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Experience and analysis of formation of land information system

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Abstract

The formation of land information system and the provision relevant organizations and government agencies with information, the integration of data will create the basis for overcoming a number of shortcomings in the area. The article examines and analyzes the advantages, tasks, principles of formation of land information system and the advantages of integrating land information with other systems.

Keywords: Land information system (LIS); land cadastre; geoinformation technologies; land relations.

1. Introduction

There is a tendency to attract labor resources directly from the sphere of material production to the sphere of information, and the process has become the most significant sign of what is now called the information revolution. According to UNESCO, in industrialized countries, more than half of the working population is currently involved in the development and dissemination of information1. Over the last three years, interest in land information systems (LIS) has grown exponentially. Land surveyors, geographers, engineers, architects, ecologists, and many other professionals began working on technologies and applications that would cover information systems2.

A land information system is a system of information about the state, use and protection of land resources in a country3. Only a systematic approach will allow for a sufficiently complete, detailed, precise and objective study of the quantitative and qualitative characteristics of land in various spheres of society and sectors of the economy. Land information is abstract and is seen as a tool for research and management, requiring adherence to the principles of creative style, austerity and transparency in forming it.

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2. Problem statement

The development of science and technology has had its impact in the sphere of geoinformation systems, as in any area. When it comes to terrestrial information systems, it is useful to give a brief description of the notion of information systems. According to Article 3 of the Law of the Republic of Uzbekistan "On Informatization", Information system is a set of organized information resources, information technologies and means of communication that allow to collect, store, search, process and use information. There days, the collection, storage, retrieval and processing of information requires digital presentation in every sphere. Titling 2020 the "Year of Science, Enlightenment and Development of the Digital Economy" in our country is a steady step for the development of our country. Reforms in the sphere are opening the door to many opportunities for every link in society. Decree of the President of the Republic of Uzbekistan No. DP–5953 of March 2, 2020 "On the State Program for the implementation of the Action Strategy for the five priority areas of development of the Republic of Uzbekistan in 2017–2021 in the "Year of Science, Enlightenment and Digital Economy" The development of the draft program "Digital Uzbekistan – 2030" also includes the issue of digitalization of public services and the development of the information ecosystem5.

Addressing such important issues as registration and protection of subjects of land relations, developing civil agreements on land and property objects, collection of land fees, protection from degrading processes of lands requires legal registration and scientific activity of cadastral and monitoring activities using geoinformation technologies and the need for organizational support arises. In order to create the necessary organizational and legal conditions that ensure the establishment of an integral information system of land, it is necessary to form it as a special category of legal relations and develop a regulatory framework for its use.

In order to regulate the relations in the sphere of preparation and use of land information in the Republic of Uzbekistan, the relevant legislative basis has been developed in the country. The legislative basis includes the Land Code of the Republic of Uzbekistan, the Law of the Republic of Uzbekistan "On State Land Cadastre", the Regulation on the procedure for maintaining the state land cadastre in the Republic of Uzbekistan.

The Land Code of the Republic of Uzbekistan (April 1998) is the main legislative act regulating land use and land information use in the country. It states that information on land consists of a necessary and reliable system of information on the natural, economic and legal status of land, their categories, quality and value characteristics, location and area of land, distribution by land (Section 15)6.

In addition, Uzbekistan is adopting and monitoring a number of laws on the further development of LIS and the introduction of digital technology systems. In particular, Resolution of the President on measures to implement the investment project "Organization of the National Geographic Information System" (No. RP–2045), measures on the widespread introduction of digital economy and e-government (No. RP–4699) This year is leading to the introduction of improved and automated systems in all areas7,8. There is no clear definition of a land information system. Land information system (LIS) is the title originally used for GIS (geo information systems) systems specifically designed for property ownership and boundary entry management9.

A land information system is a systematic collection, distribution, updating, and processing of spatially linked land processes and techniques for a designated area that assists in making economic, legal, administrative, and economic decisions. system."10. One of the definitions of LIS is given in the Glossary of Geoinformatics, according to which the land information system is a geographic information system of land resources and land cadastre specialization11.

In our opinion, the formation of a land information system on the example of a particular region will lead to effective results.

3. Result

As a result of land registration, surplus plots of previous landowners were confiscated and transferred to new farms and those living in urban-type settlements for individual farming. Land cadastre information was prepared in a short period of time for all land plots given to the population, which provided qualitative and quantitative descriptions of lands, as well as land use rights. These land plots were given with the right of lifelong inheritance.

Due to the beginning of the registration of land ownership rights, extensive work has been done to regulate non-agricultural landowners, especially in densely populated areas, with the simultaneous registration of land ownership rights. Normative legal acts on soil quality and pricing for agricultural land have been updated. At the same time, the country began to create a digital land information system (DLIS) based on computer technology.

As for the quality of the existing information system, the information produced does not always meet the production requirements in terms of its reliability and diversity. Basically, traditional, quantitative and qualitative indicators are being developed for land resources, and especially for agricultural land plots, which describe pre-established land use. Insufficient attention is paid to the development of land cadastre information in other areas of society, the system of indicators describing the efficiency of land use is almost non-existent.

Especially in the social sphere, there is no information on land use in the recreational area, and great attention should be paid to the development of land information describing the environmental aspects of land use. In a market economy, indicators describing the use of land and water resources are rarely applied. The listed shortcomings of the current land information system will undoubtedly hinder the introduction of the principles of market economy in land use, as a result of which it will not contribute to the efficient use of land resources in the country and will require its exclusion.

There is a growing need for land information around the world. This will be the basis for planning, developing and controlling the use of natural resources. The expansion of production on a global scale is greatly increasing the pressure on the natural environment. Land is the main source of material well-being and requires the creation of a management system for its efficient use. What will happen if the land use situation gets out of control can be seen in the example of developed foreign countries. When land resources are used inefficiently in agriculture, drought, soil erosion, land degradation can occur. Forests are being cut down mercilessly. In agriculture, arable land is declining, causing problems in densely populated areas. Thus, the amount of objective factors for the efficient use of land resources is increasing, which, in turn, requires the preparation of large areas of land, the availability of diverse and detailed information about land plots. General knowledge will not be enough, detailed information on land use is needed. This is a clear reason to create a land information system. Creating a digital land information system involves addressing the following important issues:

- providing information on land use;
- formation of the state statistical report on a condition and use of land resources;
- public registration of land ownership rights;
- drawing up documents confirming the right of land use, the right of lifelong ownership of the land plot and the right of ownership of private property;
- preparation of materials for coordination of location of objects of economy, withdrawal and allotment of the parcels of land, transfer of the parcels of land to the city management, change of borders of administrative-territorial objects;
- urban and rural development;
- agricultural development;
- regulation of land relations;
- land valuation;
- compensation for loss of land plots;
- incentives for efficient use of land resources;
- making land use payments;
- real estate market performance;
- development of mortgages and others.

The digital land information system can be defined as follows: this system consists of a set of software and hardware that provides automatic input, exchange, storage of spatial-attribute databases, information exchange channels and other land cadastral information. The digital land information system (DLIS) consists of a coordinate system of the corresponding points, which allows the data to be added to other data combined with the land within the system.

There is a strong demand for systematic collection, updating, processing and delivery of data to consumers in the prescribed manner. New technologies, especially computerization, have placed a number of conditions and limitations along with the further strengthening and development of such systems. Land-related information is becoming increasingly important in a market economy and in the transition to more intelligent use and development of land resources. There is a transition from traditional automated systems to software processing. The diversity of land information systems is determined by their legal basis, traditions, and other differences.

In our opinion, the priority tasks in the creation of land information systems include:

- create clear content that everyone understands;
- constructive action by the state in coordinating all actions related to land reform;
- standardization of practice and terminology.

The industry-specific land information system is designed to manage graphical information analysis and transmission, which includes both real estate and ownership rights. It is also a product of the development of the cadastral system. The land information system also serves as a register of land plots and their subjects. The function of land registration is to provide a reliable and clear basis for obtaining the right to own and manage land. The land information system includes information on the location of land plots, boundaries, property rights, valuation and other benefits and restrictions related to land plots. Soil classifications for each plot of land, information on land use are described.

A particular territory of land, regardless of the form of ownership, shall be registered by the state. This guarantees the right of landowners to own land and allows for a fair, reasonable tax on land (real estate). In the land information system, the information is legally documented and the information in the electronic register shall have legal status.

Analysis. It is known that the world practice focuses on the problems of implementation of many scientific and theoretical issues on the creation of a database, and since the advent of automated systems, theoretical problems have remained the main driving force12.

Why is it necessary to create a system of digital registration of land? In Uzbekistan, the registration of land owners and land users in the land cadastre system is currently underway, the methodology of which is based on the registration documents, for instance the land cadastre book, the book of registration of privately owned land. The system, to a certain extent, ensures that changes in private property are taken into account. However, this is true only in cases where the number of landowners and land users is minor, as well as in cases where the volume of work performed is not large.

International experience shows that there are two main systems of registration of private property rights:

- transaction registration system;
- system of registration of property rights of owners.

In a modern land information system should be based on data collection and processing, computing and telecommunication, while the formation of the technical structure of the land information system should be carried out as a result of spreading to all levels of the software and hardware systems. Depending on the level of distribution of the software and hardware complex can be formed in the form of various composite local area networks. That is, the information is stored in a distributed form on users' computers and accessed through a local network, where the information itself is stored on a central server and can be accessed by all users on the network.

The software of the land information system consists of a system-wide, basic equipment system: operational, database management, geoinformation, as well as a set of special software tools that designed to automate the processing, analysis, storage and processing of land cadastre information at all stages.

Filling in the information will greatly improve its completeness. The cadastral number of the land plot itself does not directly represent its spatial location. This leads to the idea of geocoding. In the simplest case, these are the coordinates of the center points of the plots. Thus, the collected information can be automatically identified on the cards and is not bound by administrative boundaries. Land-based information systems are flexible and easy to manage.

In the three-tier territorial organization of production units that maintain the state land cadastre in the territory of the Republic of Uzbekistan (at the republican, regional and administrative districts (cities)), the territorial database of land cadastre information is implemented and expanded within the land information system. Each land information system is divided into the following components: functional subsystems and types of supply.

Functional subsystems are the main logical component of a land information system aimed at ensuring the performance of the main functions assigned to it.

Each subsystem consists of an interconnected complex system:

- land cadastral information, its composition and content are determined by the provision of a subsystem;
- technological processes of formation, collection and registration of land cadastre information;
- information processing processes;
- processes of providing information to the consumer.

The launch of each subsystem is based on the creation of software and information technology that ensure its continuous operation.

The following basic functional subsystems can be distinguished in the structure of the land information system:

- formation of cadastral registration objects;
- maintenance of the state cadastral registration and the single state land register;
- formation and registration of territorial zones;
- state cadastral assessment of lands for taxation;
- information-analytical;
- management of interagency relations;
- work operation.

Types of land information system support include: components of system support of land information system operation, including information, technical, software, technological, normative-legal acts, organizational support, as well as information security, long-distance communication, information processing management tools.

Land are entered into the database of the land information system in accordance with the state land cadastre acts on the status and use, area, location, economic and qualitative characteristics. They are formed on the basis of reports provided by the owners on the boundaries of land plots, topographic-geodetic, cartographic, monitoring, land management, soil, geological-geomorphological and other research and studies. A list of specific information about territories of land is applied to each type of land.

Information on the economic characteristics of land plots is included in the state land cadastre documents on the basis of information from the state cadastre and land valuation, as well as the normative legal acts of local governments. Territorial information zones are entered on the basis of information received from the bodies carrying out the registration or listing.

The most important part of the land information system that provides information is the messages received as a result of the registration in the state land cadastre and its inclusion in the single state land register. In this case, the date of inclusion in the Unified State Register of Lands is the time of appearance of the land as an object of state cadastre or termination of its existence.

The technical support of the land information system is based on modern means of collecting and processing, cadastral and telecommunication equipment of modern land cadastre data. At the same time, the formation of the technical structure of the land information system is carried out as a result of the widespread deployment of software and hardware at all levels of the system hierarchy. Depending on the level of distribution (district, city, region, republic), software and hardware complexes are formed in the form of various local area networks, from a single-color architecture to the client-server.

Along with the technical means of equipping cadastral offices, the technical support of the land information system includes complexes for the collection of primary land cadastral information in the sphere. Land information system software is a set of system-wide, basic instrumental systems, for instance operational, database management,

geoinformation, as well as special application software, means of automation of analysis, presentation of information to land cadastre information at all stages of its structure.

Currently, the main technological modes in the operation of land information systems are:

- loading and control of primary data for the implementation of cadastral registration operations and the maintenance of a single state register of lands;
- updating the graphical and semantic database;
- performance of operative information and reference service on orders of users of the system;
- service of analytical inquiries;
- information exchange with existing state and administrative systems.

The dissemination of information and telecommunication environment of the land information system is carried out in conditions of lack of quality communication systems, modern software and hardware for users, access to communication environments and expensive communication services. Therefore, the choice of technical solutions for the introduction of communication components in the creation of land information systems is based on the analysis of real needs for operational data and low-cost system integration in the field of information and communication and interdepartmental information exchange.

From a technical point of view, measures to protect the land information system include:

- distribution of data of the state cadastral registration on levels of protection in the structure of the land information system;
- legal protection of information;
- licensing of activities on formation and use of state land cadastre data.

As in all sectors, Uzbekistan has been working for the last 5 years to expand the land information system, but due to certain difficulties, it will take enough time and funding. It is known that the formation of the district land information system is carried out in several stages. In other words, land information is created within the land territories within their coverage. We therefore believe that solving this problem on the example of specific objects ensures the accuracy of the information.

Turgunboy Sohibkor Agro, a farm in Tashkent district of Tashkent region of the Republic of Uzbekistan, has been selected as a research subject. It was a part of Bekhi Agro Limited Liability Company (LLC). Its total area is 43.71 ha, including orchards – 37.01 ha, irrigated arable land – 2.08 ha, arid land – 0.09 ha, with a total of 39.18 ha of agricultural land. In addition, 3.60 ha of irrigated land, 0.79 ha of roads, 0.06 ha of construction sites and 0.08 ha of non-agricultural land. The structure of the total land area (registration) does not include other land users. We know this is a methodological mistake. In practice, we observe that most land on the farm will have space for other land users.

The “registration book” for the area shows 31 land contours. Their average area is 1.41 ha. Land contours are traditionally formed on the principle of unique contour numbers at the district level. According to this system, on the territory of the LLC are marked as land contours numbered 767-798. Definitely, in this numbering method, land cadastre information in several cases provides the required level of accuracy and transparency.

For instance, 31 contours registered on the territory of the LLC show 40 types of land. But mainly contour areas of linear type (irrigation, drainage, road networks) are included in the composition of the contours occupied by the main agricultural lands. This methodologically does not ensure the accuracy of land cadastre information. As a clear example, the results of the work carried out at Bekhi Agro LLC are shown in the map below (Figure 1).

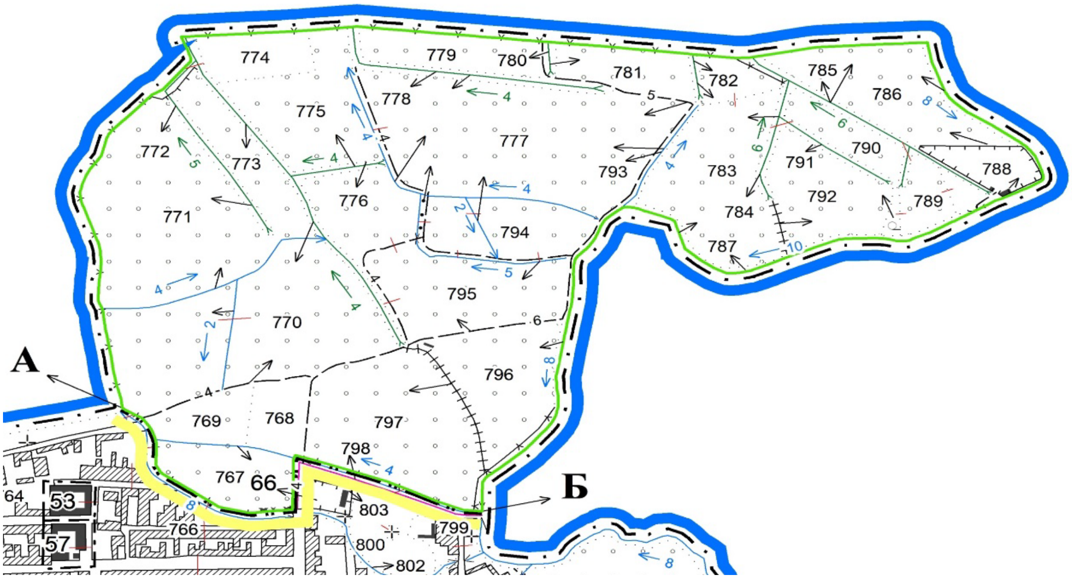

Fig. 1. Current map of Bekhi Agro LLC on the territory of Turgunboy Entrepreneurial Agro Association.

Contour registration of existing areas created for the territory of Bekhi Agro LLC

T/p	Username from the ground	purpose of use	Contour numbers	Total area (ha)	Including: Plowed lands – Total:	Plowed lands – including irrigated – Total:	Plowed lands – including irrigated – irrigated	Plowed lands – non-irrigated	Gardens – Total:	Gardens – including irrigated – Total:	Gardens – including irrigated – irrigated	Gardens – non-irrigated	Vineyards – Total:	Vineyards – including irrigated – Total:	Vineyards – including irrigated – irrigated	Vineyards – non-irrigated	Greenhouses	Fruit seedlings	mulberry bush	[illegible]	bare land – irrigated	bare land – non-irrigated	rangelands – Total:	rangelands – haystacks	Agricultural lands – Total:	Agricultural lands – watery	Томорка ерлар – Total:	Томорка ерлар – In the field	Lands in the state of reclamation constru	Forests – Total:	Forests – Including – shelter trees	Forests – Including – shrubs	Underwater lands – Total:	Underwater lands – Including – Rivers and streams	Underwater lands – Including – Lakes	Underwater lands – Including – Reservoirs and reservoirs	Underwater lands – Including – Channels, collectors and d	Roads, a road that drives cattle	Buildings streets, palaces and squares	Other lands not used in agriculture
	2	3	[illegible]	6	[illegible]	[illegible]	[illegible]		1	1			1	16	[illegible]		1				[illegible]		[illegible]		2(	2	2		[illegible]	[illegible]	3	[illegible]	3				3	3	4(	4
Farms																																								
			767	1.16					1.10	1.1															1.10	1.10							0.05				0.05		0.01	
			768	0.68	0.63	0.63																			0.63	0.63							0.01				0.01	0.04		
			769	0.71					0.65	0.65															0.65	0.65							0.03				0.03	0.03		
			770	4.62					4.47	4.47															4.47	4.47							0.09				0.09	0.06		
			771	5.21					5.15	5.15															5.15	5.15							0.06				0.06			

Fig. 2. Contour registration of existing areas created for the territory of Bekhi Agro LLC.

In Figure 1, the data of the cross-section of the land contours of the area registration of the current land were obtained for the study. In order to ensure the reliability and transparency of information, we recommend a new method of defining areas in the contour section. In this method, the contours of the types of land used in direct agriculture are first numbered, and the types of lands in indirect use, including linear land contours, are represented by consecutive numbers.

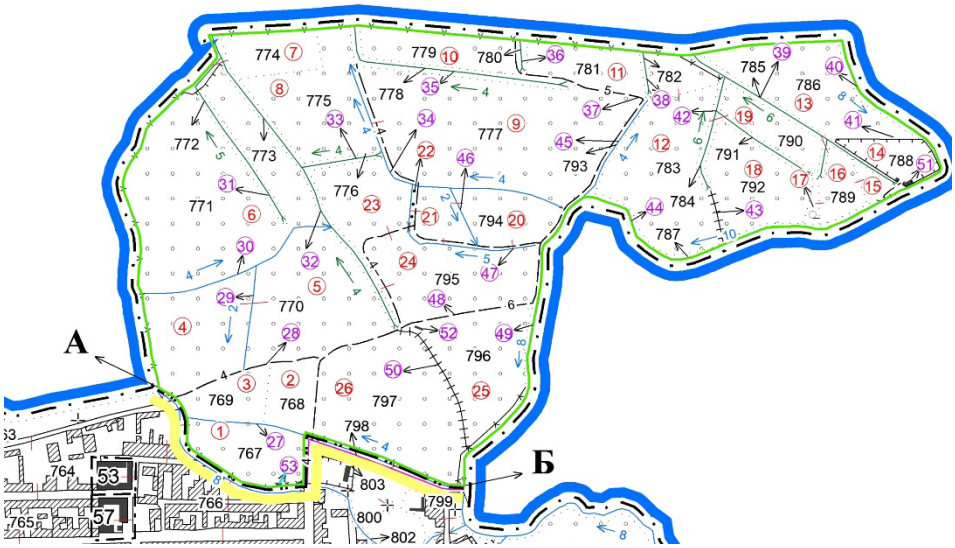

Fig. 3. shows the current numbers of the land contours (in black), the new numbers assigned to them (in red) and the design solution numbers recommended by the authors (Figure 2).

Figure No. 3. Map of existing and proposed new contour of “Bekhi Agro” LLC on the territory of “Turgunboy Sohibkor Agro Association” agro-firm

Table 1. New solution contour registration.

Contour number	Land type (according to the new style)	Area(ha)
1	garden	1.10
2	plowed lands	0.63
3	garden	0.65
4	garden	1.94
5	garden	2.66
6	garden	5.15
7	plowed lands	0.77
8	garden	1.92
9	garden	4.96
10	garden	0.99
11	garden	0.85
12	garden	2.98
13	garden	1.94
14	plowed lands	0.60
15	plowed lands	0.18
16	garden	0.47
17	poplar	0.09
18	garden	1.52
19	garden	0.66

20	garden	0.91
21	garden	0.47
22	mulberry bush	0.05
23	garden	1.12
24	garden	2.02
25	garden	1.79
26	garden	3.04
27	stream	0.06
28	road	0.09
29	stream	0.03
30	stream	0.12
31	ditch	0.22
32	ditch	0.42
33	ditch	0.04
34	stream	0.17
35	ditch	0.32
36	ditch	0.07
37	road	0.28
38	ditch	0.07
39	ditch	0.33
40	stream	0.25
41	dam	0.07
42	ditch	0.32
43	dam	0.03
44	stream	0.38
45	stream	0.14
46	stream	0.02
47	stream	0.13
48	road	0.25
49	stream	0.25
50	dam	0.13
51	under construction	0.04
52	under construction	0.01
53	under construction	0.01
	total	43.70

As a result, 26 contours of orchards, terracotta, mulberry and arable lands were formed. The remaining 27 land contours are numbered as linear elements and construction objects.

The above methodological approach basically recognizes in the proposed solution for the LLC the tariff that each land contour is part of a land with its own boundary, area, number and type of land. As a result of in-house and field research, a contour registration of the existing areas for the territory of the LLC (Fig. 2.), a solution registration covering each proposed contour, a separate land type (Table 1) and a table of their comparison (Table 2) were developed.

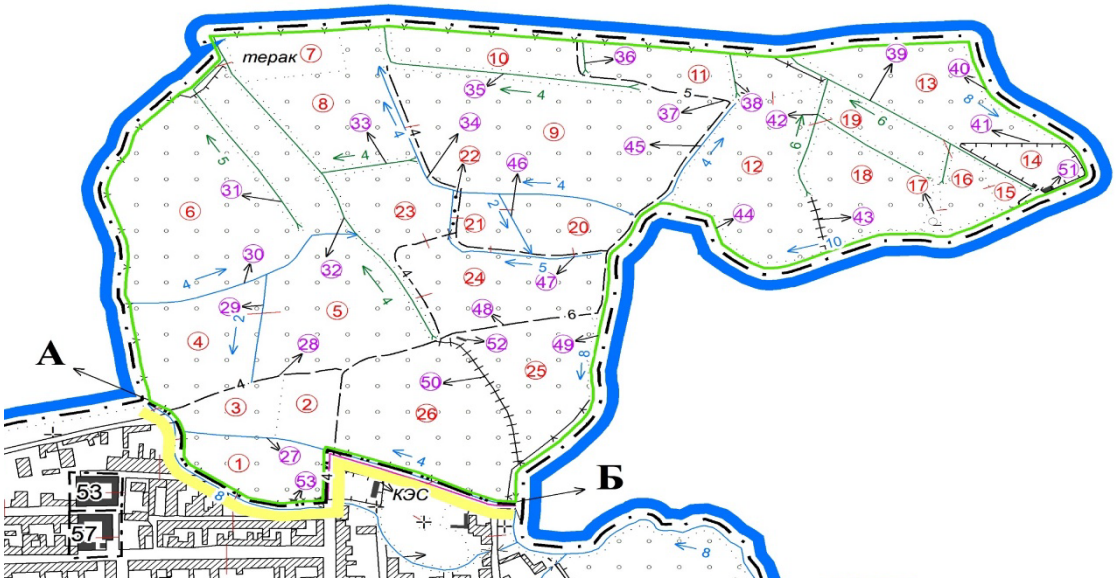

Fig. 4. The new contour numbers of Bekhi Agro LLC on the territory of Turgunboy Sokhibkor Agro Association.

Table 2. Comparison table for traditional and new analysis.

№	Land type (current status)	Area (ha)	№	Land type (according to the new style)	Area (ha)	different +/- (ra)
1	plowed lands	2.08	1	plowed lands	2.18	0.10
2	gardens	37.01	2	gardens	37.14	0.13
3	irrigation networks	1.62	3	irrigation networks	1.55	-0.07
4	ditchs	1.98	4	ditchs	1.79	-0.19
5	roads	0.79	5	roads	0.62	-0.17
6	poplar	0.09	6	poplar	0.09	0.00
7	------		7	mulberry bush	0.05	0.05
8	other lands	0.08	8	other lands	0.23	0.15
9	under construction	0.06	9	under construction	0.06	0.00
	Total area	43.71		Total area	43.71	0

In practice, barriers (dams) in the form of restrictions are included in the list of lands not used for agriculture, with an area of 0.23 ha. In Figure 3 above, the ground contour as a design solution is numbered according to the current style (in red) and the design solution (in ink) (Figure 4).

Differences in field registration were identified on the basis of the mentioned tables (relative to the current situation):

- more than + 0.10 on plowed lands;
- more than +0.13 in orchards;
- Irrigation networks less than -0.07;
- less than -0.19 ditches;
- less than -0.17 field roads.

4. Conclusion

The introduction of the contour registration for the proposed area in the land cadastre affairs will serve to highlight the limited information of the human factor. The growing population of the country from year to year increases their demand for food, as well as a steady increase in living standards. This, in turn, shows its comprehensive impact on land areas, the rational organization of their use. Land information systems are based on the sample of a clear object, which is of great practical importance for the correct conduct of quantitative registration of lands, to have accurate, transparent information on different land categories, land use.

In recent years, modern, innovative technologies have been introduced for quantitative land registration, which, certainly, greatly simplifies the work of land registration. However, the deepening of land reform, the diversity of land user rights, the emergence of new forms of land use, the need to ensure fairness in the quantitative registration of land, it is necessary to make appropriate changes. Therefore, we consider it essential to develop accurate data on the contours of certain lands in order to form transparent, reliable and accurate land information at the district level.

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