Land reclamation project

E Kolesnichenko¹, A Melentiev¹*, A Chursin², and E Nartova³

¹Belgorod State Agrarian University, 1, Vavilova st., Maysky village, Belgorod district, Belgorod region, Russia
²Penza State University of Architecture and Construction, Penza, Russia
³Voronezh state agrarian University, Emperor Peter, Voronezh, Russia

Abstract. The reclamation project establishes general requirements for the implementation of work on the reclamation of a land plot. The implementation of such work will lead to the restoration of soil cover throughout the entire territory of the reclaimed area, in which the processes of natural soil functioning can occur. The relevance of the topic is due to the fact that the reclamation project considers the development of measures aimed at optimizing the physical and chemical conditions of the environment, increasing the resistance of soils to various influences. The object of the study is the land plot of the filtration fields of JSC BZLK Citrobel, located in the western industrial region of Belgorod. The purpose of the work is to design and develop measures for the reclamation of lands disturbed as a result of the construction and operation of filtration fields of JSC BZLK Citrobel. The article examines the technical stage of reclamation, where the total area of the land plot was determined and the volume of movement of earth masses was calculated. Then the issue of the biological stage of land reclamation was considered, proposals and recommendations for its implementation were given. It is recommended to take into account the volume of excavation work taking into account the existing terrain and modern work technologies.

1 Introduction

Currently, the land is of great value for numerous agricultural activities. Such lands are constantly subjected to various soil cultivation activities, which subsequently leads to land degradation, violation of the fertile layer and various other actions that negatively affect the area of disturbed lands. As a result of the survey of territories identified with disturbed soils, a reclamation project is drawn up, a document that subsequently allows for land reclamation. Land reclamation is measures aimed at preventing land degradation and (or) restoring the fertile soil layer, which subsequently bring the land into a condition suitable for its use in accordance with its intended purpose and permitted use.

The objects of reclamation are disturbed lands, i.e. territories affected or completely destroyed components of nature, for example, soil and vegetation cover, groundwater, also the local hydrographic network (springs, rivers, streams, etc.) and terrain. Disturbed lands also include contaminated lands, on which the content of substances in the components of

* Corresponding author: melentev_07@mail.ru
nature has increased, causing negative toxic and environmental effects for flora and fauna [1].

World experience in land reclamation is about seventy-five years. The first reclamation work was carried out in 1926 in areas disturbed by mining (United States of America and Indiana).

In the USSR, reclamation work began in 1959: in Estonia, oil shale mining, in Russia, brown coal mining, and in Ukraine, iron ore mining. In our country, from 1971 to 1980, reclamation work was carried out on an area of 713 thousand hectares, i.e. the annual volume of reclamation amounted to 71.3 thousand hectares. The growth of these works was laid down in the State Comprehensive Program for Improving Soil Fertility in Russia (1992-1955), which provided for the reclamation of up to ninety-six thousand hectares. In 1955, the volume of such work amounted to 160.1 thousand hectares, in 1996. – 79.9 thousand hectares. At the same time, with the existing increase in the volume of restoration work compared to 1980, land reclamation is also carried out on an area equal to 2% to 25% of the territory of disturbed lands [2].

Reclamation of the territory is obliged to guarantee the restoration of lands to a state suitable for their use in accordance with the intended purpose and permitted use. The quality of reclaimed lands must meet: the quality standards of the surrounding environment, as well as the requirements in the field of ensuring the sanitary and epidemiological wellbeing of the population. Agricultural lands must also comply with generally accepted norms and rules in the field of ensuring the fertility of agricultural areas. According to the Regulations on the development, establishment and revision of quality standards for the surrounding environment, these standards are developed and established at the maximum permissible level of values obtained from the results of laboratory research, or at the level of characteristics of the natural background, which was formed under the influence of natural factors characteristic of a particular territory [3].

2 Materials and methods

Restoration of disturbed lands is carried out sequentially in two stages: technical and biological. The technical stage of reclamation is preparatory to the biological stage. At this stage, road construction, hydraulic engineering and reclamation structures are carried out, as well as other work that creates the necessary conditions for the further use of reclaimed land or for carrying out measures to restore soil fertility. If reclamation solutions involve the application of a fertile layer of soil and potentially fertile rocks to the reclaimed surfaces, it is necessary to establish their suitability for reclamation by determining the chemical, sanitary condition, and agrochemical properties [4-5].

The biological stage of reclamation involves a complex of agrotechnical, phytomeliorative and other measures aimed at restoring and improving the ecological functions of soils, biological productivity and other properties of the soil. When carrying out the biological stage, an assortment of plant species recommended for a particular region is used.

Studies of the soil cover at the location of the filtration fields showed the following. On the territory where the filtration fields are located, four soil sections were laid, dedicated to individual forms of terrain and artificial unevenness (embankment pits) [6-7].

The enterprise JSC BZLK "Citrobel" specializes in the production of citric acid. The industrial site of the plant is located in the industrial area of the western part of the city of Belgorod and is surrounded on two sides by nearby residential buildings: from the west - located along Chicherin and Uritsky streets, from the north - located along the street. Zagorodny. Filtration fields are a piece of land surrounded by an embankment and divided by earthen ramparts into sections (blocks) according to the cascade principle. The site is
located on a watershed with an elevation difference of 193-173 m. The average slope of the site ranges from 0.025 to 0.03. On the eastern side of the site there is a cement plant quarry. On the western side there is a ravine with bottom marks ranging from 137 to 138 m. On the southern side, at a distance of about 500 m, there is a village. The construction of the filtration fields was built in 1964 according to the project of the Kursk branch of the State Design Institute "Giprosakhar" for the plant's design capacity of 10,000 tons/year. Filtration fields are divided into maps and embanked with earthen dams. The height of earthen dams is 1.5 - 2.5 m. The size of maps varies from 30x130 m to 80x200 m.

Fig. 1. Situational plan.

3 Results and Discussion

The project for the reclamation of the land plot of the filtration fields of JSC BZLK Citrobel with cadastral number 31:16:01020001:3, with an area of 213964.0 m², located in the western industrial region of Belgorod, is being developed on the basis of technical specifications. Reclamation of the land plot is necessary in connection with the expiration of the land lease agreement No. 147 dated August 24, 2012, between the municipal formation of the urban district "City of Belgorod" and JSC "BZLK "Citrobel", as well as in accordance with the Land Code of the Russian Federation. The procedure for land reclamation is established by the requirements of the Decree of the Government of the Russian Federation dated February 23, 1991 No. 147 dated August 24, 2012. between the municipal formation of the urban district "City of Belgorod" and JSC "BZLK "Citrobel", as well as in accordance with the Land Code of the Russian Federation. The procedure for land reclamation is established by the requirements of the Decree of the Government of the Russian Federation dated February 23, 1991 No. 140 "On land reclamation, removal, preservation and rational use of fertile soil layer" and the order of the Ministry of Natural Resources of Russia No. 525 and Roskomzem No. 67 dated December 22, 1995. "On approval of the Basic Provisions on land reclamation, removal, preservation and rational use of fertile soil layer." The reclamation project establishes general requirements for the implementation of restoration work on the reclamation of a land plot and corresponds to the technical specifications. The purpose of the design is to develop a technology for performing reclamation work on a land plot with cadastral number 31:16:01020001:3, with an area of 213964.0 m², located in the western industrial region of Belgorod. Carrying out reclamation work will lead to the restoration of the soil fertile layer throughout the entire
territory of the reclaimed area, in which the processes of natural soil functioning are possible. The proposed technology will make it possible to restore the natural composition of the soil on the site in a relatively short time. To achieve a positive result, the project provides for technological operations aimed at optimizing the physical and chemical conditions of the environment, increasing the resistance of soils to various influences.

Technical stage of reclamation. The technical stage of land reclamation involves preparing the surface for the biological stage and ends with the uniform application of a fertile layer on the site. Existing roads will be used as access roads to the reclamation site [8].

The technical stage of reclamation includes the following work:

- Preparing the site for work. The total area of the plot with cadastral number 31:16:01020001:3 is 213964.0 m$^2$, the entire plot will be used during the work. As part of the preparation of the site, the area will be cleaned and garbage removed, special equipment will be delivered and placed.

- Backfilling a cascade of pits using organomineral soil. For backfilling, the soil from which the embankment around the pits will be made will be used. The volume was determined based on the calculation of the transported land masses, carried out on the basis of engineering and geodetic surveys. The volume of transported masses is 27405.45 m$^3$. The backfilling of the cascade of pits must be done evenly, repeating the natural composition of the soil profile of the background soils, the top 20 cm should be filled with a fertile 45 layer, the area on which the embankment of the cascades of pits was located should also be covered with fertile soil. Work must be carried out in accordance with GOST 17.4.3.02-85 “Nature conservation. Soils. Requirements for the protection of the fertile soil layer during excavation work” [9].

A layer of fertile soil 20 cm thick will be applied throughout the site with an area of 213964.0 m$^2$. The volume of the fertile soil layer will be 42775.31 m$^3$. The volume is determined in accordance with the calculation of the transported land masses.

Delivery of fertile soil layer is provided in agreement with the administration of Belgorod and is located at a distance of up to 4 km from the reclamation site. Cargo transportation is carried out by flatbed trucks.
Upon completion of delivery of the entire volume of fertile soil, leveling work is required to level the surface of the entire reclamation site of 213,964.0 m$^2$ and eliminate unevenness associated with soil shrinkage.

After completing the technical stage of reclamation on the south-eastern side of the site, it is necessary to dismantle the access dirt road by leveling the relief and eliminating a local depression on an area of 2840 m$^2$; after completing the site leveling, it is necessary to apply fertile soil in a volume of 568 m$^3$ with a layer of 20 cm.

Work at the biological stage of reclamation. The biological stage of reclamation includes a complex of agrotechnical and phytomeliorative measures to restore the fertile soil layer.

The biological stage is aimed at fixing the surface layer of soil with the root system of plants, creating a closed grass stand and preventing the development of water and wind soil erosion on disturbed lands.

Biological reclamation is carried out using phytomeliorative techniques. The phytomeliorative stage involves sowing perennial grasses and shrubs.

The period of work at the stage of biological reclamation must be combined with the spring or autumn sowing period of the year; the reclamation period includes one complete vegetation cycle of the crops grown (from 2 to 5 months depending on the type).

As part of biological reclamation, perennial cereals and legumes will be planted throughout the entire area of the recultivated area and shrubs along the perimeter.

Trees will be planted manually in planting spaces measuring 80x80x50 cm with the addition of vegetable soil, and shrubs will be planted in rows.

Tree planting must be carried out taking into account the rules for landscaping the territory of the urban district "City of Belgorod".

The biological stage of reclamation includes the following work:

- Plowing or loosening the reclamation site to a depth of 20 cm, the area of the work site is 213964.0 m$^2$ and 2480 m$^2$.
- Sowing of perennial grasses on an area of 213964 m$^2$ and 2480 m$^2$. A cereal-legume mixture of clover, sweet clover and orchard was chosen as a phytomeliorant. The sowing rate is adopted according to the natural climatic zone of the Belgorod region.
- Planting of 560 trees; it is proposed to use common hawthorn as a planting material along the perimeter of the reclamation site in one row (in increments of 4 m), in accordance with the rules for landscaping the territory of the urban district "City of Belgorod".

When implementing the biological stage of reclamation, the level of overgrowth of the site after sowing should be assessed.

To assess the state of overgrowth, it is important to determine the total projective cover of the soil surface by plants. The total projective coverage is calculated from 100%, which is conditionally taken to be such coverage that no bare areas of land are visible. During the normal course of overgrowth, the total projective coverage of individual areas varies from 25 to 75%. If unfavorable, the grass stand is almost not formed or is less than 15-20% [10].

In case of unfavorable overgrowing, it is necessary to repeat the sowing of the lawn with a doubling of seed and watering.

**4 Conclusion**

The reclaimed land plot and the adjacent territory, after completion of the entire complex of work, must form an optimally organized and environmentally balanced landscape. The topography and shape of the reclaimed plots must ensure their effective economic use. After completion of reclamation, the site is returned to the previous owner in a condition corresponding to its economic purpose. The transfer of land to the land user is carried out
by the Customer with the participation of the Contractor, the land user, and local authorities and is formalized by an act in the prescribed manner.

Reclamation of disturbed lands is carried out to restore agricultural, forestry, water management, recreational, construction and health purposes.

Thus, land reclamation is understood as a set of measures aimed at preventing land degradation and (or) restoring the fertile soil layer, which are subsequently brought into a state suitable for their use in accordance with their intended purpose and permitted use.

Reclamation, which requires soil restoration, takes place in two stages: technical and biological. The technical stage involves preparing the site for work, backfilling a cascade of pits, forming slopes, as well as other work that creates the conditions necessary for taking measures to restore soil fertility.

The technical stage includes the development of solutions for installing protective screens on the ground and surface of the HBOC facility, collection, purification and utilization of biogas, collection and purification of leachate and surface wastewater:

- Stabilization of the landfill body.
- Construction of a degassing system to collect landfill gas.
- Measures for the collection and disposal of surface runoff from the surface of the landfill body.
- Conservation of leachate in the body of the landfill (if necessary).
- Creation of a multifunctional reclamation protective screen.
- Creating a protective screen for the base (if necessary).

The biological stage of reclamation includes a complex of agrotechnical and phytomeliorative measures to restore the fertile soil layer. Provide a set of reclamation and agrotechnical measures aimed at restoring disturbed lands (taking into account their subsequent use):

- Soil preparation.
- Selection of an assortment of planting material.
- Sowing and caring for plants.

The volumes of excavation work should be optimal, taking into account the existing terrain and modern technologies for the work. The project for the reclamation of the land plot of the filtration fields of JSC BZLK Citrobel with cadastral number 31:16:01020001:3, with an area of 213964.0 m2, located in the western industrial region of Belgorod, is being developed on the basis of a contract and technical specifications.

The project was developed taking into account current norms and regulatory documents in the field of ecology, sanitation, construction, etc., taking into account regional and other regulatory documents, as well as standards taking into account the regional natural and climatic conditions of the location of the site. Design materials comply with current environmental standards and meet the requirements of federal and regional legislation.

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