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PROSPECTS FOR QUANTIFYING ENVIRONMENTAL INDICATORS FOR THE GENERATION, TRANSPORTATION, SORTING, RECYCLING, SERVICING AND EFFICIENT USE OF LANDFILLS OF CONSTRUCTION WASTE

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Abstract
It is time to scientifically establish the use of electronic digitization services for the exchange of information on the cost of environmental and sanitary-epidemiological operations, the level of service coverage, recycling, extension of the life of landfills, and the cost of environmental and sanitary-epidemiological operations in construction waste management using effective environmental indicators.

Keywords: Construction, waste, recycling, electronic digitization, indicator, formula, ecological and sanitary, indicators.

Introduction

The rapid introduction of electronic digitization services for data exchange in the world as a novelty creates an opportunity to save time, work more on oneself and conduct scientific research. We believe that the time has come to widely use such opportunities in the management of construction waste. Globally, waste is increasing, according to (USA Today 24/7 Wall Street), the annual per capita waste generation in Canada is 36.1 tons, in Bulgaria 26.7 tons, in the USA 25.9 tons, in Estonia 23.5 tons, in Finland 16.6 tons, in Armenia 16.3 tons, in Sweden 16.2 tons, in Luxembourg 11.8 tons, in Ukraine 10.6 tons, in Serbia 8.9 tons, which causes environmental pollution problems. More than 4 million tons of construction waste have accumulated in Uzbekistan.

This article aims to scientifically determine the level of service, recycling, extension of the life of landfills, and the share of environmental and sanitary epidemiological operational costs in the management of construction waste using effective environmental indicators using the electronic digitization service for data exchange. The Decree of the President of the Republic of Uzbekistan No. PF-149 dated September 26, 2024, set out the problem of expanding the scope of construction waste indicators based on the criteria of 10 key performance indicators of sanitary cleaning enterprises. Also, the Resolution of the President of the Republic of Uzbekistan No. PF-16 dated January 10, 2025, “Uzbekistan 2030” Strategy “Environmental Protection and

Objective 72 of the Decree on the State Program for the Implementation of the "Green Economy" Year sets the task of gradually introducing a system for sorting and recycling construction waste.

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MATERIALS AND METHODS

The method for determining the relative size and norms of construction waste generation. It is used in the presence of technological documents for construction waste, that is, technological cards, regulations, working drawings. Based on these documents, the norms for the generation of construction waste are determined according to the following formula, depending on the type of construction waste.

$Q_{ch} = UX_{m^3} - (S\ QX_{m^3} + Y_{m^3} + sh_{m^2} + P_t + T_t)$

Here,

UX_{m^3} – the total volume of the building and the standard for raw material costs; m^3.

QX_{m^3} – height of the building's floors and volume of empty floors; m^3.

Y_{m^3} – volume of wooden materials or door, frame, floor, etc .; m^3.

Sh_{m^2} – glass waste ; m^2.

P_t – Plastic waste ; tons.

T_t – iron waste, fittings, etc .; tons.

When digitizing construction waste indicators, it is necessary to take into account several service stages.

In particular, a scheme was recommended for covering legal entities and individuals with services in the regions, indicators of the level of removal of construction waste generated in legal and individual residential areas, indicators of the efficiency of providing construction waste with containers, transportation, sorting of secondary resources, placement of waste in landfills, determination of morphological composition and secondary resource raw materials, processing, efficiency of landfill use periods, environmental monitoring at construction landfills, and digitization of financial indicators (payment coefficient, environmental sanitary and epidemiological costs).

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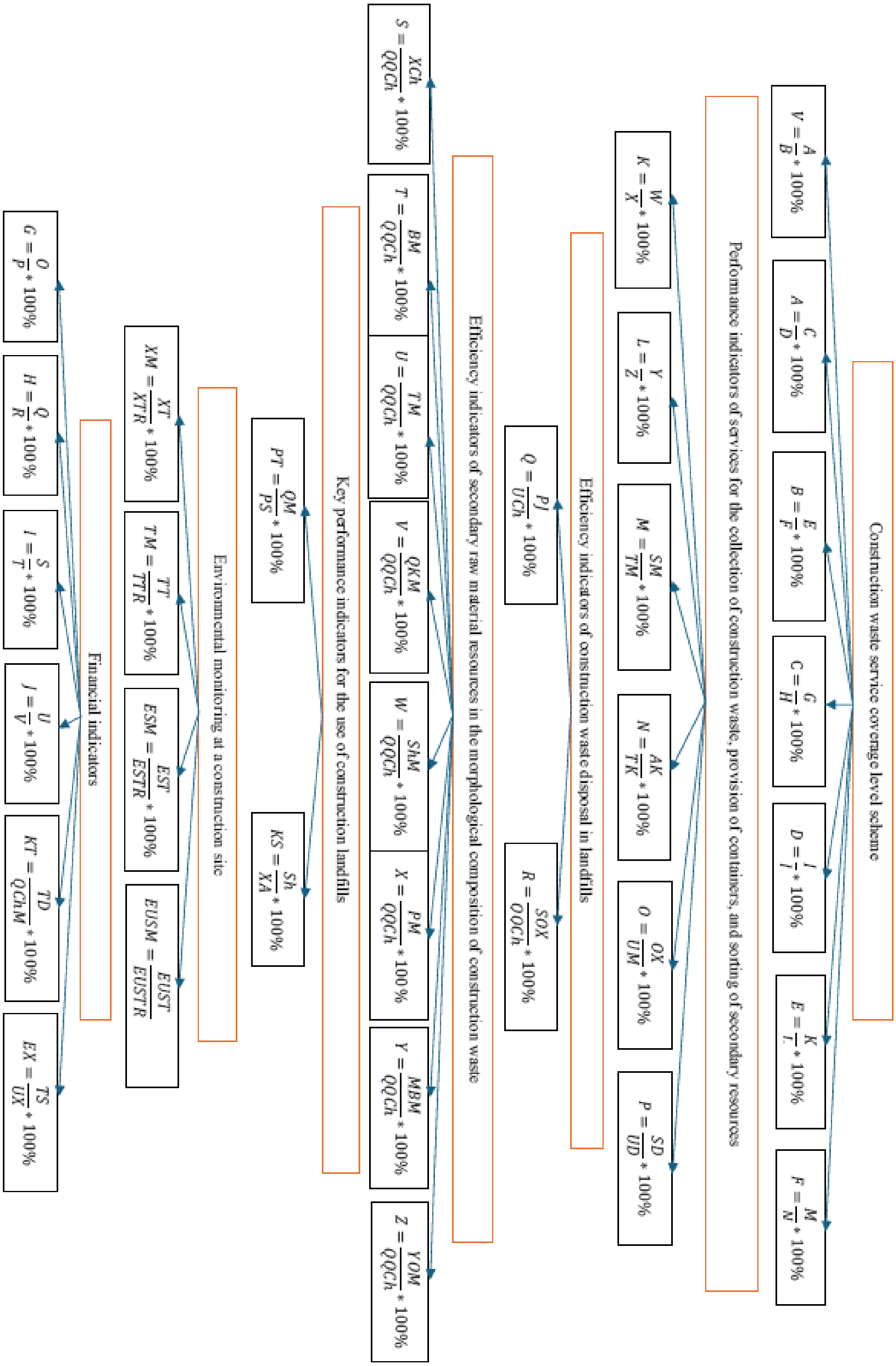

It is worth noting that the government has been paying attention to the establishment of construction waste landfills in the republic since 2021.

An example of this is the study of the ecological and economic aspects of the use of landfills of the Andijan region "Ekotibbiyot" LLC and the Tashkent region "Bio eco service" LLC.

1st column

	Indicators	Andijan region "Ekotibbiyot" hospital		Tashkent region " Bio eco service " LLC	
1	Years	2023	2024.	2023	2024
2	Total area (hectares)	5	5	20.6	20.6
3	Total waste generated (tons)	2548	1293	1043546	778500
3	Construction waste acceptance (tons)	2100	970	924960	282891
4	Recycling (tons)	-	-	244000	218000
5	Area cleared of waste (hectares)	-	-	8	7.2
6	Economic indicator (billion soums)	-	-	18.3	16.3
7	Area of preserved natural resources (at 2 m depth (hectares))	-	-	20	9
8	landfill completion time (years)	2		4.6	

Note: The results of the study show that Tashkent region "Bio eco service" LLC will generate 18.3 billion soums (at the stock exchange price of 75,000 soums per ton) in revenue per year by processing 244 thousand tons of construction waste, freeing up 8 hectares of landfill space, and preserving 20 hectares of natural resource landscape.

Due to the processing of construction waste at landfills, the maturity period of the Andijan region "Ekotibbiyot" H/K landfill was extended by 2 years, and the Tashkent region "Bio eco service" LLC landfill was extended by 4.6 years.

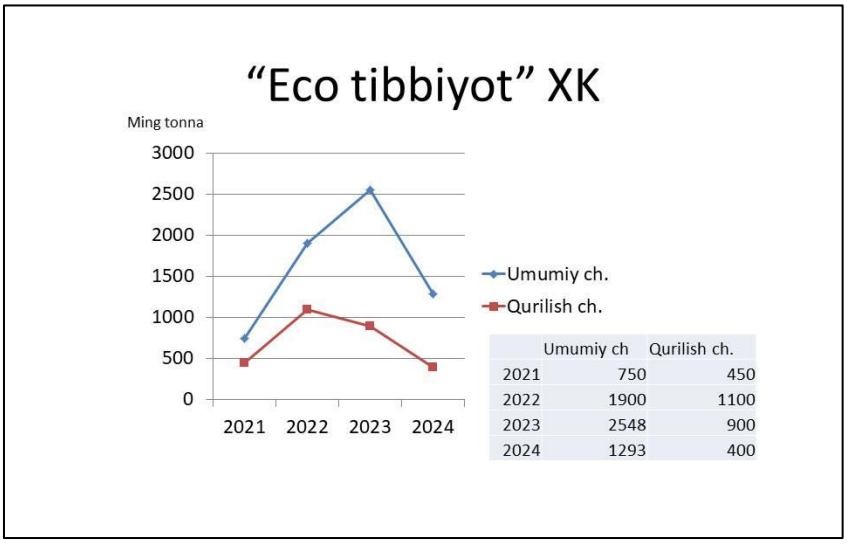

Figure 1 - Research analysis of general and construction waste of the " Eco tibiyot" PE.

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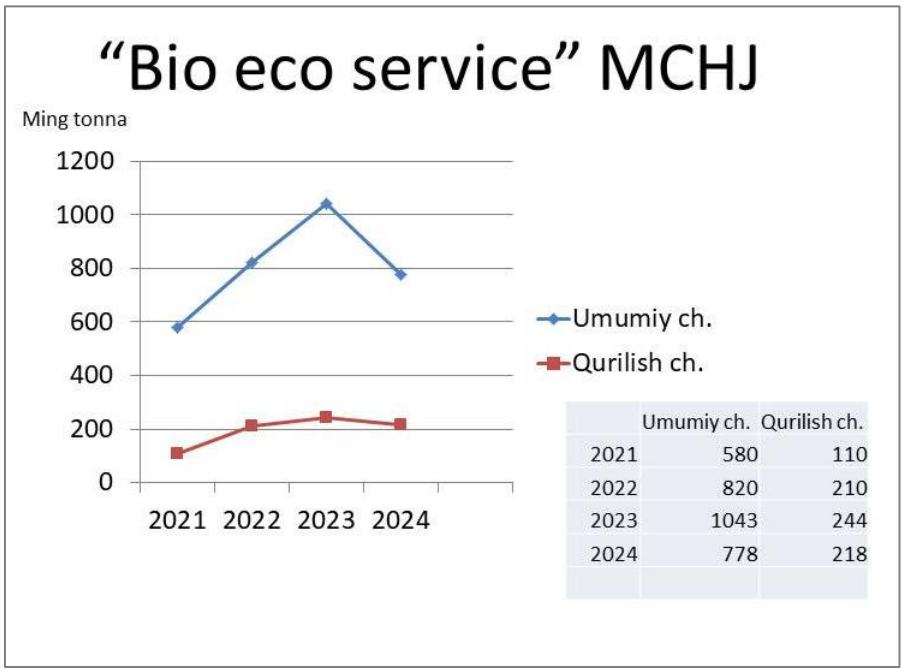

Figure 2 - Research analysis of general and construction waste of " Bio eco service" LLC.

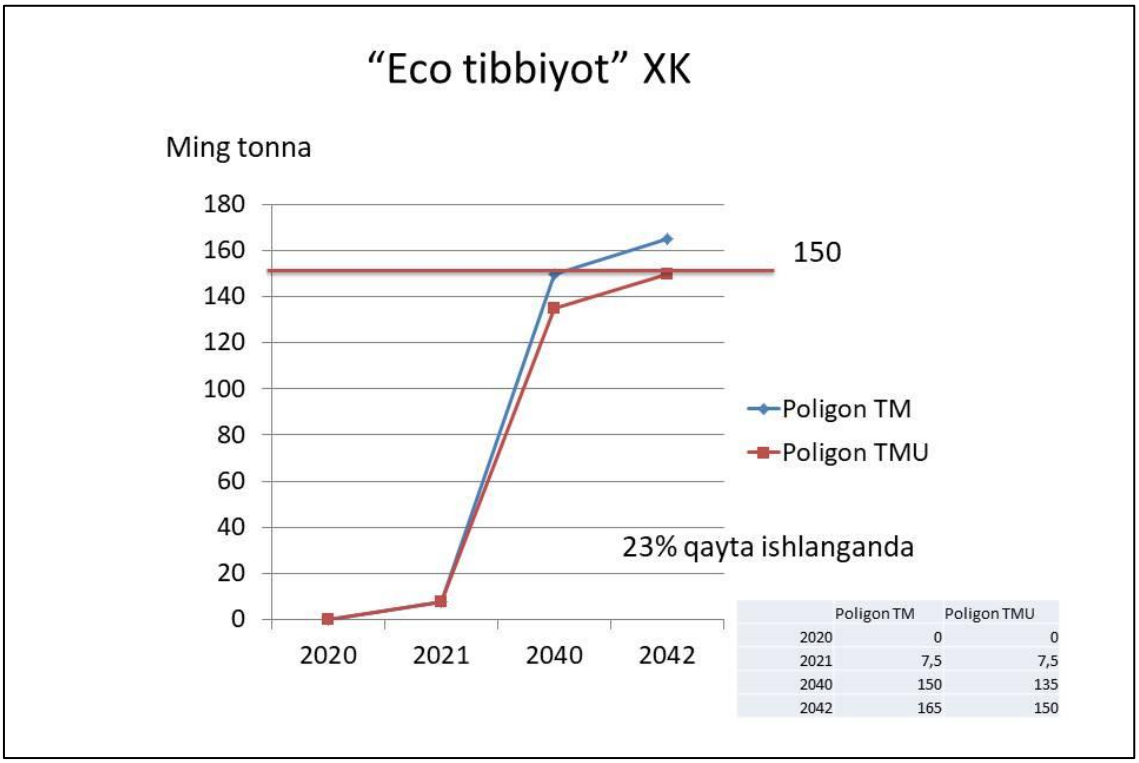

Figure 3: Research analysis of the landfill usage period of the " Eco tibiyot " PE .

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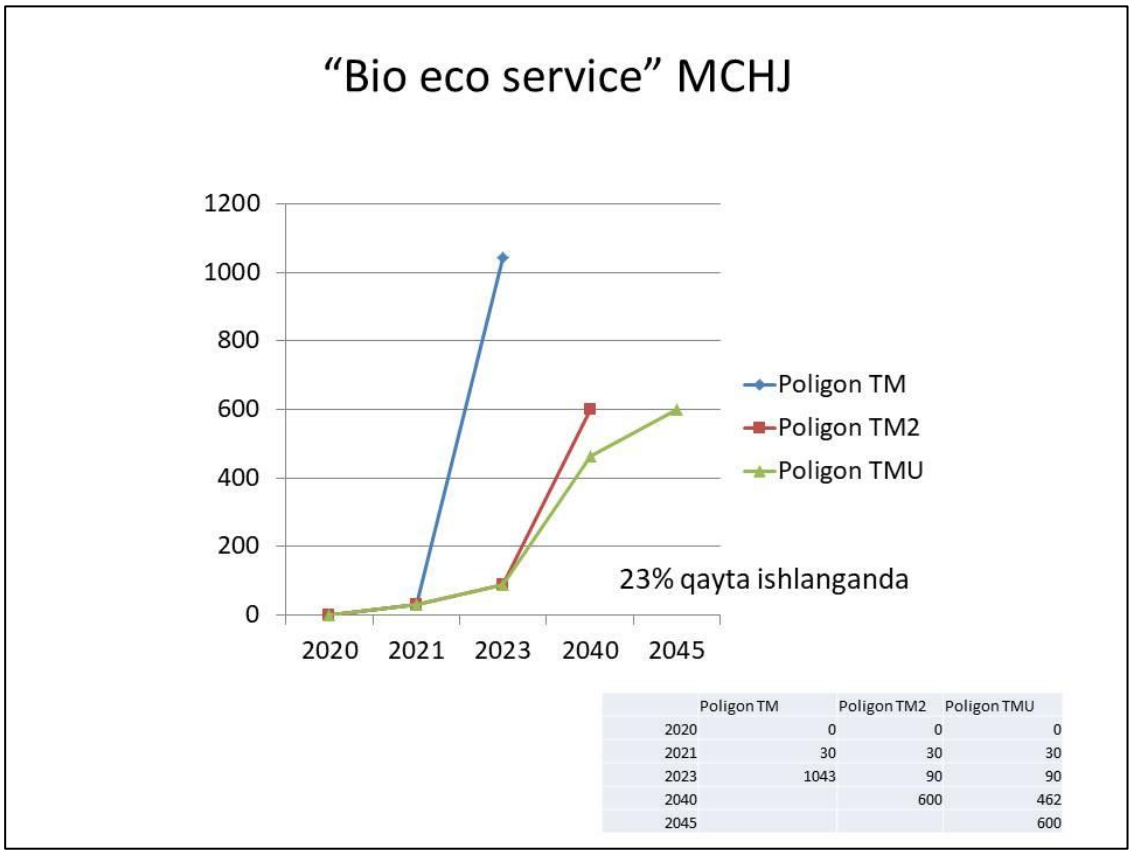
If the “Eco Medicine” PE achieves the recycling of 23% of construction waste, this will create great opportunities for the effective use of landfills and reducing the negative impact on the environment. In this case, the extension of the landfill life by 2 years is reflected in the following processes.

By recycling construction waste, many useful materials (e.g. concrete, metal, wood, etc.) can be recycled. This saves resources, reduces the amount of energy needed to produce new materials, and reduces the use of natural resources.



	Poligon TM	Poligon TM2	Poligon TMU
2020	0	0	0
2021	30	30	30
2023	1043	90	90
2040		600	462
2045			600

4 - Figure 4: Analysis of the landfill life cycle of “ Bio eco service” LLC .

The results of the study show that, based on experimental studies conducted by Bio eco service LLC, the useful life of landfills was extended by 4.6 years by recycling 23 percent of construction waste .

Implementation of research results

The logistics of environmental protection and transportation of construction waste to landfills during the renovation (demolition) of old buildings were developed. As a result, the principles of logistics used to improve the efficiency of the management system for environmental protection and transportation of construction waste to the landfill of Yukorichirchik district “Bio eco service” LLC were developed.

Practical recommendations were developed to reduce the negative impact of construction waste landfill infrastructure, their processing, and disposal on the

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environment. The results of these recommendations allowed the Tashkent regional Department of Ecology, Environmental Protection and Climate Change and Yukorichirchik district “Bio eco service” LLC to reduce the negative impact on the environment.

A principle technological scheme of the processes of collection, storage, transportation, sorting, placement, processing and burial of construction waste has been developed. According to the results of scientific research, 244 thousand tons of natural sand and gravel raw materials were saved by “Bio eco service” LLC due to the processing of concrete and reinforced concrete waste, and 20 hectares of natural landscape were prevented from being destroyed, and 4.6 hectares of land at the landfill were freed from waste.

A program for expanding the areas of construction waste landfills has been developed. As a result, it has become possible to reduce the volume of waste disposal and extend the life of landfills through the sorting and recycling of construction waste.

The developed economic and ecological efficiency method was used to develop a construction waste management system for environmental protection. As a result of the processing of construction waste by "Bio eco service" LLC, a total of 244 thousand tons of natural sand and gravel or 18.3 billion soums of raw materials were saved in the economy, an additional waste reception area was created at the construction landfill, and the ecological situation improved.

This dissertation work, completed by Nomanjan Shakirov, a researcher at the Research Institute of Environmental and Nature Protection Technologies, on the topic "Scientific foundations of secondary resource waste management in environmental protection", is related to the solution of an existing problem in waste ecology and meets the requirements for the application of research results into practice for the degree of Doctor of Philosophy (PhD) in technical sciences.

According to the scientific approaches adopted, as a result of the processing of secondary construction waste by “Bio eco service” LLC, a total of 244 thousand tons of natural sand and gravel or 18.3 billion soums worth of raw materials were saved in the economy, an additional waste reception area was created at the construction landfill, and the ecological situation improved. Also, 910 tons of ferrous and non-ferrous metals, 53 tons of plastic raw materials, 42 thousand tons of wood and firewood, and 56.8 thousand tons of other waste were directed to the recycling industry.

In addition, this enterprise installed equipment to improve the quality of crushed gravel clinkers and made changes to the technology of adding natural stones to secondary resource crushed concrete, ensuring its strength.

Conclusion

1. By developing the recycling of secondary construction waste, the use of natural resources will be effectively established, new jobs will be created. According to Schuning, a scheme for digitizing environmental indicators for secondary construction

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waste based on the "Zero Waste" principle has been created and increased from 10 to 35 indicators.

2. The results of the study show that the recycling of 23 percent of construction waste carried out by Bio Eco Servis LLC resulted in an extension of the useful life of landfills by 4.6 years.

3. According to the results of scientific research, 244 thousand tons of natural sand and gravel raw materials were saved by "Bio eco service" LLC due to the processing of concrete and reinforced concrete waste, and 20 hectares of natural landscape were prevented from being destroyed, and 8 hectares of landfill were freed from waste.

4. It is recommended to use agrotechnical measures to produce ceramics, raw and baked bricks for road construction from secondary resource soils accumulated in landfills, for recultivation of lands damaged by industrial enterprises, for landscaping, and for increasing the productivity of saline and low-grade agricultural lands.

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