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Original article

DETERMINING THE EFFECTIVENESS OF FUNCTIONAL ZONING: RIGHTS AND OBLIGATIONS OF LAND RELATIONS PARTICIPANTS, AND PLANNING AND IMPROVEMENT REQUIREMENTS FOR SETTLEMENT AREAS

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Abstract

Background. The relevance of this study under current conditions is determined by a range of factors reflecting dynamic changes in the socio-economic sphere, technological progress, and the environmental situation. It also addresses the urgent task of defining effective rights and obligations of land relation participants, along with planning and improvement requirements for populated areas. This work involves developing and implementing up-to-date territorial planning documentation, which serves as the foundation for rational and sustainable territorial development. The role of these documents in urban development is critically important, and without them, competent and well-founded planning is impossible.

Purpose. Based on the balance between the various uses of the territory, we discuss an integrated approach to development, including areas with limited suitability for development, through the application of comprehensive development strategies and advanced technologies for their realization.

Materials and methods. A systems approach was applied, in which territorial zoning decisions account for environmental safety and vertical planning aspects of territorial zones. The concept of adaptive geodetic monitoring is emphasized, involving the dynamic adaptation of measurement methods to changing conditions and precision requirements. Classification methods are used to systematize geodetic measurement technologies.

Results. At the theoretical level, modern functional zoning technologies for territorial development of populated areas were systematized, classifying them by degree of effectiveness and application conditions. Regularities of regional influence

on the spatial organization and maintenance of populated areas were identified and scientifically substantiated, allowing for the formulation of principles for adapting to dynamic changes in the socio-economic sphere, technological progress, and the environmental situation, as well as tasks for establishing effective rights and obligations of participants in land relations, planning requirements, and landscaping in populated areas. A significant contribution to the theory of settlement development lies in substantiating the optimal balance between the legislative framework and the regulatory basis of territorial planning projects.

Conclusion. The results of this study are important for land use, enabling comprehensive and well-founded decision-making regarding the rights and obligations of land relation participants, as well as planning and improvement requirements for populated areas. Ultimately, the developed method for comprehensive territorial assessment serves as a valuable tool for urban planners and decision-makers seeking to optimize functional zoning, thereby improving the quality of life of residents, promoting sustainable development, and ensuring a balanced and sustainable approach to land use.

Keywords: research; scientific research; territory; relief; vertical grading; urban zoning; territorial zoning; artificial land plot

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Научная статья

ОПРЕДЕЛЕНИЕ ДЕЙСТВЕННОСТИ ФУНКЦИОНАЛЬНОГО ЗОНИРОВАНИЯ: ПРАВА И ОБЯЗАННОСТИ УЧАСТНИКОВ ЗЕМЕЛЬНЫХ ПРАВООТНОШЕНИЙ, ТРЕБОВАНИЯ ПЛАНИРОВКИ И БЛАГОУСТРОЙСТВА ТЕРРИТОРИИ НАСЕЛЕННЫХ МЕСТ

Н.Г. Овчинникова, Н. В. Винокурова, И. А. Петрова

Аннотация

Обоснование. Актуальность работы в современных условиях обусловлена рядом факторов, отражающих динамичные изменения в социально-эко-

номической сфере, технологическом прогрессе и экологической ситуации, а также является актуальной задачей для формирования эффективных прав и обязанностей участников земельных правоотношений, требований планировки и благоустройства территории населенных мест. Данная деятельность заключается в формировании и соблюдении современной документации в сфере территориального планирования, которое в свою очередь является основой для рационального развития территорий. Роль данных документов в градостроительной деятельности крайне колоссальна и без них невозможно дальнейшее грамотное и обоснованное проектирование.

Цель. Основываясь на равновесии между разнообразными видами использования территории, мы обсуждаем комплексный подход освоения, в том числе и неудобных территорий, благодаря применению комплексного развития работ и прогрессивной техники для их выполнения.

Материалы и методы. Системный подход: решения по зонированию территории учитывает развитие экологической безопасности, вертикальной планировки территориальных зон. На первый план выходит концепция адаптивного геодезического мониторинга, предполагающая динамическую корректировку методов измерений в зависимости от изменяющихся условий и требований к точности. Классификационные методы применяются для систематизации технологий геодезических измерений.

Результаты. На теоретическом уровне проведена систематизация современных технологий функционального зонирования в области территориального развития населенных мест с их классификацией по степени эффективности и условиям применения. Выявлены и научно обоснованы закономерности влияния регионального фактора на содержание населенных пунктов, что позволило сформулировать принципы адаптации динамичных изменений в социально-экономической сфере, технологическом прогрессе и экологической ситуации и задачи для формирования эффективных прав и обязанностей участников земельных правоотношений, требований планировки и благоустройства территории населенных мест.

Значимым вкладом в теорию развития населенных мест является обоснование оптимального баланса между фундаментальной подготовкой законодательных актов и нормативов проекта планировки территории.

Заключение. Результаты данного исследования имеют важное значение для использования территории, позволяя комплексно принимать обоснованные решения как прав и обязанностей участников земельных правоотношений, так и требований планировки и благоустройства территории населенных мест. В конечном счёте, разработанный метод выявления комплексного изучения

территорий представляет собой ценный инструмент для городских планировщиков и лиц, принимающих решения, стремящихся оптимизировать функциональное зонирование, что помогает улучшению качества жизни населения, устойчивому развитию территорий, а также помогает соблюдать равновесие между видами использования земельных ресурсов.

Ключевые слова: исследование; научно-исследовательская деятельность; территория; рельеф; вертикальная планировка; градостроительное зонирование; территориальная зона; искусственный земельный участок

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Introduction

Zoning decisions are made based on the following key principles within the comprehensive organization of the territory [1-5]:

– Focus on intensive use and rational organization;

– Formation of a scientifically sound balance of lands for various purposes, preservation of specially protected natural areas, agricultural lands, and areas with valuable historical and cultural heritage, and the development of engineering and transport infrastructure necessary for the development of the territory;

– Precise differentiation of agricultural, forestry, and nature conservation lands from urbanized areas, with legislative establishment of appropriate regimes for their functional use;

– Environmental protection and environmental safety; rational use of natural resources;

– Ensuring the most favorable organizational and territorial conditions for agriculture.

Materials and methods

Environmental and social challenges: land degradation: 25% of agricultural land is subject to erosion, salinization, and oil pollution. Legal mechanisms for the conservation of such lands (Resolution No. 830) are poorly implemented due to regulatory gaps.

To maintain records of natural resources, achieve their proper and sustainable use, and ensure adequate protection, zoning is required for each territorial zoning of a settlement area.

Fig. 1 shows the documentation used to determine the zoning of each territorial zoning.

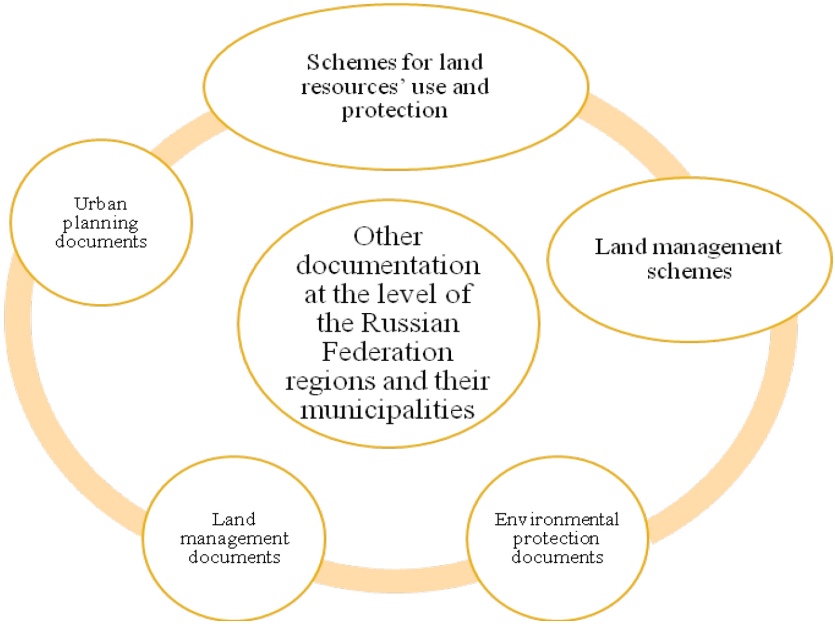

Fig. 1. Documents for zoning the territory

Results

Each territorial zoning has a specific legal status determined by its purpose.

The legal nature of functional zoning is shown in Fig. 2.

Studying this judgment, one can also conclude that the Supreme Court of the Russian Federation's Ruling of June 24, 2009, in Case No. 78-G09-22, which notes that the definition of functional zones in the master plan constitutes the projected development of municipal territories, confirms this.

The establishment or modification of the boundaries of settlement areas is:

1. Approval or modification of the master plan of an urban district or settlement, reflecting the boundaries of settlement areas located within the boundaries of the corresponding municipality.

2. Confirmation or reorganization of the territorial planning scheme of a municipal district when changing the boundaries of rural settlement areas, including territories located outside the boundaries of settlements.

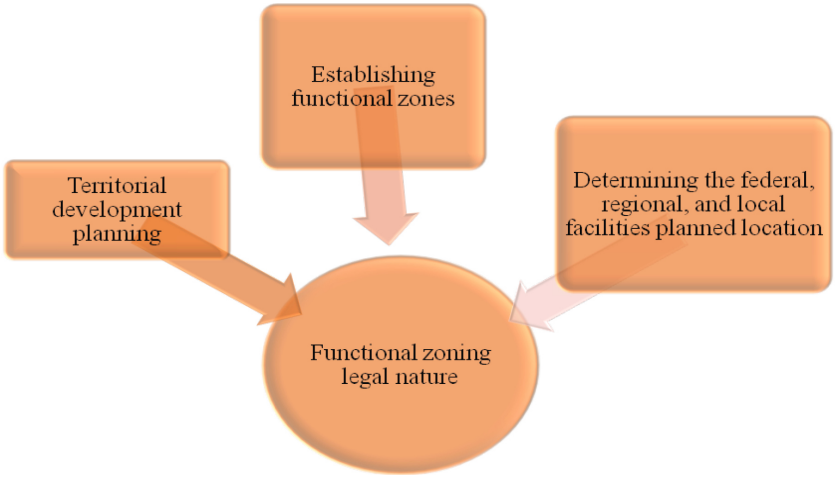

Fig. 2. Legal nature of functional zoning

It follows that when territorial planning documents are amended based on changes to the boundaries of the land category of settlement areas, the legal status of the land is affected. The Urban Development Code of the Russian Federation regulates territorial planning documents in their decision-making and implementation. These decisions can be made or implemented based on a functional zone map, which is a crucial part of municipal territorial planning documents. A decision made or implemented based on such a map (but not the map itself) may affect the rights and obligations of parties to land relations.

Functional zoning can indirectly influence the rights and obligations of parties engaged in land relations [6].

The functional purpose of zones is determined upon the entry into force of the regulatory legal act approving the relevant municipal territorial planning document.

A system of interconnected natural and natural-anthropogenic territories, ensuring sustainable development and functioning of ecosystems, as well as the conservation of biodiversity, is entering the urban development sphere as a key component in the process of renovating the foundations of territorial planning, designed to conserve natural resources while addressing issues related to the protection of natural areas.

In urban planning and land use engineering, territorial zoning are closely linked to vertical grading. Their interaction is based on the fact that the desig-

nation of zones determines the requirements for the terrain, and vertical grading ensures the technical implementation of these requirements.

Vertical grading refers to the process of designing and grading land plots to create favorable construction conditions and comfortable terrain.

To achieve these objectives, vertical grading must include work to modify elevations, slopes, and terrain forms. The objectives of vertical grading are shown in Fig. 3.

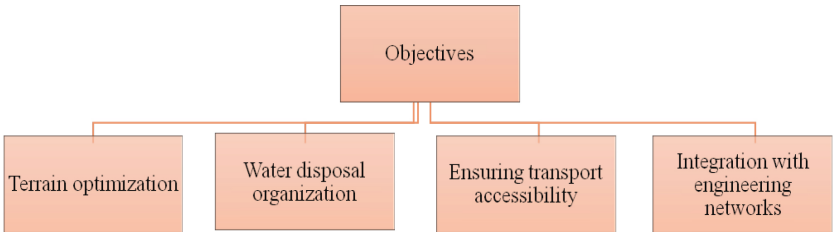

Fig. 3. Vertical grading tasks

The stages of vertical grading are ordered steps aimed at creating a stable and level ground surface [7-10]. The stages are divided into:

- Design (development of a project taking into account slope, drainage, and other requirements);
- Terrain modification (topographic survey);
- Excavation work (cutting, adding soil, creating embankments and trenches);
- Drainage system installation (laying canals, pipes, and other elements for water drainage);
- Landscaping (final landscaping and preparation of the site for use).

The main tools and methods of vertical grading are presented in Table 1.

Table 1.

Basic tools and methods of vertical grading

Vertical grading tools	Vertical grading methods
Geodetic measurements	Determination of elevation marks
Software	CAD systems for design (e.g. AutoCAD, Civil 3D)
Cartographic materials	Topographic plans and maps
Design methods	Profile method, contour method, design elevation method

Modern scientific developments in the field of geodetic monitoring are characterized by several fundamentally new approaches. The concept of adaptive

geodetic monitoring, which involves dynamically adjusting measurement methods depending on changing conditions and accuracy requirements, is becoming increasingly prominent.

Research into the integration of heterogeneous geodetic data is of significant scientific interest. Methods are being developed for the joint processing of results obtained using:

– Satellite positioning systems (GLONASS/GPS);
– Electronic tacheometry;
– Airborne and terrestrial laser scanning;
– Aerial photography from UAVs.

Particular attention has been given to the automation of geodetic support processes, including the development of intelligent decision-support systems, automated measurement-quality control algorithms, and specialized software packages for spatial data processing.

An important area of scientific research is the development of multi-level systems for assessing the accuracy of geodetic measurements. Such systems include:

1. Operational monitoring during fieldwork.
2. Office verification of compliance with regulatory requirements.
3. Expert verification of results.
4. Monitoring the stability of geodetic markers.

The methodological basis of modern research in the field of geodetic support for land management is based on a combination of theoretical and practical approaches. The theoretical component includes an in-depth analysis of regulatory documents, scientific publications, and best practices in the organization of geodetic work.

Classification methods are used to systematize geodetic measurement technologies according to a variety of parameters:

– achievable accuracy;
– productivity;
– cost;
– dependence on external conditions;
– complexity of implementation.

Modeling of technological processes is carried out using:

– mathematical models of measurement accuracy;
– computer simulators of field conditions;
– digital twins of territories;
– predictive models of boundary changes.

Experimental methods are aimed at a comparative analysis of various geodetic measurement technologies in real-world conditions. Particular attention is paid to assessing:

– the resistance of methods to external interference;
– reproducibility of results;
– labor intensity of processes;
– economic efficiency.

The mathematical apparatus of the research includes:

– statistical methods of data processing;
– correlation analysis of parameters;
– methods of optimizing technological processes;
– decision-making algorithms under uncertainty.

Geodetic support includes a set of methods and technologies aimed at accurately determining the boundaries of plots, terrain, and other parameters necessary for cadastral registration, design, and construction. Modern technologies (GNSS, UAVs, GIS) significantly accelerate and improve the accuracy of geodetic work.

Discussion

Vertical grading activities are carried out prior to the development of residential areas.

One of the fundamental principles of vertical grading is the preservation of natural topography, achieved with minimal excavation work. Regardless of the terrain modification, the preservation of the soil cover must always be taken into account [11].

Vertical grading leads to changes in the natural topography. Even if it meets planning and landscaping requirements, it can be adjusted to achieve optimal conditions. The volume of excavation work during terrain modification depends on the complexity of the original landscape, the presence of difficult areas, and the planning decisions for the entire territory or its individual elements.

As a rule, according to urban planning, there are virtually no territories that are perfectly suitable for urban development. Due to such problems, some cities are faced with construction on very unfavorable terrain. To implement such construction, landscaping and engineering preparation of the area must be carried out in advance.

It is also worth noting that there are no territories suitable for development in their natural state. Therefore, vertical grading and surface drainage are essential for all areas, including the development of topographically challenging

sites. With the use of new methods and equipment, such development is becoming possible.

Cities located in areas with particularly rugged terrain are vulnerable to wind and thermal conditions. Even basic street ventilation in these areas is very difficult, and this is taken into account during layout.

The most demanding conditions, requiring minimal surface gradients, occur in zones allocated for rail transport and industrial use. Residential areas are next; they can be located with significant slopes, but they present a number of disadvantages that force adaptation to the terrain. Recreational areas are less demanding, due to their greater freedom in terrain [12-14].

To preserve the existing natural landscape and ensure rational use, a number of measures must be taken to modify the existing functional zoning. Therefore, when assessing the effectiveness of functional zoning, it is necessary to address a range of issues related to the design, construction, and operation of interconnected infrastructure facilities. The natural topography of each territory must be taken into account during its development. Design may require modifications to the topography depending on the site's intended use and planned functions.

The location of residential microdistricts, primary urban development units, green areas, parks, and other facilities must be justified during the design and construction of settlement areas. Cultivation technologies for land planned for agricultural use must also be considered.

The area under consideration for this study is the Rostov Region, in the city of Rostov-on-Don.

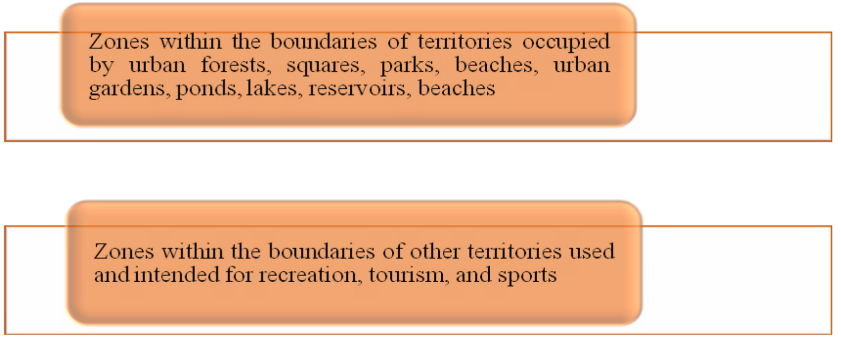

Fig. 4. Composition of territorial zoning for recreational purposes

In a rapidly changing world, functional zoning and the calculation of recreational loads in settlement areas are becoming not only essential for solving

current problems but also an important foundation for shaping the sustainable future of cities and settlement areas. The development of territorial zoning should become an active tool in the hands of society, capable of responding to the challenges of the times and creating a comfortable living environment for all citizens. Recreational zones are areas occupied by village forests, public gardens, parks, gardens, ponds, lakes, reservoirs, beaches, and natural landscapes. The composition of territorial recreational zones is shown in Fig. 4.

Territorial zoning may include specially protected areas. Specially protected areas may include land plots with special environmental, scientific, historical, cultural, aesthetic, recreational, health, or other valuable significance.

The composition of territorial zoning of specially protected areas is shown in Fig. 5.

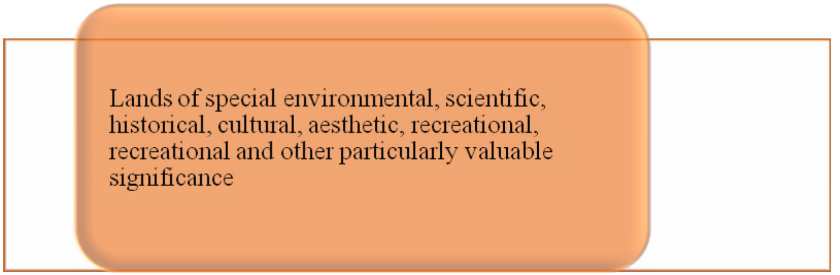

Fig. 5. Structure of specially protected territorial zoning

Areas prone to flooding, gullying, or high groundwater levels must be carefully studied, as these areas are considered difficult or impossible to build on without significant engineering and landscaping measures and are considered unsuitable or unsuitable for development. Bringing the site to the required condition increases the volume of excavation work. This type of work is important both in terms of volume and cost: the larger the volume, the more expensive it becomes.

Topography is modified by vertical grading—the movement of soil from one area to another in the form of cuts and fills. Therefore, it is important to minimize the volume of excavation work and utilize the existing topography as efficiently as possible.

Key areas for improvement are:

– Implementation of intelligent decision support systems;

– Development of digital territorial modeling technologies;

– Automation of quality control processes;

– Integration of various measurement methods;

The practical implementation of modern developments requires the creation of a comprehensive system that includes:

– Regulatory support;
– Training of qualified personnel;
– Technical re-equipment;
– methodological support.

Prospects for the development of geodetic support in territorial zoningdevelopment are linked to the active implementation of digital technologies, the development of cloud services for geodata processing, and the creation of distributed monitoring systems. This will significantly improve the accuracy and reliability of results in the context of increasingly complex territorial development tasks.

Classification methods are used to systematize geodetic measurement technologies according to a variety of parameters:

– achievable accuracy;
– productivity;
– cost;
– dependence on external conditions;
– complexity of implementation.

Vertical grading design work is carried out at all stages of horizontal planning: master plan projects; detailed planning projects; and development projects [15].

Territorial planning helps improve the quality of life of the population, promote sustainable development of territories, and also leads to a balance between land use.

In the Rostov Region, as in other regions, territorial planning plays an important role in territorial development. It is aimed at creating favorable living conditions for the population, ensuring economic growth, and the rational use of natural resources. In accordance with urban planning regulations for the category of lands of settlement areas, zoning of territories will be the assignment of land plots to territorial zoning.

The planning structure of settlement areas highlights the historically established principle of formation (as of 2025).

By and large, the settlement system and planning structure of each studied settlement area in the Rostov Region were primarily influenced by their development processes.

The park area is classified as a multifunctional park zone (according to the functional zoning map of the General Plan of the City of Rostov-on-Don).

When analyzing the functional zoning of the park, it is necessary to properly divide it into zones based on their intended purpose.

Next, to calculate the recreational load, it is necessary to determine the number of park visitors.

The number of potential park visitors is determined using formula (1).

$$N=S\cdot\rho \quad (1),$$

where N – number of potential park visitors (people);

S – area of the territory within walking distance (ha);

ρ – population density (persons/ha).

The population density of the study area should be determined using data from the official website of the district administration.

After the in-kind survey, which must be conducted on weekdays and weekends, in the morning and evening, the number of park visitors must be calculated based on the number of people entering the park per hour.

The recreational load on the area must be calculated in accordance with the above data.

According to "SP 42.13330.2016 Urban Development. Planning and Development of Urban and Rural Settlements. Updated version of SNiP 2.07.01-89," Section 9 "Recreational Zones. Zones of Specially Protected Areas": the estimated number of simultaneous visitors to city parks should not exceed 100 people/ha.

Therefore, according to the in-kind survey, the maximum number of simultaneous park visitors should not exceed the standard.

It is important to note that, to preserve the existing natural landscape of the area and ensure rational use, it is necessary to implement a number of measures to change the existing functional zoning.

The implementation of urban planning principles—the formation of a city center, main routes, landscaping systems, social services, and improvements—is carried out as the city's master plans are developed.

The key factors that will determine the rational functional zoning of a land plot in each territorial zoning of the studied settlement for decision-making are presented in Table 2.

The relevance of research in functional zoning is also linked to the concept of sustainable development. Therefore, it is necessary to consider not only the current needs of the population but also the needs of future generations. This requires the integration of economic, social, and environmental aspects in both territorial planning and development. Research in this area helps develop strategies that balance development and resource conservation.

Table 2.

Key factors associated with high-quality functional zoning of a land plot in each territorial zoning

Factors to consider when making a decision		
Insolation Improvement	Technical condition and reliability of the territory	Residual value of infrastructure
Noisiness of the area	Structural, technological and organizational solutions	Residual value of buildings
Atmospheric pollution	Level of recreation of the territory	Profit assessment
Transport accessibility	Recreational method	Project profitability with an assessment of the volume of capital investments
Decision making		

One modern solution to the shortage of land designated for construction and subsequent residential use is the creation and use of artificial land plots located within the boundaries of water bodies. For example, in 2015, work was completed in St. Petersburg to create an artificial land plot within the boundaries of the Gulf of Finland on the western part of Krestovsky Island. The project aimed to extend the embankment and accommodate transport infrastructure within this area. Federal Law No. 246-FZ of July 19, 2011, "On Artificial Land Plots Created on Federally Owned Water Bodies and Amending Certain Legislative Acts of the Russian Federation," will help us clarify this issue.

A key feature of artificial land plots is their physical connection to the natural landmass, making them a direct extension of the earth's surface. This means that artificial land plots created by reclamation, backfill, or other technologies should be considered an integral part of the earth's surface, not indirect structures connected to the land only through operational or construction elements. Thus, artificial land plots possess the fundamental characteristic of natural land plots—their connection to the earth's landmass.

However, this also raises the question of how to register this type of structure. Since, until the moment of commissioning, a real estate object is technically considered a structure with an attached technical plan, however, after commissioning, it is recognized as a land plot for which a cadastral plan is required.

Even at the design stage, the process of creating an artificial land plot involves the development of a large amount of documentation to ensure the legal and technical justification for creating the artificial land plot. However, this process can be thought of as a sequential chain of regulatory documentation development.

The first stage of designing an artificial land plot is the creation of design documentation in accordance with the requirements of the Urban Development Code of the Russian Federation and other regulatory acts. In particular, the most important step here is to develop a land use plan (LUP).

A land use plan for artificial land plots contains a comprehensive set of information necessary for the proper creation of the construction project and its subsequent operation. Several key points contained in a land use plan can be highlighted:

Description of the artificial land plot. This section includes:

- the method of construction: reclamation, backfill, reclamation, hydraulic method, or a combination of methods, etc.;

- area. This indicates the total area of the land plot, as well as the areas of its individual zones and objects, etc.;

− Geometric characteristics: the shape of the described object, boundaries, topography, and slope;

− Compaction degree: soil compaction requirements to ensure stability and prevent subsidence.

− Utilities. These include planned utilities that will be located on the land plot: water supply, sewerage, electricity, gas, heat, communications, etc.

Environmental aspects:

− Environmental impact assessment: analysis of potential risks of water, air, and soil pollution, impact on flora and fauna;

− Measures to minimize negative impacts: design solutions for environmental protection, such as wastewater filtration systems, reclamation of disturbed land, landscaping, etc.

Functional purpose:

− Type of use: residential, industrial, commercial, recreational, agricultural;

− Planned objects: buildings, structures, roads, transport infrastructure, parks, squares, etc.

− Architectural and urban planning solutions: design, style, development concept, architectural solutions for buildings, site planning, etc.

Engineering solutions:

− Utility network designs: road layouts, water supply, sewerage, electricity, gas, heat, and communications;

− Coastal strengthening: erosion protection, coastal fortification, dam construction;

Reclamation measures:

− Landscaping: planting trees, shrubs, and lawns to improve the ecological situation;

− Soil formation: application of organic fertilizers, creation of a fertile soil layer;

− Irrigation systems: irrigation systems to maintain soil moisture.

Implementation stages:

− Construction stages: a description of the phased implementation of work, from site preparation to completion of construction;

− Implementation timeline: determining the deadlines for each stage of work;

− Estimate: calculating the project cost, including the costs of materials, equipment, labor, etc.

A conclusion can be drawn regarding the feasibility of the project, i.e., determining the environmental and economic feasibility of the work to be performed, and outlining recommendations for project implementation, taking into account all the characteristics of the territory.

It is important to note that the territorial planning project is a comprehensive document that must be developed in accordance with laws and regulations, and all design solutions must be based on the principles of sustainable development and environmental safety, which includes the maximum minimization of negative impacts on the environment. The regulation and specifics of this process are reflected primarily in Article 45 of the Urban Development Code of the Russian Federation.

In addition, a land surveying project (LSP) is prepared, which more accurately displays the site boundaries and provides the results of geodetic measurements and cadastral data. Such documentation is primarily required for subsequent cadastral registration of a plot. This process is outlined in Article 43 of the Urban Development Code of the Russian Federation. Several key points contained in a land survey project can be highlighted:

Establishing the boundaries and area of the land being formed.

A land survey project establishes the clear boundaries of the land being formed, including the shape, size, and coordinates of turning points. The coordinates are determined through geodetic surveys using specialized equipment.

Creating cadastral plans of the territory.

A land survey project is the basis for creating cadastral plans, which are necessary for registering the plot with the cadastral register and entering information into the Unified State Register of Real Estate. This procedure is necessary for obtaining ownership of the land.

Establishing easements and functional zoning of the land being formed.

A land survey project is the basis for developing land planning projects, development plans, utility plans, and other documents necessary for the further

development of the territory. After this documentation is prepared, two important assessments are carried out: environmental and engineering. The purpose of these assessments is to understand the extent of the environmental impact and to determine whether the project is technically feasible.

Conclusion

Validating research results is an important step that enables the verification of theoretical conclusions and practical recommendations in practice. This process involves several essential stages and methods that ensure the effective validation and implementation of research findings.

The problematic nature of this topic stems from the fact that current Russian legislation is not adapted to the specifics of the creation and legal registration of such territories, which gives rise to a complex set of interdisciplinary contradictions. Key aspects of the problem include:

Legal uncertainty

− the lack of a clear definition of an artificial land plot (ALP) in the Land Code of the Russian Federation (in contrast to Federal Law No. 246-FZ "On Artificial Land Plots," which regulates only marine territories).

− conflict of regulations: the creation of ALPs on water bodies requires approval under the Water Code (Article 11) and Federal Law No. 246; fill territories on land are covered by the Urban Development Code of the Russian Federation and Federal Law No. 218, but their geotechnical risks are not taken into account.

Technical and legal conflicts during land surveying

− impossibility of using standard methods: Traditional geodetic benchmarks "float" on unstable soils; artificial plot of land boundaries are dynamic (e.g., due to erosion or backfill).

− cadastral registration issues: Rosreestr requires precise coordinates, but the permissible error for artificial plot of land, as defined by Order No. 921 of the Ministry of Economic Development.

Environmental and urban development risks are presented in Table 3.

Economic imbalances

− Financing: inability to obtain a mortgage for construction on artificial land plots (banks do not accept them as collateral due to legal risks).

− Taxation: the cadastral value of artificial land plots is calculated as for regular land, ignoring: high maintenance costs (bank stabilization, drainage); limited-service life (max. 50-70 years for filled areas).

The research topic is relevant to 20+ artificial land plot projects in the Russian Federation. Its implementation will prevent losses (up to 7 billion rubles/year) and

create a legal basis for sustainable development of coastal agglomerations. Testing is planned in pilot regions: Moscow, Kaliningrad, and Vladivostok.

Table 3.

Environmental and urban development risks

Problem	Consequences	Regulatory gap
Lack of environmental impact assessment during the creation of the artificial plot of land	Pollution of waters, destruction of biological resources (Black Sea, Sochi)	Federal Law No. 7 «On Environmental Protection» does not require an environmental impact assessment for the ISU
Failure to take into account the load on infrastructure	Subsidence of soil under buildings (example: the reclaimed area of Novy Bereg in Kaliningrad)	SP 47.13330 does not contain standards for artificial plots of land.

Addressing these challenges will not only enhance the quality of recreational land use but also foster the development of sustainable strategies for the efficient utilization of territories.

The key performance indicators of functional zoning are presented in Table 4.

Table 4.

Key performance indicators of functional zoning

Economic	Reducing technical support costs during the modernization of territorial zoning
Ecological	Supporting public health through the use of environmentally friendly zoning
Social	Living conditions of the population in old and new urban areas must be gradually equalized and qualitatively improved.
Urban planning	Modernization of the development and planning structure of the territorial zoning with the aim of increasing the architectural and spatial qualities of the territory

In our opinion, the proposed indicators for functional zoning in each territorial zoning of the studied settlement will help to efficiently use the territory and get as close as possible to its rational use.

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