Forest Chemicals Review
www.forestchemicalsreview.com
ISSN: 1520-0191
September-October 2022 Page No. 165-172
Article History: Received: 05 April 2022, Revised: 27 April 2022, Accepted: 03 May 2022, Publication: 14 May 2022

Explore of Scheme and Prediction of Loss and Conservation of Soil and Water of a Drainage Pump Station Project

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Abstract:

A drainage pump station project was located on the beach area on the left bank of the middle and lower reaches of the Yangtze River in Wuwei County. Therefore, special attention should be paid to water and soil loss in the construction of A drainage pump station project. Based on the prediction of the original landform, damage to land and vegetation, amount of spoil (stone and slag), damage to water and soil conservation facilities and possible water and soil loss of A drainage pump station project, this paper carries out the design of water and soil conservation scheme. According to the prevention and control area, spoil area, construction layout area, temporary soil stacking area and temporary road area of the main project, the water and soil conservation measures were put forward, and the water and soil conservation workload was calculated. Through the prediction of water and soil loss and discussion of water and soil conservation scheme in the construction process of the project, the adverse impact of the construction process of A drainage pump station can be minimized.

Keywords*: Water loss and soil erosion, Water and soil conservation, Programme, Drainage pump station.*

I. INTRODUCTION

A drainage pump station project is located on the left bank beach of the middle and lower reaches of the Yangtze River in Wuwei County, which is an alluvial plain of river and lake facies. The terrain within the scope of the project is relatively flat, with the dike height at the station site of 14.8m-15.0m and the ground elevation of 8.2m-8.5m; in general, the ground elevation of diversion canal is generally 6.9m-8.5m. According to the exploration, it is shown that the stratum of the proposed site of A drainage pump station project and the downstream outlet pipeline is mainly formed by Quaternary alluvial. The project construction area mainly includes the main project construction area (including management area), spoil area, temporary dump area and construction layout area. Therefore, carrying out the prediction of water loss and soil erosion and the study of soil and water conservation measures for the construction of A drainage pump station project is of great significance to the regional ecological environment protection. Targeted soil and water conservation measures can be implemented to minimize the adverse effects [1-2].

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II. PREDICTION OF WATER LOSS AND SOIL EROSION

2.1 Prediction of the Original Landform, Land and Vegetation Damage

The construction area of A drainage pump station project mainly includes main project construction area (including management area), spoil area, temporary dump area and construction layout area. The land and vegetation area damaged by the project is mainly due to excavation and occupation of the diversion canal, pump station buildings and management area. Through calculation, the damaged area of the surface and vegetation in the construction area of the main project is 6.2hm^2. The abandoned soil of the project covers an area of 6.9m^2. It is cultivated land, and is temporarily requisitioned for one year.

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The layout area mainly includes temporary houses, roads, temporary cofferdams, etc. Because some temporary works (such as cofferdam construction, etc.) are located in the construction area of the main project, the total area of the damaged surface vegetation has been included in the construction area of the main project. Temporary works outside the main construction area cover an area of 1.5hm^2.

The temporary dump area outside the main project covers an area of 0.46hm^2, which is cultivated land and temporarily requisitioned for one year. The temporary road area outside the main part of the project covers an area of 0.7hm^2, which is cultivated land and temporarily requisitioned for one year.

To sum up, the area of disturbed surface, occupied land and destroyed forest and grass vegetation during the basic construction period of A drainage pump station project is 15.8hm^2, as shown in Table I.

TABLE I. AREA OF DISTURBED SURFACE, OCCUPIED LAND AND DESTROYED FOREST AND GRASS VEGETATION BY EXCAVATION

Construction area	Project construction area					In total
	Main project construction area	Spoil area	Construction layout area	Temporary dump area	Temporary road area	
Occupied area (hm^2)	6.2	6.9	1.5	0.47	0.7	15.8

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2.2 Prediction of Spoil (Stone, Slag) Quantity

According to the construction organization design, a total of 118,000 m^3 of waste soil is produced by excavation of foundation pit, removal of cofferdam, dredging of forebay and removal of overburden in soil yard.

2.3 Prediction of Damage to Soil and Water Conservation Facilities

Before the construction of A drainage pump station project, the cultivated land, woodland and water area in the project construction area had good water and soil conservation functions. These areas can be regarded as water and soil conservation facilities. However, after the implementation of the project, these sites will be artificially cleared of vegetation, excavated to disturb the surface and backfilled with earth. Before new measures for soil and water conservation are taken, a certain amount of water loss and soil erosion will occur. Therefore, it should be counted as damage to soil and water conservation facilities.

During the construction of A drainage pump station project, the area of disturbed surface, occupied land and damaged forest and grass vegetation is 15.8hm^2, and the area of soil and water conservation facilities that may be damaged is about 14.5hm^2.

2.4 Prediction of Possible Water Loss and Soil Erosion

Due to the lack of monitoring data of water loss and soil erosion in the project area and surrounding areas, this scheme compares and analyzes two forecasting methods, expert forecasting method and mathematical model method, to comprehensively determine the forecast results of water loss and soil erosion in this project [3-4].

According to the calculation, during the construction of A drainage pump station project, a total of 14.7hm^2 of soil and water conservation area was destroyed, and the newly increased water loss and soil erosion was 7430t.

2.5 Comprehensive Analysis of Prediction Results

The whole project construction will destroy the soil and water conservation area of 14.5hm^2, and the total amount of waste slag generated during the construction will be 118,000 m^3, which may cause 7,345 t of new water loss and soil erosion during the construction period.

III. SOIL AND WATER CONSERVATION MEASURES

3.1 Main Project Prevention and Control Area

Roads on both sides of the diversion channel in the main project prevention and control area adopt clay-bound clay bound macadam pavement, which has the function of soil and water conservation. The

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main project prevention and control area mainly prevents the water loss and soil erosion that may occur during the construction of pump houses, special substations and other pivotal buildings, and afforests and beautifies the scope of the project management area. The main project prevention and control area is 6.2hm^2.

(1) Trees are planted in the open space around the pump room and substation and on both sides of traffic roads inside and outside the plant. Populus simonii is chosen as the tree species.

(2) Hedges and roadside trees are planted on both sides of roads in the management area. Populus simonii is selected as the tree species. Lawn is laid around buildings. Manila is selected as the grass species. Ornamental trees and flowers are planted on the lawn, such as Magnolia grandiflora. The height and shape of the trees are rationally allocated to make tress well-arranged, thus achieving the effect of greening and beautification.

3.2 Spoil Area

3.2.1 Engineering measures

The spoil area covers an area of dry wasteland. After the construction, it will be covered with soil for remediation. The land remediation area is 6.9hm^2.

3.2.2 Temporary measures

Because the topsoil is fertile and is conducive to plant growth, the topsoil in the spoil area should be stripped to the temporary dump area for temporary storage before spoil, with a total of 20,700 m^3 of topsoil to be stripped. After construction, the spoil area is covered with the topsoil.

3.2.3 Plant measures

After the construction, the topsoil is covered and Populus simoniis are planted. According to 30 plants/ mu, a total of 3,105 Populus simoniis are planted.

3.2.4 Quantities

According to the above design, the quantities of soil and water conservation measures in the borrow area are shown in Table II.

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TABLE II. QUANTITIES OF SOIL AND WATER CONSERVATION MEASURES IN SPOIL AREA

Partition	Prevention measures	Prevention and control content	Unit	Quantity	Remarks
Spoil area	Engineering measures	Land remediation	hm^2	6.9	
		Topsoil covering	Ten thousand m^3	2.07	
	Temporary measures	Topsoil stripping	Ten thousand m^3	2.07	
	Plant measures	Populus simoniis	Plant	3105	

3.3 Construction Layout Area

The temporary works of this project mainly include temporary buildings such as warehouse, comprehensive processing plant, concrete mixing station, machine room, power distribution room, laboratory, living and office buildings, and traffic access roads inside and outside the construction site.

3.3.1 Engineering measures

According to the construction layout, the construction layout area outside the main project area covers an area of 1.49hm^2. After the construction, the land will be covered and reclaimed, and the land remediation area will be 1.49hm^2, covering 4500 m^3.

3.3.2 Temporary measures

Before the construction, the topsoil should be stripped to the temporary dump area for temporary storage. A total of 0.45 million m^3 of topsoil should be stripped. After the construction, the site of the construction layout area should be leveled and covered with the topsoil.

3.3.3 Engineering quantity

According to the above design, the quantities of soil and water conservation measures in the construction layout area are shown in Table III.

TABLE III. Bill of quantities of soil and water conservation measures in construction layout area

Partition	Prevention measures	Prevention and control content	Unit	Quantity	Remarks
Constructio	Engineering	Land	hm^2	1.49	

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n layout area	measures	remediation			
		Topsoil covering	Ten thousand m^3	0.45	
	Temporary measures	Topsoil stripping	Ten thousand m^3	0.45	

3.4 Temporary Dump Area

3.4.1 Engineering measures

According to the construction layout, the temporary dump area covers an area of 0.47hm^2. After the construction, the land will be covered with soil for rehabilitation. The land remediation area is 0.47hm^2, and the covering area is of 0.14 million m^3.

3.4.2 Temporary measures

Before the construction, the topsoil should be stripped to the temporary dump area for temporary storage. A total of 0.14 million m^3 of topsoil is stripped. After the construction, the site of the construction layout area should be leveled for topsoil covering. In addition, woven bags will be used in the temporary dump area as block to prevent water loss and soil erosion. A total of 504m^3 of woven bags will be used to load soil.

3.4.3 Quantities

According to the above design, see Table IV for the quantities of soil and water conservation measures in temporary dump area.

TABLE IV. BILL OF QUANTITIES OF SOIL AND WATER CONSERVATION MEASURES IN TEMPORARY DUMP AREA

Partition	Prevention measures	Prevention and control contents	Unit	Quantity	Remarks
Temporary dump area	Engineering measures	Land remediation	hm^2	0.47	
		Topsoil covering	Ten thousand m^3	0.14	
	Temporary measures	Topsoil stripping	Ten thousand m^3	0.14	
		Woven bag loading soil	m^3	504	

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3.5 Temporary Road Area

For temporary roads in construction, pavement hardening measure is not taken in general during the construction process because it is easy to cause the erosion of pavement soil due to rainfall splash or runoff scouring. They are engineering units sensitive to water loss and soil erosion in project construction. According to the main design, the construction access roads of this project adopt clay bound macadam pavement.

After the construction, it is necessary to remove the hardened material on the road surface and take land remediation measures, with a land preparation area of 0.7hm^2.

3.6 Quantities of Prevention Measures

According to the design of prevention measures, the quantities of soil and water conservation in this project are shown in Table V, with a total investment of 849,500 yuan.

TABLE V. A BILL OF QUANTITIES OF WATER AND SOIL CONSERVATION OF A DRAINAGE PUMP STATION PROJECT

Partition	Prevention measures	Prevention and control content	Unit	Quantity	Remarks
Engineering management area	Plant measure	Chinese ilex	Plant	80	
		Dragon juniper	Plant	60	
		Magnolia gradiflora	Plant	60	
		Cedar	Plant	20	
		Buxus microphylla	Plant	400	
		Chinese rose	Plant	80	
		Manila lawn	m^2	900	
Spoil area	Engineering measure	Land remediation	hm^2	6.9	
		Topsoil covering	Ten thousand m^3	2.07	
	Temporary measure	Topsoil stripping	Ten thousand m^3	2.07	
	Plant measure	Populus simoniis	Plant	3105	
Construction layout area	Engineering measure	Land remediation	hm^2	1.49	
		Topsoil covering	Ten thousand m^3	0.45	

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	Temporary measure	Topsoil stripping	Ten thousand m^3	0.45	
Temporary dump area	Engineering measure	Land remediation	hm^2	0.47	
		Topsoil covering	Ten thousand m^3	0.14	
	Temporary measure	Topsoil stripping	Ten thousand m^3	0.14	
		Woven bag loading soil	m^3	504	
Temporary road area	Engineering measure	Land remediation	hm^2	0.7	
Compensation area of soil and water conservation			hm^2	14.5	

IV. CONCLUSION

To give full play to the role of water conservancy projects, it is vitally important to ensure soil and water conservation during the construction of water conservancy projects [5-6]. Through the prediction of water loss and soil erosion during the construction of this project and the discussion of soil and water conservation schemes of this project, the adverse effects can be reduced to the lowest degree.

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