EMP Appendix 4

ANHUI YELLOW MOUNTAIN NEW COUNTRYSIDE DEMONSTRATION PROJECT

Water and Soil Conservation Schemes

(For Appraisal)

Huangshan New Countryside Project Management Office

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1 The current status of water and soil conservation

1.1 Current status of water and soil loss

Huangshan city's topography is varied and complicated, with hilly land, raging and meandering rivers and mountains of large gradient inside. Due to the natural geographic environment and other factors, the rainfall is mostly concentrated from April to July. The average annual rainfall in Huangshan city is1670mm, therefore, severe water and soil loss is liable to occur, mainly influencing Nanxiang Township in Shexian County and Yokoe basin in the upstream of Xin'an River. With the growing population and increase of development and construction activities, human behavior aggravated water and soil loss, making Huangshan city one of the two most serious water and soil loss regions in Anhui Province. The main soil erosion type in this region is water erosion, followed by gravitational erosion.

According to annual water and soil loss conservation bulletin in 2005, the city's existing water and soil loss area is 2587.42km^2, accounting for 26.38% of the total land areas of the city, including 1798.02km^2 of mild water and soil loss, 616.01km^2 of moderate water and soil loss, 160.57km^2 of intense water and soil loss, 12.82km^2 of highly intense water and soil loss. Average soil erosion modulus in water and soil loss region reached 2624t/km^2·a , and soil erosion in this year surplus 6.7894 million tons. As described in the table below.

Table 1.1.1 the current status of water and soil loss in Huangshan City

County	Land area	Mild erosion		Moderate erosion		Intense erosion		Highly intense erosion	
		Area	%	Area	%	Area	%	Area	%
Tunxi District	213	32.98	15.48	0	0.00	0	0.00	0	0.00
Huangshan District	1601.4	355.77	22.22	38.05	2.38	9.3	0.58	0	0.00
Huizhou District	440	75.75	17.2	38.88	8.8	48.84	11.37	0	0.00
Shexian County	2129.83	392.75	18.44	233.01	10.94	72.37	3.40	12.05	0.57
Xiuning County	2150.56	271.79	12.64	221.34	10.29	28.53	1.33	0.59	0.03
Yixian County	847.27	204.99	24.19	59.1	6.98	1.37	0.16	0.18	0.02
Qimen County	2207.83	463.99	21.02	25.63	1.16	0.16	0.01	0	0.00
Total	9589.89	1798.02	18.62	616.01	6.02	160.57	1.17	12.82	0.13

1.2 “Three Partition” of water and soil conservation

In line with *Announcement on Partition of Key Water and Soil Loss Conservation Areas at State Level* (see Announcement of Ministry of Water Resource, No.2, 2006) and *Notification about the Strengthen of Water and Soil Conservation Work in Partitioned Key Areas* (see Government documents of Anhui Province, No. 53, 1999), the project area belongs to the water and soil loss prevention and protection area at state level of Xin’an River and key water and soil loss prevention area, supervision area and control area under Anhui Province.

2 Extent of responsibility of water and soil loss control

According to principle “who exploit should protect, who cause water and soil loss shoulder the responsibility”, in accordance with requirements in *Regulation of Techniques for Water and Soil Conservation in Development and Construction Project*, in combination of survey of the project area, general layout of project and its characteristics, the extent of responsibility of the prevention and control of water and soil loss in new countryside construction demonstration project of World Bank Loan in Huangshan, Anhui Province includes the constructing area of the project and the direct influencing area, responsibility of the water and soil loss control is borne by the construction unit.

2.1 The constructing area of the project

The constructing area of the project refers to the disturbance area, including the project’s scope of land acquisition, land occupation, construction land and the scope of permanent and temporary land acquisition in the project’s control limit. The constructing area of the project has a permanent land acquisition of 926.6hm^2 and temporary land acquisition of 16 hm^2 , adding up to942.6 hm^2.

2.2 Direct influencing area

Direct influencing area refers to areas where water and soil loss caused by construction of the project and regions influenced by the aforementioned water and soil loss, except constructing area of the project.

By site survey and investigation, in combination of geographical conditions, etc., the direct influencing area is identified as follow:

(1) Infrastructure works area：Land occupation has all been included in the constructing area of the project, extended 2 meters outside the works area is included. Direct influencing area is 9.83hm^2.

(2) Cultural heritage protection and utilization works area: Since this project area aims at renovation of old houses, all land occupation has been included in the constructing area of the project, and direct influencing area would be negligible.

(3) Specialty industry works area: Extended 1meter outside the industry district is included. Direct influencing area is 13.7hm^2.

(4) Construction works area: Extended 2 meters around the construction works area is included. Direct influencing area is 0.32hm^2.

(5) Waste disposal area: Since the filled soil height is relatively low and obstruction measure is taken, so extended 2 meters around the area is included. Direct influencing area is 0.58hm^2.

All required gravel and rock block etc. will be purchased from commercial quarry nearby, the responsibility of water and soil loss control shall be borne by the mining side. This project's extent of responsibility may not cover this.

Based on the abovementioned principle, direct influencing area of the project is 24.43hm^2.

To sum up, this project's extent of responsibility of water and soil loss control is 967.03 hm^2, of which the constructing works area is 942.6 hm^{2}and the direct influencing area is 24.43 hm^2.

3 Water and soil loss prediction

3.1 Analysis of characteristics of water and soil loss

Engineering construction in this project includes land flattening, construction of buildings, drainage ditches excavation and laying and construction of road etc., which demand complex construction technology. Characteristics of water and soil loss at different construction times are described as follows:

(1) Preparatory period of construction: The land vegetation removal, cleanup land flattening, etc. the original ground surface is disturbed, mantle of the land, especially the vegetation is damaged, and most land is fully exposed. Under the effect of rainfall, new water and soil loss may occur easily.

(2) Construction period: Civil construction includes massive excavation of foundation pit, project of pile foundation and construction of buildings. At this time, a mass of original ground surface is disturbed. Since excavation and backfill cannot be conducted at the same time and same place, exposed or mounded soil often leads to water and soil loss.

(3) Natural recovery period: During this period, since excavation and backfill on the ground surface is finished, buildings and road surface is hardened, vegetation is fixed, trees and grass have been recovering and come into effect, intensity of water and soil loss is greatly lessened. But a small amount of water and soil loss would occur.

3.2 Prediction range and period

3.2.1 Prediction range

Prediction range of water and soil loss refers to the disturbance area of each control zoning. Prediction unit should be the area in which the time of disturbance surface, disturbance forms, disturbance strength and features are consistent in general.

According to the requirements above, and in combination with natural situation, project layout and construction characteristics in project areas, the prediction range consists of 68 Grade 1 partitions and 68 Grade 2 partitions. Infrastructure engineering area in Grade 2 partitions can be divided into road and appurtenant engineering, water

drainage engineering and water and soil loss prediction partition in Grade 3 hydraulic engineering partition.

3.2.2 Prediction period

This project is a construction project. According to characteristics of the project, the water and soil loss prediction mainly forecasts water and soil loss in engineering construction period. Nearly no water and soil will get lost after the completion of the engineering construction, so we don't forecast the water and soil loss produced in the production run period of the project. But make prediction during the engineering construction period including construction preparatory period, construction period and natural recovery period.

According to the feasibility study report of the project, during construction preparatory period, it's required to complete all the formalities for engineering construction using land, clean the construction site, complete "three supplies and one leveling" and build necessary infrastructures before construction. The construction preparatory period will last about 3-4 months.

The construction period starts from buildings and roads excavation to the competition of civil engineering mainly including buildings and roads excavation, foundation construction, prefabricated parts, water drainage facilities and afforest construction, etc. The construction of buildings is from March 2013 to February 2016. Construction periods exceeding the rainy season are accounted as a year, and construction periods not exceeding the rainy season (rainy season in the project area lasts for 4 months from May to August) are accounted according to its length proportion of the rainy season.

It is assumed that 2 years' natural recovery period is more appropriate according to climate and soil condition of the project area. See water and soil loss prediction time of each construction unit in Table 3.2-1.

Table 3.2-1 Water and soil loss prediction time division during engineering construction period

Prediction Partition	Prediction period of time (year)		
	Construction preparatory period	Construction period	Natural recovery period
Infrastructure engineering area	1	3	2.0
Cultural heritage protection and utilization engineering area	1	3	2.0
Special industry engineering area	1	3	2.0
Waste disposal area	1	3	2.0
Construction site	1	3	2.0

3.3 Prediction content and methods

The purpose of water and soil loss prediction is to analyze the amount of possible water and soil loss caused by engineering construction and potential damage of water and soil loss, grasp the particular time when the incremental water and soil loss may happen as well as the particular place so that to make a scientific basis for reasonable layout of each control measure. As per provisions of Water and Soil Conservation Technical Specification of Development and Construction Projects (GB50433-2008), the water and soil loss prediction content of the project mainly includes the area of disturbance surface, the number of destroyed water and soil conservation facilities, abandoned soil and slag amount, water and soil loss amount, incremental water and soil loss amount, and damage of water and soil loss.

According to the analysis of factors affecting water and soil loss, we can know that, in addition to natural factors in project area such as hydrology, atmosphere, soil, landform and vegetation cover, the water and soil loss during engineering construction is affected by all kinds of construction activities, which make water and soil loss in construction area special (such as the form of water and soil loss, great change of quantity, etc.). As a result, the water and soil loss changes with the change of construction units and progress, showing a dynamic nature of space and time change.

3.3.1 Area of disturbance surface

According to relevant data of the general layout of the project and feasibility study report, the area of disturbance surface is 942.6 hm^2 in total by calculation, of which

there are 926.6hm^2 of permanent land occupation and 16hm^2 of temporary land occupation.

3.3.2 Destroying water and soil conservation facilities

According to Management Approaches of Compensation for Water and Soil Conservation Facilities, Collection Standard and Use of Soil and Water Conservation Fee of Anhui Province (W.J.F. [2006] No.160), except for some water, residences and cultural heritages, other land types with a function of soil and water conservation occupied by the project during construction period should be incorporated into the soil and water conservation facilities. The total area of soil and water conservation facilities that may be destroyed during construction of the project is 309.7hm^2.

3.3.3 Amount of abandoned soil and slag

By calculating earth volume in this scheme and balance analysis, the area of earth excavation during construction period is 1,200,490 m^3, and backfill 1,033,840m^3, 166,600m^3 abandoned earth needs to be carried to the waste spoil area.

3.4 Prediction of water and soil loss amount

3.4.1 Prediction methods

Use analogy method to predict the increment quantity of probable soil loss produced in construction process according to natural conditions and construction disturbance characteristics of the project area on the basis of functions of main body design.

Using the following formula to calculate the quantity of soil loss:

$$W = \sum_{j=1}^{3} \sum_{i=1}^{n} \left(F_{ji} \times M_{ji} \times T_{ji} \right)$$

$$\triangle W = \sum_{j=1}^{3} \sum_{i=1}^{n} \left(F_{ji} \times \triangle M_{ji} \times T_{ji} \right)$$

W-the quantity of soil loss, t

△ W-the incremental quantity of soil loss, t

Prediction area of Unit i in Fji-j period, km^2

Soil erosion modulus of Unit i in Mji-j period, t/km^2.a

Incremental soil erosion modulus of Unit i in △ Mji-j period, t/km^2.a

Prediction time of Unit i in Tji-j period, a

i- Prediction unit, i=1, 2, 3… n

j- Prediction time, j=1, 2, 3, refers to construction preparatory period, construction period and natural recovery period.

3.4.2 Predictive parameters

(a) Background value of soil erosion modulus

According to soil erosion modulus measured by standard runoff plot of Shexian County water and soil conversation testing station, the background value of soil erosion modulus of the selected area is 150-500t/km^2.a.

(b) Erosion modulus selection of analogy projects

According to actual measurement of standard runoff plot (15°, 100 m^2, bare all year) of Shexian County water and soil conversation testing station, the maximum erosion modulus is 7518 t/km^2.a.

(c) Soil erosion modulus after disturbance

When confirm the disturbed soil erosion modulus of the project, correct the monitoring results of soil erosion modulus according to the measured data of Shexian County water and soil conversation testing station, main factors affecting water and soil loss and functions of water and soil conservation measures on reducing water and soil loss.

3.4.3 Prediction result

Separately predict the quantity of water and soil loss may be caused during construction preparatory period, construction period and natural recovery period according to the prediction time divided in Table 11.3-1. According to the predictive calculation, the total probable water and soil loss caused by the engineering construction is 500486t including background loss amount 14934t, incremental loss amount 485552t. See detailed prediction results of water and soil loss partition in Table 3.4-1.

Table 3.4-1 Prediction Results of Water and Soil Loss Amount

Prediction Partition and period		Area of Probable Water and Soil Loss	Background Values of Water And Soil Loss	Predictive Water and Soil Loss Amount	Incremental Water and Soil Loss Amount
		(hm^2)	(t)	(t)	(t)
Buildings engineering area	construction preparatory period	282.350	564.70	85967.10	85402.40
	civil construction period		1694.10	85967.10	84273.00
	natural recovery period		1129.40	13722.21	12592.81
Cultural heritage protection and utilization engineering area	construction preparatory period	11.360	22.72	845.52	822.80
	civil construction period		68.16	2766.96	2698.80
	natural recovery period		45.44	441.68	396.24
Specialty industry engineering area	construction preparatory period	914.800	1829.60	68088.56	66258.96
	civil construction period		5488.80	204265.69	198776.89
	natural recovery period		3659.20	32603.47	28944.27
Waste disposal area	construction preparatory period	10.00	45.00	811.90	766.90
	civil construction period		135.00	2435.70	2300.70
	natural recovery period		90.00	388.80	298.80
Construction site	construction preparatory period	6.000	27.00	487.14	460.14
	civil construction period		81.00	1461.42	1380.42
	natural recovery period		54.00	233.28	179.28
Sum of construction period	construction preparatory period	1224.510	2489.02	156200.23	153711.21
	civil construction period		7467.06	296896.87	289429.81
	natural recovery period		4978.04	47389.44	42411.40
Sum of construction period		1224.510	14934.120	500486.544	485552.424

3.4.4 Analysis on harm of water and soil loss

The project construction will disturb the earth surface and destroy vegetation, which may worsen the local ecological environment and affect the development of the local industry and agriculture as well as people's living standards unless taking effective control measures. The main harms of water and soil loss may be caused are as follows:

(a) Possible harms to the project

Aggravate water and soil loss and affect the engineering operating. Construction processes during the engineering construction such as site excavation and remediation, structures and roads, etc will disturb the original soil layer, destroy the soil mass and

seriously affect its stability and aggravate water and soil loss, which is adverse to the project's normal operating.

(b) Impacts on river water quality

Cleaning river water during construction period will affect the quality of river water as dredging will take up silt, microorganism and suspended matter in river which may flow to downstream with water and worsen river water quality as a result.

(c) Possible harms to water and soil resources of the project area

Accelerate land fertility loss and lower land capability. The disturbance of the original landscape and destroy of surface vegetation and soil layer in project areas lead to soil organic matter lose, content of nitrogen, phosphorus, organic matter and inorganic salt in soil decrease rapidly at the same time, which can deteriorate site conditions and make it difficult to later vegetation restoration work.

(d) Possible harms to surrounding areas

The construction disturbance surface area and earth and stone work amount of the project will disturb the original landscape, greatly decrease anti-erosion ability of surface soil, and will cause water and soil loss very easily. With appearance of water and soil loss and surface runoff running into rivers, the water environmental service engineering will reduce, resulting in ecological environment deterioration.

3.5 Predication conclusion and comprehensive analysis

3.5.1 Prediction conclusion

Through communication with the project construction unit and the design organization, based on relevant design drawing, design data and land utilization planning provided by local government sector, the concluded and calculated data statistics of the project construction is as follow: the disturbance area: 1302 hm^2, damaged soil and water conservation facilities area: 1224hm^2, total quantity of earth work during the construction period: 22.3million m^3, and underlying total quantity of water and soil loss caused by construction: 5.0048million tons, including 14934tons of background water and soil loss and 485552tons of newly increased water and soil loss. The predicted quantity of underlying water and soil loss can be seen from Table 3.5-1.

Table 3.5-1 Summary sheet of quantity of underlying water and soil loss

Prediction partition	Preparatory period	Civil construction period	Natural recovery period	Newly increased water and soil loss	Proportion of partition
	(%)	(%)	(%)	(t)	(%)
Infrastructure	17.59	17.36	2.59	182268.22	37.54
Cultural heritage protection and utilization	0.17	0.56	0.08	3917.84	0.81
Specialty industry	13.65	40.94	5.96	293980.13	60.55
Waste disposal area	0.16	0.47	0.04	3366.40	0.69
Construction plant	0.09	0.28	0.04	2019.84	0.42
In all	**31.66**	**59.62**	**8.72**	**485552.42**	**100.00**

3.5.2 Comprehensive analysis

(1) Key area and period of water and soil loss

The underlying total quantity of water and soil loss caused by civil construction during the construction period is 5.0048million tons, and the quantity of newly increased water and soil loss is 485552tons, including 37.54% of which caused by infrastructure construction, 0.81% by cultural heritage protection and utilization, 60.55% by specialty industry, 0.8% by construction plant and 7.6% by waste disposal area. Therefore, infrastructure area and specialty industry area should be seriously controlled and listed as key areas to be protected and supervised over water and soil loss; construction period and preparatory period, taking up 59.62% and 31.66% of water and soil loss respectively, are the two major periods water and soil loss happens, as well as two important periods when water and soil loss water and soil loss should be prevented and controlled.

(2) Suggestions on control measures layout

The main soil erosion type in this area is water erosion, so rainfall becomes the major factor that lead to water and soil loss. Measures and plans of water and soil conservation should strive to complete the drainage system and build makeshift drainage ditches and sand basin to drain away rainfall and avoid the formation of

plash or flood which would worsen water and soil loss; meanwhile, excavation and backfill of this project may result in serious water and soil loss, so preventive works should be done, besides, open space should be covered by trees and grass as much as possible, controlling underlying water and soil loss, as well as improving environment of the project area, through vegetation measure. Water and soil conservation measures should keep pace with the construction period of the main project. In theory, temporary measures should be carried out first, and then carry out engineering measures and at last vegetation measures. As for provisional mounding, “damming up before mounding” measure should be taken. Construction schedule of the main project should be arranged compact and construction in rainy season should be avoided. For this reason, water and soil loss period will be shortened and water and soil loss can be reduced.

(3) Soil and water conservation monitoring

Soil and water conservation monitoring in this project is mainly over watercourse revetment work area and construction period is the especially critical. Water and soil loss mainly happens in rainy season, regular monitoring should be increased during this period.

4 Soil and water conservation measures

4.1 Control measures layout principle

Layout of the control measures system refers to the scientific arrangement of project-listed engineering measures, newly-added engineering measures, vegetation measures and control measures on the bases of analysis and evaluation of the design of the main construction project. Through this arrangement, prevention measures and control measures are separately carried out, but an integrated prevention and control measures system is formed.

Controlling measures of water and soil loss in this project should comply with the following rules:

(1) According to the type of soil erosion in the project region, in combination with engineering practice and current status of the water and soil loss in the project region, adjust measures to the local conditions, set up fortification against unexpected water and soil loss, implement scientific allocation and optimize layout.

(2) Avoid artificial disturbance and rejected materials in the project region during construction, and carry out provisional controlling measures to lessen newly increased water and soil loss to the minimum amount.

(3) Learn from the local government and similar projects their experience in water and soil conservation, and using advanced technology home and abroad for reference, effectively control newly increased and natural water and soil loss in the process of construction and manufacturing with high-tech, low-input and high effectiveness.

(4) Lay emphasis on both the scientificness inside each control area and the connection and systematicness between control areas.

(5) When laying out control measures, several measures should be put forward to control water and soil loss in spoil ground (either for rock and residue) and large-scale excavation and choose the best measure with consideration to safety, control effect, construction conditions and investment.

(6) Apply scientific outlook on development, build up the concepts of people-oriented,

overall coordination, sustainable development and harmony between human and nature, show respect to law of nature, and coordinate with the surrounding landscape.

(7) The layout of control measure system should be in close combination and coordination with main project, forming an integrated part.

(8) When carrying out engineering measures, local materials should be chosen, realizing feasibility in technology and rationality in financial condition.

(9) When carrying out vegetation measures, plant varieties suitable to the local condition should be chosen, and results of virescence and landscaping should be taken into consideration.

4.2 Control measures system and general layout

4.2.1 General layout

Water and soil loss control in the project region should be conducted according to “Three Simultaneities”. Layout of water and soil conservation measures should be implemented in full scale, with equal emphasis first on overall situation and then on local region, first on key areas and then on areas of less importance, in order of priority, differential treatment. The general layout guideline is as follow: engineering measures combine with temporary measures; combine control measures of water and soil loss caused by pitting corrosion, line corrosion and surface corrosion; give full play to control and timeliness of engineering measures; curtail and reduce water and soil loss in a short period of time; hold the water in the soil and protect the new ground surface through water and soil conservation measures and physical planning measure, achieving overall control over water and soil loss.

The water and soil loss control in this project is mainly over project construction area. Water and soil loss in infrastructure works area is severe, so infrastructure works area should be controlled as a key area. When carrying out control measures of different regions, emphasis should be put both on characteristics of water and soil loss in each region, as well as its relevant control measures, key areas and requirements, and on correlation, continuity, integration, systematicness and scientificness of each area.

4.2.2 Measures system

On the bases of analysis and evaluation of water and soil conservation in this main

project, in combination of the defined water and soil conservation works, according to prediction conclusion of water and soil loss and characteristics of each control area, logical, integrated and systematic planning should be carried out, and supplementary and detailed control measures should be put forward, so that an integrated water and soil loss control measure system is formed, with engineering measures taking the lead, and vegetation measures and temporary measures combined.

With obstruct project set up in waste disposal area, water and soil loss produced by spoil and residue can be obstructed in one “Spot”; when new ground face is formed, waterway and revetment should be built to ensure slope stability, so water and soil loss is controlled by “Drain Line”; at the same time, land improvement, such as flattening, planting trees and grass, should be conducted, so water and soil loss is controlled by “Surface Landscaping”. With combined “Spot”, “Line”, and “Surface” control measures and their interaction, a comprehensive control measure system is formed, so ground surface is protected, ecological environment is improved and water and soil loss is controlled. This is the transformation from passive control of water and soil loss to overall development and improvement.

According to layout of main project, construction features, main factors that lead to water and soil loss, and other similar principles, this water and soil loss control measure system is partitioned as follow: grade-one partitions are the 68 regions of each village; grade-two partitions include five areas, and they are: area of infrastructure, area of cultural heritage reservation and utilization, area of specialty industry, area of construction, and area of waste disposal; grade-three partitions include 4 areas, and they are: area of road works and area of its ancillary works, area of water supply and drainage, and area of water conservancy project. Grade-three partitions make demands of water and soil conservation on materials purchased abroad.

(1) Area of infrastructure project

a. Road works and its ancillary works

Engineering measures: To take preventive measures to maintain rain water drainage pipes on both sides of the road, roadbed slope protection, roadbed drainage system, roadbed compaction, and landscaping engineering. Thus, roadbed is stabilized; surface gathered water is removed; road condition is improved and safety is

guaranteed. Meanwhile, main works area finishes road-hardening of new road and broadened road, provides service for road safety and prevents water and soil loss from destroying the main works.

Temporary measures: for the case of temporary land occupation in construction, fertile soil should be moved aside, and when the construction is finished, the removed mellow soil should be moved back for future cultivation. According to the local natural conditions, suitable evergreen plants should be planted in open ground except Hard Cover so that open space increased by road construction can regain vegetation.

b. Water supply and sewerage works

Engineering measures: To remove topsoil and put together earthwork of excavation in layers as temporary waste disposal area according to the status of excavation and backfill. When the engineering is finished, backfill-consolidation should be proceeded promptly in order to avoid damage to the engineering construction from water and soil loss.

Temporary measures: excavation and side-slope-fill in construction period, to cover fill slope, and to build up temporary drainage ditches and sand basin.

c. Water conservancy project

Engineering measures: To remove topsoil, put together and cover earthwork of excavation in layers according to the status of excavation and backfill. When the engineering is finished, backfill-consolidation should be proceeded promptly in order to avoid damage to the engineering construction from water and soil loss.

In construction of side ditches of the main road inside the village, bank protection and seepage prevention should be built to lessen scouring, reduce sediment runoff and prevent water and soil loss in water delivery through soil channels. When side ditch revetment and channels are in construction, try to backfill with earthwork of excavation and save earthwork as much as possible.

In channel improvement, try to backfill with earthwork of excavation and save earthwork as much as possible, cutting down on water and soil loss in the project area to the minimum.

Temporary measures: foundation construction of road and revetment in upstream or downstream, filling and dismantling earth-bag for temporary cofferdam and

temporary sand basin inside cofferdam.

d. Ancillary facilities

Build new guardrails on both side of the river in the village, which will not affect water and soil conservation facilities. Do not take it into consideration.

Engineering measures: To build 2 public toilets and 3 parking lots in the project area. In construction, topsoil should be removed, put together at temporary waste disposal area and used for public landscaping.

(2) Area of cultural heritage protection and utilization project

Engineering measures: To transport construction waste to waste disposal area and put it in the bottom layer.

Temporary measures: To put together construction waste in one spot with covering on them, avoiding water and soil loss in construction.

(3) Area of specialty industry project

Engineering measures: To flatten earthwork, build irrigation and drainage waterways, impounding reservoirs, drainage ditches and plant fruit trees, which are water and soil conservation measures. Construction should be conducted in accordance with *Regulation of Techniques for Comprehensive Control of Soil Erosion* to reduce water and soil loss.

Temporary measures: To remove the topsoil of excavation in planning area, temporarily put the removed topsoil in one spot, used as a nursery stock base; and remove topsoil of earthwork.

(4) Area of construction plant

Engineering measures: To implement land consolidation in construction plant after completing construction; and recover the land occupation type.

Vegetation measures: To sow cynodon dactylon seeds on grassland in the construction plant.

Temporary measures: To excavate makeshift drain ditch around the area; build sand basin; consolidate the ground where machines are placed and the open space for material processing with gravel.

(5) Area of waste disposal

Engineering measures: To build brick wall around the area to separate from the non-project area; and connect water system nearby with drainage ditches outside the wall. At the end of each drainage ditch, a sand basin should be built.

Vegetation measures: To sow cynodon dactylon seeds on spoil ground where vegetation recovery is necessary.

5 Water and soil conservation monitoring

5.1 Monitoring Period

The project is a construction one. While water and soil loss is mainly occurred during the period of the construction. Therefore, there is a 6-year's monitoring period from the preparation period (2012) to the design level year (2017).

5.2 Monitoring Content and frequency

5.2.1 Monitoring Contents

The monitoring content of water and soil conservation consists of these following parts:

(1) Causes monitoring of water and soil loss

Including: landforms, soil property, vegetation coverage, precipitation, wind, and so on.

(2) Environment monitoring of water and soil conservation

Including: changes in landforms and hydrographic net, floor space and disturbance area of the project, excavation and embankment volume and area, quantity of spoils (stone, slag) and their form and area of pile-up, quantity, time, form and area of temporary soil storage, vegetation coverage of the project zone.

(3) Dynamic monitoring of water and soil loss

It includes damage and the trend of damage to the downstream and surrounding areas imposed by different type, area, intensity and load of water and soil loss.

(4) Result monitoring of water and soil conservation measures

Including: quality and quantity of various water and soil conservation measures, survival and preserving rate of forest and grass after the vegetation measures as well as their growth condition and coverage, stability, soundness and operation of engineering measures, and the result of soil conservation through several conservation measures.

(5) Objective monitoring of water and soil conservation

Including 6 targets: improvement rate of disturbed land, general degree of water and soil loss management, control rate of soil loss, slag blocking rate, coefficient of vegetation restoration, vegetation coverage and so on.

Main monitoring points: implementation of water and soil conservation measures, management of application as well as safety requirements of the spoil area, information of disturbed land and occupied vegetation, practice of water and soil conservation measures (including temporary conservation measures), and the implementation of the accountability system of water and soil conservation.

5.2.2 Monitoring Frequency

The project shall be monitored constantly during the whole construction period (including the preparation period).

The spoil area and the development of water and soil conservation shall be monitored at least once per 10 days; the disturbed area and the engineering blocking measures of water and soil conservation shall be monitored at least once a month; the progress of the principal work, influencing factors of water and soil loss and the growth of the vegetation under water and soil conservation measures shall be monitored at least once every 3 months; once encountered rainstorm, gale or something alike, monitoring shall be added immediately; and the monitoring shall be completed within a week after water and soil loss.

5.3 Monitoring Area, Monitoring Site and Plan

5.3.1 Monitoring Area

The monitoring range of this project belongs to the extent of responsibility of water and soil conservation. The main monitoring area is the infrastructure area.

5.3.2 Monitoring Point

Monitoring point is a site for observing the intensity of water and soil loss. And this site shall be established according to the forecast and analysis of water and soil loss. And the following principles shall be conformed while establishing:

(1) Representativeness. Monitoring sites shall be built among areas of different water and soil loss types. The original landscape under comparative observation shall be

comparable to the disturbed landscape and one monitoring site is enough for the same places of different partitions.

(2) Convenient monitoring. Choose a place as convenient as possible so as to manage it easily.

(3) Avoid interference. Try to avoid interference brought by human activities.

(4) Build in different time period.

The location of the monitoring site shall be determined by the principles above-mentioned, and also by these following factors: features of the project, the disturbed area and its feature, different types of water and soil loss, facilities and distributions disturbing the excavation, vegetation condition as well as water and soil conservation, transportation and communication conditions. In this project, there are 5 monitoring sites, and there is one site in every secondary engineering division.

On the basis of fixed-site monitoring above-mentioned, investigation and inspecting system shall be established and improved, expanding the coverage of monitoring as a supplement of monitoring sites and increasing the frequency of investigation.

5.4 Monitoring Facilities, Organization and Personnel

In accordance with the requirement of monitoring content and monitoring approaches, facilities determining the water and soil conservation measures included: diastimeter, GPS position indicator, ombrometer, sightcing and camera. The monitoring is borne by the organization with monitoring qualification for water and soil conservation authorized by the employer. The organization shall monitor under detailed rules of relative monitoring specifications, entrusting qualified personnel with certificate.

5.5 Monitoring system

5.5.1 Monitoring report

(1) Before the project coming into operation (including preparation period), *Implementation on Water and Soil Conservation Measures of Production and Construction Project* shall be submitted to relative water administrative department. During the construction period, *Quarterly Report Table on Water and Soil Conservation Measures of Production and Construction Project* of previous quarter shall be submitted within the first month of every quarter. Meanwhile, pictures and

other image date concerning spoils at important places shall be also provided. Serious water and soil loss and relative damage caused by rainfall, gale or other human factors shall be reported within a week after these events. At the end of monitoring, *Final Report on Water and Soil Conservation Measures of Production and Construction Project* shall be submitted within 3 months.

(2) After the approval of the project by water administrative department, the report and report table above-mentioned shall be submitted to the river-basin organization in which the project located by the construction unit. Meanwhile, copying the subordinate water administrative department the project has involved. The report and report table submitted shall be sealed by the production and construction organization and signed by the principal of the project. *Implementation on Water and Soil Conservation Measures of Production and Construction Project* and *Final Report on Water and Soil Conservation Measures of Production and Construction Project* shall also be sealed by the monitoring organization.

5.5.2 Announcement of Monitoring Results

On the basis of analyzing the monitoring results, the river-basin organization or the water administrative department shall publish the water and soil loss of production and construction project and its conservation conditions regularly (at least once a year), and shall also be subject to public supervision. The main content of the publication including: disturbed land, areas of occupied vegetation, quantity of spoils (stone), slag blocking rate, periodic management results, water and soil loss event and main measures for water and soil conservation.

6 Investment estimation of water and soil conservation

The newly added investment for water and soil conservation totaled RMB10.7066 million, among which the engineering measures 3.6587 million, vegetation measures 2.1359 million, temporary measures 1.9501million, plus independent cost 0.8949 million (containing construction management cost 0.24 million and water and soil conservation monitoring fee 0.3 million), basic reserve funds 0.5184 million as well as facility compensation fees for water and soil conservation 1.5486 million.