioactive Devices of the People's Republic of China”.

d) “Regulations on the Management of Civil Explosives of the People's Republic of China”

(2) The management of intra-regional hazardous articles transportation should be strengthened.

a) The local transport bureau should set up a network of vehicle routing and freight forwarder for the transportation of hazardous cargo in its jurisdiction.

b) The qualification authentication for freight forwarders and construction units should be practiced.

c) In hazardous cargo transportation, the system of “hazardous cargo transport license”, "driving license" and "supercargo license" shall be practiced, and the dedicated signs of hazardous articles should be marked on the vehicles engaged in hazardous cargo transportation, and the institution of fixed-point detection shall be executed. Passengers and freight shall not be transported in the same vehicle.

d) During the transportation of hazardous articles, smoking by the drivers and conductors is strictly prohibited, and the vehicle is not allowed to park near open fire and high temperature places. The drivers must concentrate during transportation, pay attention to road signs and markings, and especially to traffic safety when passing rivers and densely populated residential areas, and casual stopping is not allowed.

When accidents such as flaming, explosion, pollution and poisoning, etc. happen during transportation, the drivers must take corresponding emergency measures according to the nature of the hazardous cargo transported and the requirements to prevent the situation from becoming worse, and at the meantime report promptly to the local road transportation administrative organs and relevant departments such as public security bureaus and environmental protection agencies, and take measures to remove hazards at the same time.

(3) The engineering measures such as setting up bridge anti-collision bars and safety signs, etc., should be strengthened to instruct the vehicles transporting hazardous articles to go at the limit speed. The speed of vehicles transporting hazardous articles in rainy days should be limited, and the transportation of hazardous articles should be prohibited in heavy foggy time.

(4) If the hazardous articles are solid, then they can be cleared by sweeping, and the

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accident should be recorded in files.

(5) If the hazardous articles are gaseous and highly toxic, then the firefighters should wear anti-gas mask when handling. If the leakage of hazardous articles is impossible to avoid, it is necessary to notify the environmental protection and public security departments immediately, and the personnel within the scope of pollution along the line should be evacuated to avoid poisoning casualties if necessary.

(6) In sensitive sections and densely populated villages, warning signs with words such as “driving carefully”, etc. should be placed.

(7) Highways should be equipped with monitoring facilities to implement monitoring. When accidents occur, personnel concerned shall get to the scene the first time to implement rescue.

(8) The emergency network should be set up, the leading group for emergency should be formed and the emergency commanding person should be assigned.

The emergency network should consist of the local project organizational unit as its head, and other relevant units such as environmental protection bureau, public security bureau, fire brigade, environmental monitoring station, water conservancy department, etc. and the accident treatment group for hazardous article transportation should be composed of the personnel from concerned units who are capable of handling the accidents, and to be the responsible for the emergency treatment of the accident in the hazardous article transportation.

(9) Strict management rules and regulations for the transportation of oil, chemicals, etc. should be formulated, based on investigation, and the controlling and preventive measures for unexpected environmental pollution accidents on highways should be strengthened.

(10) The management of the transportation of hazardous chemicals should be strengthened, and the emergency plan for the accidents in the transportation of hazardous articles should be made. All the activities of transporting hazardous articles should be registered and recorded in files in the public security traffic department. In order to avoid the happening of leakage accidents, job training for the relevant managers and employees should be provided so that everyone concerned can do the job after obtaining the relevant license or certificate.

The drivers must concentrate during transportation, pay attention to road signs and markings, and ensure traffic safety especially when passing rivers and densely populated residential areas, and casual stopping is not allowed.

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### 4.2.2 Risk Contingency Plans

The construction unit shall make detailed emergency plan, unify emergency actions, and clarify the responsibilities of the person in charge of emergency and relevant departments, ensure the accidents can be controlled in the shortest possible time to reduce the damage to the environment. The emergency plan of the project should be integrated into the regional emergency plan in order to carry out the rescue work at the fastest speed when hazardous chemical accidents happen, reduce the damage caused by the accidents, and minimize the accident loss. Emergency rescue headquarters for hazardous chemical accidents should be established to be responsible for the unified organization and command of the rescue work in hazardous chemical accidents within its jurisdiction. The main content of the plan should include:

- (1) the means of alarming and communication;
- (2) graded response procedures;
- (3) measures for emergency environmental monitoring, emergency relief work, rescue and control;
- (4) plans for organizing the activities of personnel evacuation and escape in emergency;
- (5) and restoration measures. Accident restoration mainly refers to the restorations of contaminated soil and water body. For the severely contaminated soil, the contaminated topsoil should be scraped and sent to the dangerous waste center for processing. For the polluted water body, positive purification measures should be taken such as skimming the surface contaminants, etc., and the skimmed contaminants should be sent to the sewage treatment plant or disposed by means of incineration.
- (6) and emergency training plan.

Appendix 5:

## Provisions on Soil and Water Conservation & Environmental Protection

### 5.1. Water Loss and Soil Erosion Prevention Scheme

#### 5.1.1 Objectives

The project area is a key provincial-level area in soil erosion prevention. According to “Standards on Soil Erosion Prevention for Development and Construction Projects” (GB50434—2008), the secondary standard on soil erosion prevention and construction should be implied. Based on adequate considerations of the natural conditions such as annual rainfall, topography and other factors like soil erosion intensity and the standing situation of this project amendment has been made to set forth realistic and achievable objectives. Table 5-1 lists the objectives.

**Table 5-1 Objectives for soil erosion prevention**

Regions	Indicators	Norm values		Amended values by rainfall	Amended values by soil erosion intensity	Adopted values after amendments	
		During Construction	During Test-run	160,352.3m m	Light	During Constr uction	During Test-run
Liangzhou District	Treatment percentage of disturbed land (%)	*	95			*	95
	Controlled percentage of erosion area (%)	*	85	-5		*	80
	Controlled ratio of soil erosion modulus (%)	0.5	0.7		+0.3	0.8	1.0
	Percentage of dammed slag and ashes (%)	90	95			90	95
	Recovery percentage of the forestry and grass (%)	*	95			*	90

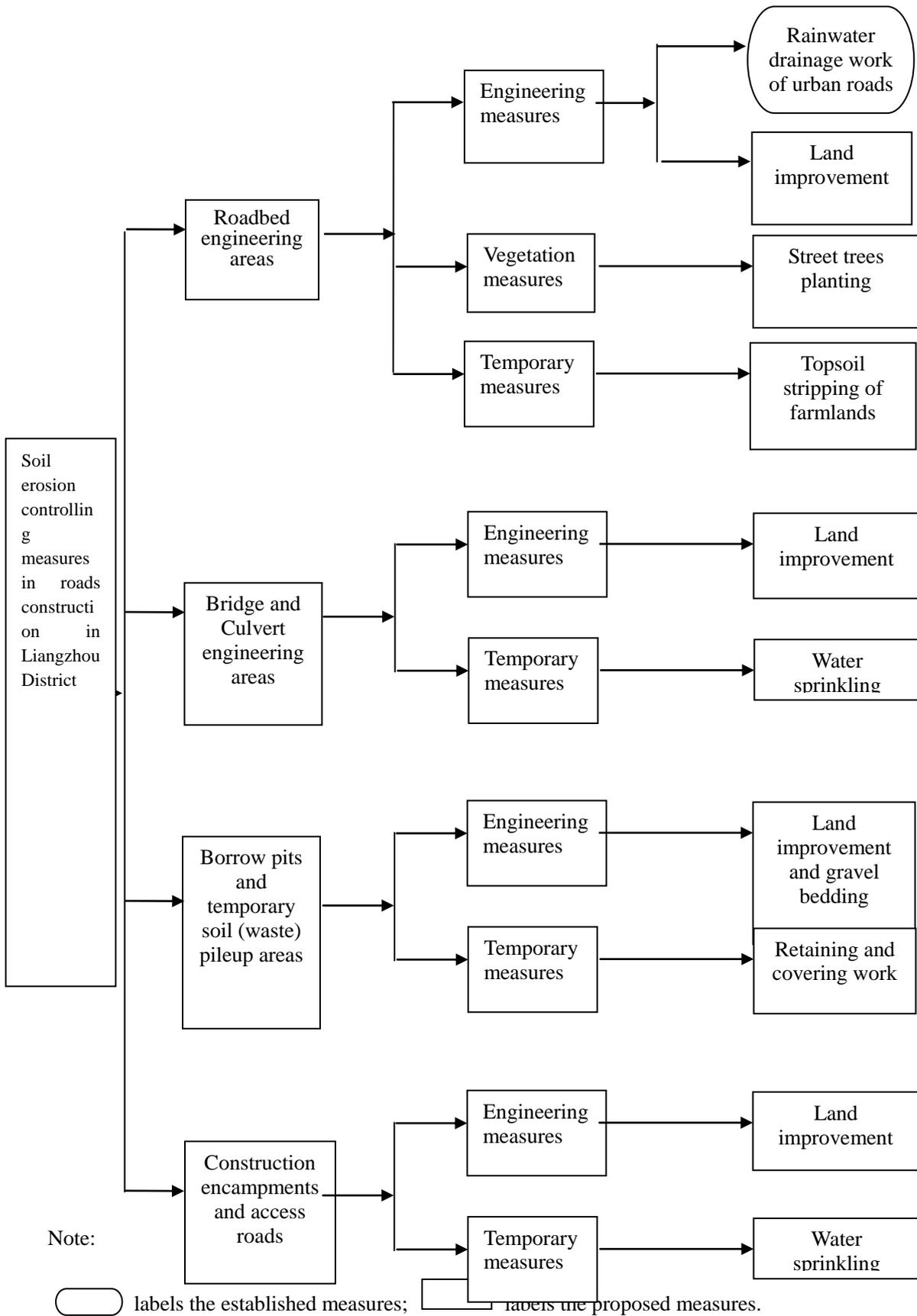
	Percentage of the forestry and grass coverage (%)	*	20			*	1
Gulang County	Treatment percentage of disturbed land (%)	*	95			*	95
	Controlled percentage of erosion area (%)	*	85	-3		*	82
	Controlled ratio of soil erosion modulus (%)	0.5	0.7		+0.3	0.8	1.0
	Percentage of dammed slag and ashes (%)	90	95			90	95
	Recovery percentage of the forestry and grass (%)	*	95			*	90
	Percentage of the forestry and grass coverage (%)	*	20			*	1
Project area	Treatment percentage of disturbed land (%)	*	95			*	95
	Controlled percentage of erosion area (%)	*	85	-4		*	81
	Controlled ratio of soil erosion modulus (%)	0.5	0.7		+0.3	0.8	1.0
	Percentage of dammed slag and ashes (%)	90	95			90	95
	Recovery percentage of the forestry and grass (%)	*	95			*	90
	Percentage of the forestry and grass coverage (%)	*	20			*	1

### 5.1.2 Soil erosion prevention schedules

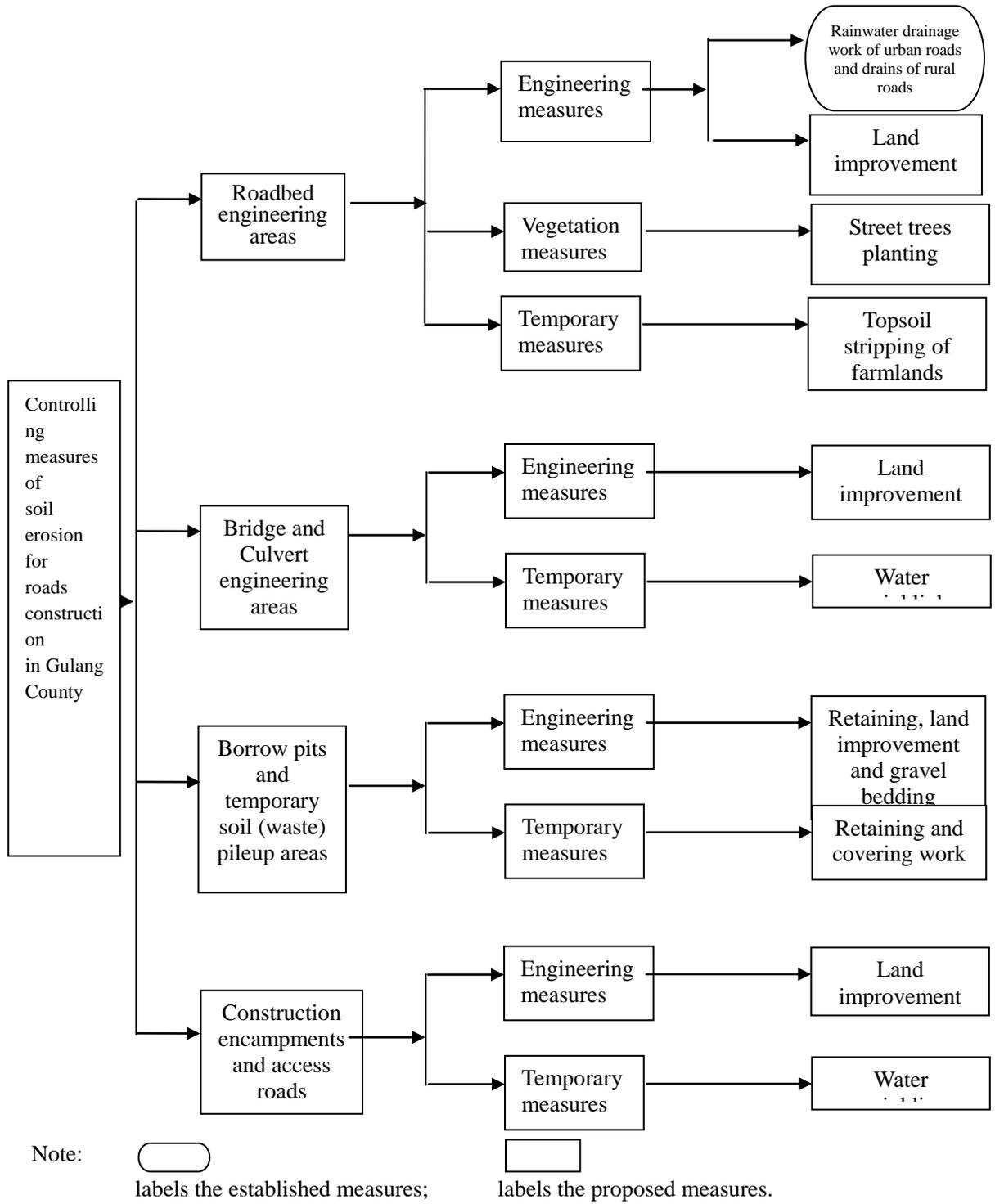
The present program of soil erosion prevention is established on the base of an analysis

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and evaluation of the conservation function of the main project and on adequate considerations of relevant technical regulations for erosion controlling, features of the present project, and environment and soil erosion features in the project affected areas, unifying the whole and the parts, balancing the interests of the key and the average and avoiding redundancy and omissions. The newly added conservation measures include engineering, plants growing and temporary protective measures. Engineering measures will be laid at areas on both sides of the roadbeds, borrow pits, temporary soil pileup sites, waste disposal areas and construction sites. Trees will be planted on both sides of the city roads. As for temporary soil pileup sites where topsoil stripping is stacked, temporary measures such as retaining and covering work will be carried out. In construction areas, water will be sprinkled along the streets to reduce dust pollution. The soil erosion prevention schedules are shown in Picture 5-1 and 5-2.



**Diagram 5-1 Diagram of soil erosion controlling measures in Liangzhou District**



**Picture 5-2 Diagram of soil erosion controlling measures in Gulang County**

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### 5.1.3 The overall layout of water loss and soil erosion prevention

(1) Roadbed engineering areas: Rainwater drainage for urban roads and side ditches and drains for rural roads have been designed in the major project respectively.

The Newly added measures are:

- ①Engineering measure: land consolidation on both sides of roadbeds;
- ②Vegetation measure: street-tree planting on both sides of urban roads;
- ③Temporary measure: topsoil stripping

(2) Bridge and culvert engineering areas: land consolidation and water sprinkling work are added in the scheme.

(3) Borrow pits and temporary soil (waste) pileup site: the newly added measures are:

- ①Engineering: slope cutting, blocking, draining, land leveling and gravel bedding;
- ②Temporary: temporary-wall-retaining and covering work.

(4) Construction plant and side roads: the newly added measures are:

- ①Engineering measure: land consolidation;
- ②Temporary measure: water sprinkling.

The overall layout of soil and water conservation measures for subareas is shown in Table 5-2.

**Table 5-2 Overall layout of soil and water conservation measures**

Roads	Subareas	Engineering measures	Vegetation measures	Temporary measures
A1-Road from Golden Avenue to Fengle Town	Roadbed engineering areas	22069m rainwater drain pipes, 4.89hm <sup>2</sup> land leveling	0.61hm <sup>2</sup> roadside tree planting , 6110 trees , 6110m <sup>3</sup> soil replacement	
	Bridge and culvert engineering areas	0.35hm <sup>2</sup> land leveling		0.4hm <sup>2</sup> water sprinkling , 40m <sup>3</sup> quantity
	Borrow pits, temporary soil pileup areas and waste disposal areas	3.07hm <sup>2</sup> land leveling, 2.95hm <sup>2</sup> gravel bedding		138m retaining walls built by woven fabric bags, 1306m <sup>2</sup> covering with dust-proof nets
	Construction encampment and access roads	0.46hm <sup>2</sup> land leveling		0.19hm <sup>2</sup> water sprinkling , 95m <sup>3</sup> quantity
A2- Road from Golden Avenue to Yongchang Town	Roadbed engineering areas	12834m rainwater drain pipes , 2.91hm <sup>2</sup> land leveling	0.36hm <sup>2</sup> street-tree planting , 3639 trees , 3639m <sup>3</sup> soil replacement	1.21hm <sup>2</sup> topsoil stripping
	Borrow pits and temporary soil(waste) pileup areas	0.55hm <sup>2</sup> land leveling		584m retaining walls built by woven fabric bags, 6016m <sup>2</sup> covered with dust-proof nets
	Construction encampment and access roads	0.42hm <sup>2</sup> land leveling		0.02hm <sup>2</sup> water sprinkling , 10m <sup>3</sup>
A3- Road from Yanjia Village to Liuqi Villiage in	Roadbed engineering areas	8650m rainwater drain pipes, 1.40hm <sup>2</sup> land leveling	0.18hm <sup>2</sup> roadside tree planting , 1750 trees , 1750m <sup>3</sup> soil replacement	0.58hm <sup>2</sup> topsoil stripping

Gaoba Town	Borrow pits and temporary soil(waste) pileup areas	0.10hm <sup>2</sup> leveling	land		128m retaining walls built by woven fabric bags , 1128m <sup>2</sup> covered with dust-proof nets
	Construction encampment and access roads	0.21hm <sup>2</sup> leveling	land		0.01hm <sup>2</sup> water sprinkling ,5m <sup>3</sup>
A4- Road from Golden Avenue to Wunan Town	Roadbed engineering areas	1.68hm <sup>2</sup> leveling	land	0.32hm <sup>2</sup> roadside tree planting ,3150 trees, 3150m <sup>3</sup> soil replacement	1.05hm <sup>2</sup> topsoil stripping
	Borrow pits and temporary soil(waste) pileup areas	2.99hm <sup>2</sup> leveling,2.52hm <sup>2</sup> gravel bedding	land		306m retaining walls built by woven fabric bags , 3256m <sup>2</sup> covered with dust-proof nets
	Construction plant and side roads	0.21hm <sup>2</sup> leveling	land		0.06hm <sup>2</sup> water sprinkling, 30m <sup>3</sup>
A5- Road from Golden Avenue to Huangyang Town	Roadbed engineering areas	8852m rainwater drain pipe, 2.32hm <sup>2</sup> land leveling		0.29hm <sup>2</sup> roadside tree planting , 2900 trees , 2900m <sup>3</sup> soil replacement	0.97hm <sup>2</sup> topsoil stripping
	Bridge and culvert engineering areas	0.03hm <sup>2</sup> leveling	land		0.04hm <sup>2</sup> water sprinkling ,4m <sup>3</sup> quantity
	Borrow pits, temporary soil pileup areas and waste disposal areas	0.16hm <sup>2</sup> leveling	land		162m retaining walls built by woven fabric bags , 1777m <sup>2</sup> covered with dust-proof nets
	Construction plant and side roads	0.21hm <sup>2</sup> leveling	land		0.01hm <sup>2</sup> water sprinkling ,5m <sup>3</sup>

**Table 5-2 Overall layout of soil and water conservation measures (continued)**

Roads	Subareas	Engineering measures	Vegetation measures	Temporary measures
A6-Road of Huangyang Town	Roadbed engineering areas	9584m rainwater drain pipes, 2.28hm <sup>2</sup> land leveling	0.29hm <sup>2</sup> roadside tree planting, 2850 trees, 2850m <sup>3</sup> soil replacement	0.95hm <sup>2</sup> topsoil stripping
	Borrow pits and temporary soil(waste) pileup areas	0.16hm <sup>2</sup> land leveling		160m retaining walls built by woven fabric bags, 1735m <sup>2</sup> covered with dust-proof nets
	Construction plant and side roads	0.42hm <sup>2</sup> land leveling		0.02hm <sup>2</sup> water sprinkling, 10m <sup>3</sup>
A7- Road of Tumen Zone in the core area of urban-rural overall development	Roadbed engineering areas	17841m rainwater drain pipes, 5.08hm <sup>2</sup> land leveling	0.64hm <sup>2</sup> roadside tree planting, 6350 trees, 6350m <sup>3</sup> soil replacement	2.12hm <sup>2</sup> topsoil stripping
	Bridge and culvert engineering areas	0.50hm <sup>2</sup> land leveling		0.66hm <sup>2</sup> water sprinkling, 66m <sup>3</sup>
	Borrow pits, temporary soil pileup areas and waste disposal areas	5.84hm land leveling, 5.15hm <sup>2</sup> gravel bedding		732m retaining walls built by woven fabric bags,

				7637m <sup>2</sup> covered with dust-proof nets
	Construction plant and side roads	0.92hm <sup>2</sup> land leveling		0.51hm <sup>2</sup> water sprinkling, 255m <sup>3</sup>
A8- Reconstruction project of 2 <sup>nd</sup> -rank road from Tumen Town to Huanghuatan Village in Gulang County	Roadbed engineering areas	9420m side ditches, 1080m drains, 5.68hm <sup>2</sup> land leveling		
	Bridge and culvert engineering areas	0.15hm <sup>2</sup> land leveling		0.21hm <sup>2</sup> water sprinkling, 21m <sup>3</sup>
	Borrow pits, temporary soil pileup areas and waste disposal areas	0.06hm <sup>2</sup> land leveling		
	Construction plant and side roads	0.62hm <sup>2</sup> land leveling		0.02hm <sup>2</sup> water sprinkling, 10m <sup>3</sup>
A9- Reconstruction project of 3 <sup>rd</sup> -rank road from Xiaoshanzi Town to Dajing Town	Roadbed engineering areas	9800m side ditches, 1800m drains, 6.70hm <sup>2</sup> land leveling		
	Bridge and culvert engineering areas	0.20hm <sup>2</sup> land leveling		0.27hm <sup>2</sup> water sprinkling, 27m <sup>3</sup>
	Borrow pits, temporary soil pileup areas and waste disposal areas	50m waste-retaining walls, 0.75hm <sup>2</sup> land leveling		
	Construction plant and side roads	1.26hm <sup>2</sup> land leveling		0.01hm <sup>2</sup> water sprinkling, 5m <sup>3</sup>

A10-Road of the new part in Dajing Town	Roadbed engineering areas	13025m rainwater drain pipes, 2.85hm <sup>2</sup> land leveling	0.36hm <sup>2</sup> roadside tree planting, 3560 trees, 3560m <sup>3</sup> soil replacement	1.19hm <sup>2</sup> topsoil stripping
	Borrow pits and temporary soil(waste) pileup areas	5.52hm <sup>2</sup> land leveling, 3.33hm <sup>2</sup> gravel bedding		474m retaining walls built by woven fabric bags, 8214m <sup>2</sup> covered with dust-proof nets
	Construction plant and side roads	0.30hm <sup>2</sup> land leveling		

## 5.2. Monitoring Program for Water and soil Conservation

### 5.2.1 Purpose and significance

By laws and regulations for soil and water conservation, construction units should carry out feasible measures to control soil erosion caused by the construction. They should also keep monitoring on soil and water conservation during the whole process of construction preparation and implementation. Monitoring helps to find out the status of current soil erosion in the project area, to check the erosion type, intensity and damage during the construction process, to grasp the developing trend of newly emerged soil erosion in time, and to find out the effect of the measures taken for water and soil protection. By providing feedbacks of the monitoring results to the design institution, the soil erosion controlling measures could be effectively adjusted for water and soil conservation.

### 5.2.2 Monitoring scope, periods, contents and frequency

#### (1) Monitoring scope

The monitoring scope covers the responsibility compass of preventing soil erosion. The roadbed engineering area, temporary soil pileup site and waste disposal area are the three key areas for monitoring in the project, which is determined out of the considerations on the characteristics of the project, the prediction of soil erosion, the division of key prevention

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areas and the overall layout of the controlling measures for water and soil conservation.

(2) Monitoring periods

Since the project belongs to the production and construction category, in accordance with the requirements of “Technical Regulations on Soil and Water Conservation for Development and Construction Projects”, the monitoring work will begin from the preparation stage and finish at the target year. The project is henceforth scheduled from 2014.08 to 2020.12.

(3) Monitoring contents

Following the provisions of “Technical code of practice on water and soil conservation monitoring” (SL277—2002) and “Regulations on Monitoring Work of Soil and Water Conservation for Production and Construction Project” (Ministry of Water Resources: 2009-No.187), the six key monitoring contents are stipulated as follows: the schedule of the main construction, the surface disturbance area, the erosion disasters and hidden dangers, soil erosion and the damages caused, construction process of soil and water conservation, the effects of soil erosion controlling measures, and the designing and management work.

1) Monitoring on the ecological status of soil and water conservation

This includes the following items: ①days of rainfall, the intensity and duration, etc.; ②expropriation land area and surface disturbance area; ③the volumes of cuts and fills and the temporary piling-up soil area; ④the surface structure and vegetation coverage rate in the project area.

2) Monitoring on dynamic changes of soil erosion

- ①changes of soil erosion area;
- ②changes of soil erosion volume;
- ③changes of soil erosion intensity;
- ④damage to surrounding areas caused by soil erosion and its trend.

3) Monitoring on the effects of soil erosion controlling measures

- ①Quantity and quality of the measures;
- ②Survival rate, preservation rate, growth conditions and vegetation coverage rate of the forestry and grass;
- ③Stability, soundness and operation status of retaining and drainage works;
- ④Erosion-reducing effect of the controlling measures.

4) Monitoring on the background values of soil erosion

- ①Current land use status, the area and land types;
- ②Vegetation type and coverage;

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③ Current situation of soil erosion;

④ Quantities of facilities for, and area of, water and soil conservation.

5) Monitoring on major erosion events

It mainly investigates whether the construction work cause serious erosion, such as landslides, floods and sandstorms, in the project area and the surrounding areas.

(4) Monitoring frequency

1) Monitoring being maintained throughout the whole construction period;

2) Recorded monitoring on the effect of water and soil erosion controlling measures in waste disposal sites, borrow pits and roadbeds is exercised by every 10 days;

3) Keeping recordings of effects of the conservation measures in waste disposal sites, borrow pits, surface disturbance area once a month;

4) Keeping recordings of the main construction progress, factors that influence soil erosion and the growth condition of vegetation for conservation every 3 months;

5) Additional times of monitoring shall be executed in case of gale (wind speed  $\geq 17\text{m/s}$ );

6) Disasters of soil erosion shall be surveyed within a week.

### 5.2.3 Key Monitoring Items

The program will focus on:

(1) Implementation of the program;

(2) Utilization of waste disposal areas and borrow pits and implementation of safety regulations;

(3) Land disturbance and vegetation destruction;

(4) Implementation of conservation measures (including temporary protecting ones);

(5) Implementation of accountability system for soil and water conservation

### 5.2.4 Monitoring points

Considering the overall arrangement of the project, 16 temporary monitoring positions are located, with 8 in Liangzhou District and Gulang County respectively. Table 5-3 lists the monitoring positions, contents and frequency. Distribution of the monitoring points can be referred to Water and Soil Conservation Monitoring Points Map.

**Table 5-3 List of the monitoring positions, contents and frequency in construction**

Areas	Contents	Methods	Positions	Frequency
Roadbed slopes	Disturbance area, implementation of construction measures, vegetation survival rate, coverage rate and increment growth,	On-site inspection, sample plot,	JC1,JC2	Monitoring on the effect of water and

	water and soil loss amount and stability of side slopes	positioning monitoring		soil erosion controlling measures is exercised every 10 days; monitoring on surface disturbance area and retaining effects once a month; main construction progress, factors that influence soil erosion and the growth condition of vegetation for conservation every 3 months; additional records in case of gale (wind speed $\geq 17\text{m/s}$ ); disasters monitored within a week
Bridges	Disturbance area, water and soil loss amount	On-site inspection method, positioning monitoring	JC3,JC4	
Waste disposal areas	Waste disposal amount, disturbance area, integrity and stability of waste retaining facilities, water and soil loss amount, layout of protective measures, vegetation survival rate, coverage rate and increment growth	On-site inspection, sample plot, positioning monitoring	JC5,JC6	
Borrow pits	Borrowing amount, disturbance area, implementation of construction measures, quality, integrity and stability of cutting drain ditches, water and soil loss amount, vegetation survival rate, coverage rate and increment growth	On-site inspection, sample plot, positioning monitoring	JC7,JC8	
Temporary soil pileup area	Temporary soil pileup amount, disturbance area, integrity and effect of protective measures, water and soil loss amount	On-site inspection method, positioning monitoring	JC9, JC10	
Access roads	Disturbance area, implementation of protective measures, water and soil loss amount	On-site inspection, positioning monitoring	JC11, JC12	
Construction sites	Disturbance area, implementation of protective measures, water and soil loss amount	On-site inspection, positioning monitoring	JC13, JC14	
Original landscape	Water and soil loss amount	positioning monitoring	JC15, JC16	

### 5.2.5 Monitoring administration system

#### (1) Monitoring institutions and management

The construction party must entrust the monitoring work of the project to institutions bearing Grade B or above qualification for water and soil conservation. Implementation Plan on Monitoring on Soil and Water Conservation shall be formulated according to Technical

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code of practice on water and soil conservation monitoring (SL277—2002) and Regulations on Monitoring Work of Soil and Water Conservation for Production and Construction Project (Water Conservation [2009] Document No. 187). The entrusted institution shall appoint licensed monitoring personnel to carry out the monitoring tasks. Monitoring results shall be reported regularly to the construction unit and the concerned water conservancy administrative departments, as one basis for monitoring and supervision and checking whether the facilities meet the standard.

The monitoring data shall be systematically filed and analyzed and a scientific evaluation report on the controlling measures shall be written so as to provide a reliable basis for comparative analysis.

(2) Monitoring system

1) Before used for monitoring, the instruments and equipment shall be checked and collaborated.

2) Statistical and comparative analysis of the monitoring results shall be done and a brief assessment report shall be written. Whenever problems appear, timely report shall be submitted and remedial measures shall be taken so as to maintain the water conservation facilities in good condition.

3) Before the construction starts (the preparation stage included), “Implementation Plan of Monitoring on Soil and Water Conservation in Production and Construction Projects” shall be filed to both the water conservancy administrative departments which approves this project and the local administrative departments in charge. During construction, “Quarterly Report on Soil and Water Conservation Monitoring in Production and Construction Projects” of the bygone quarter shall be updated within the first month of the coming quarter. Serious soil erosion and damages due to rain, wind or human causes should be reported within a week after the incident. “Summary Report of Soil and Water Conservation Monitoring in Production and Construction Projects” shall be filed within three months after the monitoring task is completed. The above reports shall be updated with the official seals of the construction unit and monitoring institutions.

### **5.3. Investment estimation of soil and water conservation**

The total investment is RMB 39,392,200 Yuan, of which RMB 30,397,200 Yuan (with the main part listed 28,892,100 Yuan) is for engineering measures, RMB 2054,200 Yuan for vegetation measures, RMB 1,230,600 Yuan for temporary construction measures, RMB 4040,800 Yuan for independent cost (1.3 million Yuan for supervision, RMB 1,315,000 Yuan

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for monitoring), RMB 529,700 Yuan for basic reserve fund and RMB 1,139,700 as compensation for erosion hazards.

Annual investment: RMB 1,853,600 Yuan in RMB 2014; 2,192,300 Yuan in 2015; RMB 4,142,700 Yuan in RMB 2016; 7,243,900 Yuan for 2017; RMB 12,892,700 Yuan in 2018; RMB 10,194,700 Yuan in 2019 and RMB 872,300 Yuan in 2020.

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Appendix 6:

## Regulations on Drinking Water Source Area

### Environmental Protection

The proposed subproject A9 passes through the Dajingxia Reservoir and the Liujiatan secondary drinking water source reservation area. Since the roads will be constructed along the original route and the existing roads were seriously damaged after long-time use without any fixation, negative impacts on the safety of water sources in that area might occur without protective measures. The traffic conditions will be improved after the completion of the proposed project. This project will also do good to the protection of water resources by such measures as building anti-crash fences, accident wastewater collection pools and bridge rainwater collection systems. Mandatory conservation measures have been stipulated as follows for the construction work near the water source area (ie. Xiaoshanzi to reservoir-end):

#### **(1) Emergency Sewage Pool**

Statistics show that from 17:00 to 23:00 on July 27th, 2012, thunder showers hit areas like Liangzhou District, Gulang County, Tianzhu County in Wuwei, and Jinchuan District in Jinchang, with a maximum rainfall of 60.2 mm, leading to flood and waterlog disaster. Wuwei and Jinchang suffered from great property loss, and the torrential flood brought two deaths. The rainfall was relatively heavier in the region that year. Meteorological statistics of the past decades indicate that the annual precipitation is 300 mm in Gulang County. Taking the above data into consideration, the EIA shall calculate the volume of the emergency sewage pool with a maximum rainfall of 100 mm one time.

Assuming the rainwater all runs into the emergency pools located every 300m, and a tanker truck can load 40m<sup>3</sup> water, the collected sewage amount of each pool shall be 265m<sup>3</sup>. The recommended volume of each pool shall be 300m<sup>3</sup>.

Therefore, in order to protect the source water area, the EIA requires one 300m<sup>3</sup> emergency sewage pool built every 300m in these areas. The building work shall be in accordance with the terrain conditions and meet the conditions of collected gravity flow.

#### **(2) Rainwater collection system for bridges**

The project proposes to build 6 bridges for the crossing section in the water source area, which will be located at K0 +158.8 (L70, W7.5), K0 +460 (L23, W7.5), K1 +22 (L23, W7.5), K2 +200 (L23, W7.5), K4 +580 (L23, W7.5), K6 +520 (L70, W7.5) respectively.

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The EIA recommends rainwater collection systems for the six bridges are able to divert the sewage on the bridge floors to nearby emergency pools in prevention of the rainwater's inflow to water source protection areas.

**(3) Rainwater and sewage collection ditches**

To smoothly divert the rainwater from the pavements and waste water to the sewage tanks, seepage-proofing ditches shall be built along the roadside. Rainwater shall be diverted from the ditch exits into the nearby tanks through chutes. No external outlets shall be built on the crossing section in the water source area.

**(4) Crash barriers**

To prevent the sewage overflow to the ditches that may be caused by the serious leakage from overturned tankers with dangerous goods, enclosed anti-collision walls shall be built along the outboard of side ditches. The walls can also effectively intercept the surface runoff and sewage, and divert them into the emergency pool via the ditches.

**(5) Other facilities**

Emergency sand boxes, sand bed and other facilities shall be placed along the section to implement timely containment of sewage and prevent the overflow polluting the water.

**(6) Protection Requirements**

The project must meet the following nine principles of environmental protection requirements:

① The roads shall be co-constructed with the water source, strengthening water conservation to ensure the safety of water source. Road length in Liujiatan secondary drinking water source protection area must be reduced to the minimum in the design and the reconstructed roads need to be father away from the top protected region.

② In the following designing stage, embankment seepage ability shall be strengthened to reduce the infiltration of surface pollutants, which may influence the water quality in the protection area.

③ Alarming boards shall be set up around the protection area on which the vehicles speed limit, phone numbers of emergency rescue and prevention of water pollution offices shall be marked and deceleration strips shall be built in the area.

④ Seepage-proofing drainage ditches shall be built along the roads in the protection area. No waterspouts shall be built in the area. In accordance with roadside terrain conditions, seepage-proofing emergency pools of no less than 300m<sup>3</sup> per 300m shall be constructed. In principle, the sewage collection system must have the capacity of collecting various leaked

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liquid pollutants on the roads. Special units shall be assigned the responsibility to remove and dispose the pollutants, preventing them from flowing to rivers and groundwater.

⑤The emergency sewage pools shall be checked regularly by responsible personnel in case that rainwater and other types of sewage are stored. Fences shall be built around the pools, and blocking shall be located at the entrance.

⑥Crash barriers shall be set up along the roadsides to prevent traffic accidents' polluting the water.

⑦Transportation regulation shall be strengthened so that vehicles loaded with uncovered bulk cargo like coal, lime, cement and overloaded trucks shall be banned on the road.

⑧Place alarming boards to prohibit vehicles with dangerous chemicals from entering the water source area. Publishing the phone number of highway management departments and formulating patrol duty system. Vehicles shall be guided by the management departments to pass through the area.

⑨For the designing and construction of the next stage, measures like tap-losing and seepage-proofing shall be taken; special sewage collection system shall be established; contingency plans of water environment shall be formulated and implemented so as to minimize threats to water safety.

The construction of the project shall only start on the premise that rigid water environment conservation measures are implemented and water supply threats are efficiently lessened.

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**Appendix 7:**

## **Tomb Environment Protection Regulations**

### (1) Relevant Laws and Regulations

According to Funeral and Interment Regulations in Gansu Province:

**18.** Public cemeteries are provided for bodies or ashes of the deceased in dispersed administrative and natural villages.

The village committee and representatives of villagers should negotiate to confirm the location and establishment of public tombs, which should be approved by the town government and then sanctioned by the county government.

**29.** Any activities during funerals should not breach public order, endanger public security, influence public health and intrude other people's legitimate right.

When people move tombs that might be destroyed during the construction, the above-mentioned regulations must be observed.

### (2) Emplacement of tombs

There are altogether 309 tombs need to be moved away from the land that will be permanently expropriated in the construction.

**Table 7-1 Tombs to be moved**

Proposed Roads	Location	Numbers	Property	Compensation (10000 CNY)	Emplacement
Jinse Dadao to Yongchang Town	Yongchang Town	84	Private, no antique	12.6	Cemetery
Yanjia Village, Gaoba Town to Liuwa Village	Gaoba Town	25	Private, no antique	3.75	Cemetery
Jinse Dadao to Wupu Town	Wunan Town	80	Private, no antique	12	Cemetery
Huangyang Town	Huangyang Town	10	Private, no antique	1.5	Cemetery
Core area in Urban and Rural	Tumen Town	38	Private, no antique	5.7	Cemetery

Integrity Development Tumen					
Dajing Town New Town	Dajing Town	72	Private, no antique	11	Cemetery
Total		309		46.55	

Since these 309 tombs were established after 1949 and are not historical relics, they are proposed to be moved into the public cemeteries of the project-related towns and villages.

#### 1 ) Moving Time

In order to show respect to the local custom that tombs are relocated in auspicious dates, the constructors should negotiate with families in advance and make sure all the compensation payment be handed. All tombs should be moved properly a month before the construction starts and any constructions are forbidden until tombs are completely removed.

2) The compensation payment for tomb relocation should be executed in accordance with *Resettlement Plan*.

#### 3) Monitoring Mechanism

Special personnel need to be put in charge of tomb moving and monitoring telephone line should be set in order to receive people's suggestions. There should be a *Suggestion Notes* to record the names, contact information of people who dial to consult or come to complain, and the influence to the project must be recorded. It is required that all complaints and consults must be responded in three working days and solutions must be provided and implemented in 10 to 15 days. All the implementing process and solutions must be recorded in *Suggestions Processed Notes*. The notes must be put under the supervision of Civil Affairs Bureau of Wuwei to ensure a timely treatment.

#### 4) Tomb Relocation Plan

The details of tombs relocation plan are in Table 7-2.

**Table 7-2 Tomb Moving Plan**

Tomb Location	Time	Institution of operation	Institution in charge	Supervisory institution
Yonhchang Town	A month before starting construction	All village committees	Lianghzou District Traffic Bureau	Civil Affairs Bureau of Wuwei
Gaoba Town				
Wunan Town			Gulang County Traffic Bureau	
Huangyang Town				
Tumen Town				
Dajing Town				

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**Appendix 8:**

## **Social management plan and implementation regulations**

### **8.1 Social Management Plan**

The Executive Office of the World Bank loan will fund the Overall Urban and Rural Development and Infrastructure Construction Project in Wuwei, Gansu Province.

Experts from the Immigration Center, Hehai University (ICHU), conducted an investigation and assessment of potential impact of this project, according to which a “Social Assessment Report” is compiled.

The social assessment report is based on adequate understanding of relevant regulations, laws and productive discussions with concerned parties, such as potentially affected residents, freight drivers, and relevant administrative departments. The major project designs and application-linked risks with potential impacts on the construction, and the development goals in accordance with field investigation and statistics analysis are clarified. Thereby, the assessors have proposed guidelines for the mitigation or prevention of potential losses.

#### **(1) Enforcing supervision on the construction quality to meet the need of the local people.**

To prevent an inadequate realization of social and economic interest due to the ignorance of public demand, or at the expense of some special group interests, the assessment makers propose the following measures to ensure road and relevant infrastructure constructions fully meeting the demand of the local people.

a. The project office, along with the Communications Bureau, shall supervise the technical data of the construction to ensure that they meet designed requirements and public demand;

b. The project office shall consult women’s opinions and opinions of residents from ethnical minority groups on monitoring and administrative affairs to cater to their interests;

c. The project office shall establish a feedback channel, through which public concerns for the construction will be collected, evaluated, and dealt with, with special

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attention to their needs for commuting and transportation.

**(2) Resisting and reducing negative impact of construction on residents' health.**

Inevitably, nearby residents' health will be affected during the construction. To overcome those drawbacks, the project office shall take four measures as follows:

- a. Starting the road construction in a semi-closed way, seeing that the construction to be conducted in non-rush hours to minimize inconveniences to commuting and transportation;
- b. Adopting proper measures, such as setting up caution boarders ahead of the junctures of nearby crossroads and conspicuous warning signs along the construction sections, to safeguard local residents from potential dangers that may cause damages to life or property;
- c. Enforcing proper measures to alleviated noise, dust, solid waste pollution to minimize construction-generated inconveniences; avoiding night shifts and shifts on windy days on construction sites to reduce noise and air pollution, reducing negative impact of dusting on adjacent residents and crops; disposing solid wastes lest they may affect residents' health or cause secondary pollution.
- d. The workers on the construction sites are expected to show respect for residents' convention and customs.

**(3) Information sharing and public engagement**

To release information concerning the progress of the construction and let the affected residents participate in the design of the project, ensuring a full realization of social and economic efficiency, the ICHU suggest the following approaches:

- a. Using governmental websites, networks, bulletins, brochures and other methods to the fullest extent to transmit relevant information about the project, allowing the residents to learn the process.
- b. Using governmental websites, networks, bulletins, brochures and other methods to recruit non-technical workers for posts of sanitation and maintenance on construction site, encouraging an active participation in the project.

**(4) Promulgating traffic safety rules among residents**

As many residents living in the vicinity of construction sites lack knowledge

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on traffic safety, the ICHU suggests that the residents should be made aware of it along with the process of the construction to reduce risks caused by human factors. The following are some concrete suggestions:

- a. Forming traffic safety publicity teams to promulgate traffic safety rules.
- b. Spreading traffic safety rules among residents, especially women, senior citizens and children, who do not know the basics of traffic safety, by adopting ways and means that are attractive to them, such as using propaganda cars in holidays, and issuing cards raising people's safety awareness on occasions of security education.
- c. Issuing brochures sensitizing safety awareness to migrant workers.
- d. Transportation administrations and freight firms shall sponsor traffic safety training programs for motor drivers (especially freight and passenger drivers) to raise their safety awareness.

**(5) Administration and maintenance upon the completion of the construction.**

At present, it is a common practice that many are keen on building up new roads; meanwhile, they largely neglect the maintenance once the roads are built. Suffering from severe damages, the roads are rendered virtually useless ahead of schedule. On this occasion, the residents request that some agency shall be held responsible for the day-to-day maintenance and funding. To meet this demand, the ICHU proposes:

- a. To recruit road maintenance staff from residents in the vicinity. It is hoped that the scheme will involve the locals more conscientiously into the maintenance work and increase their income at the same time.
- b. Regulating duties, criteria of assessment and other regulations for the maintenance staff, encouraging them to be zealous workers.
- c. Duties of the maintenance staff should include the following: day-to-day maintenance of newly built and reconstructed, day-to-day maintenance of road infrastructures, such as road lamps, railings, safety alert signs, greening strips and gutters. Besides, the staff shall stop saboteurs from causing damage, or report to those in charge for timely maintenance.

**(6) Providing jobs to affected residents.**

This project will have to affect residents' life in the vicinity, especially

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farmers whose land has been requisitioned and who have to move elsewhere. To make compensations for their losses and help the vulnerable to start a more prosperous and energetic life, the ICHU proposes some remedies aiming at the residents' shift to non-farming employments and a growth in per capita GDP, especially for women, the impoverished, the relocated, and farmers who have lost their land.

- a. 40 percent of non-technical working positions created in the project, temporary or permanent, shall be allocated in priority to women, the impoverished, people from ethnical minority living in or along the boundary of construction sites.
- b. Service industry along the newly-built roads shall be encouraged. The government shall help women, the impoverished and farmers have lost their land to start their own business, making full use of favorable policies and local resources.
- c. Skill trainings shall be provided to women, the impoverished and farmers whose land has been requisitioned, to help them to become adaptable to non-farming employments.
- d. Favorable policies shall be formulated to encourage local enterprise to recruit project-affected residents, especially farmers who have lost their land, to be employed in local enterprises with priority.

This social administration plan is formulated, on the basis of perpetual discussions with stakeholders, to ensure a thorough application and implementation of the above proposals, and a full realization of project goals.

Details are in Table 8-1.

## **8.2 Public Participation Plan**

Information openness and public participation plan was formulated based on questionnaires, meetings, and deep interviews of key informants. Details are in Table 8-2.

**Table 8-1 Social Management Plan of Infrastructure Construction Project in Core Urban and Rural Integration Zone**

Suggested Actions	Specific Measures	Executors	Time	Source of Fund	Monitoring Contents
<p><b>1. Strengthen construction quality monitoring and make sure roads and infrastructures meet people's need.</b></p>	<p>a. The Project Office and Transport Bureau need to adopt technology monitoring in project construction quality, making sure the construction meet the designing standard.                      b. The Project Office and other relevant units need to include female and ethnic group representatives in the project management, making sure the construction takes needs of them into account.                      c. Establishing feedback channels and accepting monitoring from people during the construction.</p>	<p>Project Office and Transport Bureau</p>	<p>Construction period</p>	<p>The project research fund, special fund from Transport Bureau</p>	<p>a. Road surface quality, road width, bridges, culverts and road lamps, green areas, traffic safety management facilities.                      b. Women's participation in the project management.                      c. Feedback channels.                      d. People's reorganization and evaluation.</p>
<p><b>2. Reduce negative influence exerted by the project on residents' daily life.</b></p>	<p>a. Road construction adopts semi-closed method in order to reduce negative influence on local people's life.                      b. Taking corresponding safety measures to avoid harm to local people's safety and property.                      c. Taking relevant measures to reduce noises, ashes and solid disposal pollution, reducing negative influence.                      d. Workers in construction sites need to respect local ethnic customs.</p>	<p>Project Office, the project contractors and other relevant units.</p>	<p>Constructing period</p>	<p>The project research fund</p>	<p>a. Semi-closed construction method, relevant safety measures and pollution control measures.                      b. Feedback and evaluation from people on the construction process and workers.</p>
<p><b>3. Strengthen information transparency and public</b></p>	<p>a. Using government website, TV, posters and others to publish project design, construction schedule, and construction results and so on.                      b. Using government website, TV, announcement, village</p>	<p>Project Office, Transport Bureau, City Construction</p>	<p>During and after Construction</p>	<p>The project research fund and</p>	<p>a. Publicity of information, including channels, ways, time, location and times.                      b. Publicity of recruiting</p>

<b>participation.</b>	committee announcement and so forth to publish posts, including non-technic workers, clean staff after construction completing and road maintenance staff.	and Environment Protection Management Office, the project contractors, TV station and other relevant units.		special fund from relevant units	information and the information of recruited people in the project-affected areas. c. People's awareness of information transparency and their evaluation on the information transparency work.
<b>4. Strengthen traffic safety education and publicity.</b>	<p>a. Establishing traffic safety knowledge disseminating group in charge of traffic safety.</p> <p>b. Adopting ways people like to disseminate transport safety knowledge to people in construction areas in proper time. Women, the senior, children and people who lack transport safety awareness should be involved.</p> <p>c. Paying attention to transport safety awareness education and assessment of drivers (esp. passenger and cargo transport drivers).</p>	Project Office, Traffic Police Brigade, the Highway Administrative Bureau, cargo and passenger transport companies with schools and village committee	During and after Construction	The project research fund, special fund from Traffic Police Brigade	<p>a. Results of traffic safety disseminating, including work reports, materials and photos.</p> <p>b. People's participation and evaluation.</p> <p>c. Changes of people's (esp. drivers) awareness after they receive the traffic safety awareness disseminating.</p>
<b>5. Pay attention to maintenance of road.</b>	<p>a. Recruiting road maintenance staff from construction areas and establishing village and town road maintenance groups.</p> <p>b. Making sure the responsibility of road maintenance group</p>	Project Office, Transport Bureau and	After the project is done	The project research	a. Village and town road maintenance establishment,

	<p>are known to its members and establishing assessment and subsidy method.</p> <p>c. The road maintenance group takes the responsibility of maintenance work of new-built and reconstructed road and roads in use.</p>	<p>other relevant units</p>		<p>fund, special fund from Transport Bureau</p>	<p>including members, responsibilities, assessment and subsidies method.</p> <p>b. Actual work and self-assessment</p> <p>c. People's feedback and evaluation on the group.</p>
<p><b>6. Provide subsidies to influenced residents</b></p>	<p>a. 30% of permanent non-technic posts and temporary posts should be distributed to women and the poor in construction areas.</p> <p>b. When the project is finished, areas located along roads and ones with tourism resources can develop tourism. Relevant units should encourage and provide support for women, the poor and resettled families to start business of their own nearby.</p> <p>c. Providing technology training to farmers, women and the poor in construction areas, preparing them for job transfer and non-agricultural posts.</p> <p>d. Formulating policies favorable to local enterprises and encouraging them to recruit people affected by the project (esp. those who are resettled because of land requisition).</p>	<p>Project Office, Poverty Alleviation Office and other relevant units.</p>	<p>During and after Construction</p>	<p>The project research fund and relevant poverty alleviation fund</p>	<p>a. Employment of people (esp. farmers affected by land requisition, women and the poor) affected by the project</p> <p>b. Supporting policies from relevant units targeting affected people.</p> <p>c. Training and participation of people (esp. farmers affected by land requisition, women and the poor).</p> <p>d. Feedback and evaluation from people (esp. farmers affected by land requisition, women and the poor).</p>

**Table 8-2 Information and Public Participation Plan of World Bank Project of Liangzhou District of Wuwei and Gulang Country**

Stage	Contents	Methods	Executors	Participants	Purposes	Sources of Fund
<b>Prepari ng Stage</b>	Basic information transparency of the project	TV, broadcasting, poster, banner, brochure, village committee announcement	Project Office and Transport Bureau	Residents/villagers (including women, the poor, the senior and other disadvantaged groups)/residential committee/village committee, etc.	Publishing basic information of the project; Collecting suggestions from residents; Answering residents' questions	Research budget of the project
	Feedback of need and suggestion from relevant units and residents/villagers in the project construction areas	Meeting, interview and questionnaire	Project Office, Social evaluation groups, resettlement plan group	Relevant units in construction areas, residents/villagers, esp. ones influenced by land requisition.	Collecting suggestions and need of relevant units, residents/villagers in construction areas; Stressing on suggestions from women, low-income group and other disadvantaged groups; guaranteeing transparency and justice of the project	Research budget of the project
<b>Constru -ction stage</b>	Project construction units	Non-technology posts residents/villagers participate in construction areas during construction	Project Office, project contractors	Residents/villagers (esp. disadvantaged groups) in construction areas	Making sure 30% of non-technology posts are distributed to residents/villagers in construction areas; Residents/villagers can be employed; Residents/villagers participating in the project monitor the quality of construction.	Project contractors
	Feedback of	Monitoring hot-lines and	Project Office	Project Office, project	Receiving monitoring from people in	Project

	people's suggestions	survey for people's suggestions		contractors, residents/villagers in construction areas	construction areas and reducing negative influence caused by construction to people's daily life as much as possible; Making sure corresponding safety measures are adopted and avoiding harm caused by construction to people's safety and property; Making sure local custom and ethnic culture are respected.	contractors
	Monitoring environmental impact of the project	TV, posters, public monitor	Project Office, Environment Protection Bureau	Project Office, Environment Protection Bureau, residents/villagers in construction areas	Monitoring pollution like ashes, noises and solid disposal, etc.	Research budget of the project
<b>Operation stage</b>	Establishing county and town road maintenance group	Posters, villagers represents meeting	Project Office, Transport Bureau	Project Office, Transport Bureau, residents/villagers in construction areas	Taking the responsibility of road maintenance, daily road management, preventing road harm and uploading road and facility harm.	Road maintenance fund from Transport Bureau
	Establishing traffic safety education mechanism	Paper materials (transport safety brochure, pamphlet, calendars and postcards with transport safety knowledge),	Project Office, Transport Bureau	Project Office, Transport Bureau, residents/villagers in construction areas	Imparting traffic safety knowledge to people (esp. women, the senior, children and people lack traffic safety awareness) in construction areas, making sure they master basic traffic safety knowledge, voluntarily obey traffic regulations and traffic accidents which are caused by	The project research fund, transport safety

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		electronic materials (LED screens), traffic police, and safety education meetings.			violation of traffic regulations will be avoided.	knowledge disseminating fund from Transport Bureau
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## **8.3 Complaints, supervision and evaluation**

### **8.3.1 Complaint Procedures**

The proposed project should establish effective and various complaint channels in order to timely find and solve problems caused by the project to residents; information transparency and possible community participation should be guaranteed. Based on the current situation in residential areas in the vicinity of the project construction, basic complaint procedures are established as follows:

Stage 1 If any residents' interests are harmed during construction, the residents can complain to the village committee, and the committee and residents can then go to village and town government for negotiation. The town government will record the complaints, and in two weeks, discuss the solutions with the village committee and residents.

Stage 2 If residents are not satisfied with the initial solutions, they can forward their complaints to Project Office in Liangzhou District or Gulang Country, and the office will respond to the complaints in two weeks.

Stage 3 If residents are not satisfied with the solutions in Stage 2, they can forward complaints to Project Office in Wuwei which will provide solutions in two weeks.

Stage 4 If residents are not satisfied with the solutions in Stage 3, they can forward complaints to administrative unites and go to arbitration according to *Administrative Action Law of People's Republic of China*.

Stage 5 If residents are not satisfied with the arbitration results, they can press law suit to civil court according to Civil Procedure Laws.

### **8.3.2 Monitoring and Evaluation**

Monitoring and evaluation is a major link of the implementation of a social management project. As an important error correction and participation mechanism, monitoring and evaluation are aimed at guaranteeing information disclosure, public participation and a sufficient emphasis on the project. Accordingly, a monitoring and evaluation mechanism has been set up in the proposed project which involves internal

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supervision as well as external monitoring and evaluation.

The internal supervision will be conducted in terms of the pace of the proposed project, the implementation of the social management program, information disclosure, public participation, expenses of the project and the enforcement of regulations.

The independent external monitoring and evaluation, directed at the social management program, will be conducted by qualified organizations that have sufficient experience in World Bank projects. The monitoring and evaluation organizations will supervise the social management plan in regularly, following it up all the way, providing consultation and reporting its work to the World Bank.