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**Technical specification for land reclamation and ecological
restoration of coal mines**

煤矿土地复垦与生态修复技术规范

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3 Terms and definitions

Mine land reclamation and ecological restoration is defined as the activity that, for the geological environment damage, land destruction and ecosystem damage or degradation caused by the extraction of mineral resources, relies on human support and guidance together with natural restorative capacity and takes preventive and restorative measures so that the mine geological environment becomes safe and stable, the destroyed land is reclaimed for use and the ecosystem function is restored or improved; a note abbreviates it to reclamation and restoration.

Land destruction is the process and state in which the original function of the land is partly or wholly lost through mine production and construction activity. Subsided land is the area where underground extraction has caused the overlying strata to move and the surface to deform, damaging the land resource and the ecosystem. A dumping site is the place where the stripped material of open-pit mining is heaped, called an internal dump when it lies inside the open pit and an external dump when outside. An open-pit field is the collective term for the pit, benches and haul roads formed by open-pit extraction. A mine yard is the site occupied by the shaft mouth, the surface production system, the auxiliary production facilities, the processing and transport system and the living service facilities.

Landform reshaping is defined as forming a new landform in harmony with the surrounding landscape, by orderly dumping, backfilling and land shaping, on the basis of eliminating geological safety hazards and soil erosion hazards, according to the way the mine landform has been damaged and the degree of destruction and taking account of the original relief. Soil reconstruction is the reconstitution of the soil matrix on destroyed mine land by engineering, physical, chemical and biological measures so as to form a soil profile and fertility fit for vegetation growth. Vegetation reconstruction is the rebuilding of a lasting and stable plant community by selecting pioneer and site-adapted species and carrying out their arrangement, planting and tending, having regard to climate, altitude, slope, aspect, the composition of the surface material and the thickness of the effective soil layer. Landscape construction is the building, at the hydro-geomorphic scale of the catchment, of an ecosystem in harmony with the surrounding landscape, following the integrated protection and restoration of mountains, rivers, forests, farmland, lakes, grassland and sand, and taking full account of the structural adjustment and optimal allocation of land, water, biological resources and the human settlement environment during the fragmentation and reintegration of the point, line, area and network landscape of the mining area.

Natural restoration is defined as stopping human disturbance of the ecosystem so as to lighten the load, and relying on the self-regulating and self-organizing capacity of the ecosystem to let it succeed and renew itself in an orderly direction. Assisted restoration

makes full use of that self-recovery capacity with the help of artificial promoting measures, so that the degraded or damaged ecosystem gradually recovers and enters a virtuous cycle. Ecological reconstruction applies mainly artificial measures to a mining area whose ecological function is impaired and whose self-recovery capacity is lost or irreversibly changed, rebuilding the ecosystem through biological, physical, chemical, ecological or engineering methods around the restoration of habitat, of vegetation and of biodiversity. Adaptive management is the method and process of gaining experience by monitoring and assessing the management and practical measures taken in the past and of correcting and improving them as the ecosystem changes, given the uncertainty of the ecosystem and the time-bound character of what is known about it.

4 General requirements and basic principles

4.1 The work should follow the concept of integrated protection and restoration of mountains, rivers, forests, farmland, lakes, grassland and sand, and hold to the policy of conservation first, protection first and natural recovery as the mainstay. It should regulate reclamation and restoration at working coal mines and, through mitigation and protection, preventive control and reclamation measures, bring reclamation and restoration and the extraction of mineral resources under one plan and one implementation, reclaim destroyed land for use in good time, restore and raise the diversity, stability and sustainability of the ecosystem of the mining area, advance green mine construction and achieve harmony between people and nature.

4.2.1 Protection first and control at source. Following the concept of protecting while developing and developing while protecting, the siting and alignment of mine land and the design of the production process system are to be optimized so as to reduce at the source the effect on sensitive targets such as farmland and permanent basic farmland, basic grassland, key protected species, public welfare forest, protected areas, water sources and cultural relics; sound preventive control measures are to be used to remove geological environment hazards in real time and to prevent and control environmental pollution and soil erosion, reaching a safe, stable and pollution-free condition; and for the ecological problems unavoidably produced during coal mine production and construction, engineering, biological and chemical measures are to be taken to restore the damaged ecosystem.

4.2.2 Unified planning and coordinated implementation. The targets, direction, standards and measures of reclamation and restoration are to be aligned with territorial spatial planning, mineral resource planning, territorial ecological restoration planning, the overall planning of the coal mining area and the mineral resource development and utilization plan, and to be in harmony with the current land use and the surrounding landscape; the design of reclamation and restoration is to be unified with the mining design, and its technical measures and timing closely combined with the extraction process, so that over the whole life of the mine extraction and reclamation proceed together.

4.2.3 Combination of human guidance and natural recovery. According to the stability of the mine geological environment, the suitability for reclamation and the ecological resilience, the principle of farmland where farmland is fit, forest where forest is fit, grassland where grassland is fit, wetland where wetland is fit and construction where construction is fit is to be held to; engineering, biological and chemical means of human support are to bring the damaged land to a usable state and restore ecosystem function, while respecting, conforming to and protecting nature and making full use of natural restorative capacity so that the composition and structure of the local biological community are gradually restored and the restored ecosystem becomes self-maintaining and self-regulating.

4.2.4 Systematic treatment and functional improvement. The damaged ecosystem is to be protected as a whole, restored as a system and treated in an integrated way, having regard to the geological conditions of the coal mine, the physical geography, the land use and the restoration targets together with the mining process and its timing, so that the geological environment becomes stable, the destroyed land is reclaimed and ecosystem function is restored or raised; planning and implementation are to follow the requirements of biodiversity protection, which is to be carried through the whole process of reclamation and restoration by way of landform reshaping, soil reconstruction, vegetation reconstruction and landscape construction.

4.2.5 Public participation and monitoring throughout. Over the whole life of mine development and of reclamation and restoration, contact with the stakeholders is to be kept up and they are to be given active and meaningful opportunities to take part, so that the drafting, implementation, monitoring, evaluation and adaptive management of the plan reflect their views, and progress is to be reported and updated to the wider group of stakeholders so that the fairness and inclusiveness of the whole project are ensured. Representative stakeholders include the affected land users, communities, government, regulators and enterprises of the mining area, together with investors, industry peers, academia and the media.

6 Baseline survey and problem identification and diagnosis

6.1.1 The baseline survey should be carried out before mine construction and extraction, and continuous follow-up survey, monitoring and evaluation should be carried out at the stages of planning and design, plan preparation, reclamation and restoration, and post-closure management and maintenance. A working mine should progressively build a complete database of baseline survey and monitoring, master the local natural conditions and socio-economic setting, and establish the ecological condition before extraction.

6.1.2 The survey of natural conditions covers the hydro-geomorphology of the catchment, the soil condition, the vegetation condition and the landscape condition of the mining area. For the catchment, the extent and degree of the effect of coal extraction are to be determined from the hydrological, geological and geomorphic type features of the