Ministry of Agriculture of the Republic of Kazakhstan
NJSC "KAZAKH NATIONAL AGRARIAN RESEARCH UNIVERSITY"
(NJSC KAZNARU)

UDC 332.024.3
№ state reg. 0124PK01187
IRN BR24993222
Inv.

APPROVE
Member of the Board, First
Deputy Chairman of the Board-
Rector, D.V.N., Professor
_____ P.Sh.Ibragimov
«__24__» ___11_____2024 y.

REPORT
ABOUT THE RESEARCH WORK

«BUILDING A DECISION SUPPORT SYSTEM FOR THE NATURAL AND ECONOMIC DEVELOPMENT OF THE TERRITORY OF THE NORTH KAZAKHSTAN REGION IN THE CONTEXT OF SUSTAINABLE DEVELOPMENT"

(interim, annual)

Program-targeted financing for scientific and (or) scientific and technical programs for 2024-2026

Program Manager, PhD _____ D.K.Molzhigitova

Almaty 2024

LIST OF PERFORMERS

Quality manager – group Leader	25.11.24 date, signature	F.K.Yermekov (Chapter 1)
Human resources and safety manager	25.11.24 date, signature	A.A.Nurmakhanov (Chapter 1)
International relationships Manager	25.11.24 date, signature	D.Imanmadi (Chapter 1)
Clerk	25.11.24 date, signature	B.Seisenbikyzy (Chapter 1)
L.R.(Leading Researcher)- group Leader	25.11.24 date, signature	Zh.A.Bazarbayeva (Chapter 1)
L.R.	25.11.24 date, signature	A.F.Sugirbayev (Chapter 1)
J.R.(Junior Researcher)	25.11.24 date, signature	N.N.Karabkina (Chapter 1)
L.R. – group Leader	25.11.24 date, signature	Y.P.Makashev (Chapters 4,5)
L.R.	25.11.24 date, signature	B.K.Asilbekov (Chapters 4,5)
B.H.C.	25.11.24 date, signature	P.T.Omarova (Chapters 4,5)
M.H.C.	25.11.24 date, signature	D.T.Baitulenov (Chapters 4,5)
Expert – group Leader	25.11.24 date, signature	Y.K.Onglassyn (Chapter 2.3)
J.R.	25.11.24 date, signature	D.M.Murat (Chapter 2.3)
L.R.-group Leader	25.11.24 date, signature	Maira Kussainova D. (Chapter 1.1)
L.R.	25.11.24 date, signature	Bayan Tussupova Kh. (Chapter 1.1)
J.R.	25.11.24 date, signature	Zhandos Mukaliyev K. (Chapter 1.1)
J.R.	25.11.24 date, signature	Timur Rafikov K. (Chapter 1.1)

J.R.	25.11.24 date, signature	Asset Arystanov A. (Chapter 1.1)
J.R.	25.11.24 date, signature	Timur Tamenov B. (Chapter 1.1)
L.R.- group Leader	25.11.24 date, signature	S.S.Abdygalieva (Chapter 2.2)
J.R.	25.11.24 date, signature	A.D.Omarbekova (Chapter 2.2)
J.R.	25.11.24 date, signature	N.V.Dzhangarasheva (Chapter 2.2)
J.R.	25.11.24 date, signature	G.E.Akhmetkerimova (Chapter 2.2)
J.R.	25.11.24 date, signature	B.E.Dabylova (Chapter 2.2)
J.R.	25.11.24 date, signature	Sh.K.Kadyr (Chapter 2.2)
L.R.- group Leader	25.11.24 date, signature	A.N.Munaitpassova (Chapter 2.1)
J.R.	25.11.24 date, signature	A.K.Zhexenbayeva (Chapter 2.1)
L.R.- group Leader	25.11.24 date, signature	A.E.Bekturganova (Chapter 1)
L.R.	25.11.24 date, signature	I.T.Tokbergenov (Chapter 1)
J.R.	25.11.24 date, signature	Д.N.Nabieva (Chapter 1)
L.R.- group Leader	25.11.24 date, signature	N.M.Orynbayev (Chapter 3.3)
L.R.	25.11.24 date, signature	G.K.Serikbaeva (Chapter 3.3)
J.R.	25.11.24 date, signature	A.B.Zholdasbek (Chapter 3.3)
J.R.	25.11.24 date, signature	D.N.Sagandykova (Chapter 3.3)
J.R.	25.11.24 date, signature	A.D.Atabay (Chapter 3.3)

J.R.	25.11.24	date, signature	E.R.Tashim (Chapter 3.3)
J.R.	25.11.24	date, signature	N.Meiramkhan (Chapter 3.3)
L.R.- group Leader	25.11.24	date, signature	U.K.Kerimova (Chapter 3.1)
L.R.	25.11.24	date, signature	Galizhan Madiyev (Chapter 3.1)
L.R.	25.11.24	date, signature	Kulmukhanbet Akhmetov (Chapter 3.1)
L.R.	25.11.24	date, signature	N.Zh.Demeukulova (Chapter 3.1)
J.R.	25.11.24	date, signature	G.Y.Bekenova (Chapter 3.1)
J.R.	25.11.24	date, signature	S.K.Essengaziyeva (Chapter 3.1)
J.R.	25.11.24	date, signature	G.M.Rakhimzhanova (Chapter 3.1)
L.R.	25.11.24	date, signature	A.N. Zhildikbayeva (Chapter 3.1)
J.R.	25.11.24	date, signature	A.Kudaibergenova (Chapter 3.1)
J.R.	25.11.24	date, signature	Zh.K.Karymsakova (Chapter 3.1)
J.R.	25.11.24	date, signature	A.B. Zhambulatova (Chapter 3.1)
L.R.- group Leader	25.11.24	date, signature	S.O.Topayev (Chapter 2.4)
J.R.	25.11.24	date, signature	A.Zh.Zhabayev (Chapter 2.4)
J.R.	25.11.24	date, signature	Y.B.Ussalinov (Chapter 2.4)
J.R.	25.11.24	date, signature	D.R.Yelubayev (Chapter 2.4)
J.R.	25.11.24	date, signature	Zh.B.Teleubay (Chapter 2.4)

J.R.	25.11.24 date, signature	Zh.Zh.Ainakulov (Chapter 2.4)
J.R.	25.11.24 date, signature	B.K.Saginbekov (Chapter 2.4)
L.R.- group Leader	25.11.24 date, signature	L.B.Kenespayeva (Chapter 3.2.)
L.R.	25.11.24 date, signature	G.B.Aidarkhanova (Chapter 3.2.)
J.R.	25.11.24 date, signature	D.A.Tazhiyeva (Chapter 3.2.)
J.R.	25.11.24 date, signature	G.K.Kairanbayeva (Chapter 3.2.)
J.R.	25.11.24 date, signature	G.B.Aubakirova (Chapter 3.2.)
Normocontroller	25.11.24 date, signature	G.A.Akhmetkanova

РЕФЕРАТ

Отчет состоит из 332 страниц, 35 рисунков, 42 таблиц, 111 источников, 10 приложений.

ПРИРОДНО-ХОЗЯЙСТВЕННОЕ ОБУСТРОЙСТВО, СЕВЕРО-КАЗАХСТАНСКАЯ ОБЛАСТЬ, ТЕРРИТОРИАЛЬНОЕ ПЛАНИРОВАНИЕ, ЗЕМЕЛЬНЫЕ РЕСУРСЫ, ИЗМЕНЕНИЕ КЛИМАТА, ВОДНЫЕ РЕСУРСЫ, СОЦИАЛЬНО-ЭКОНОМИЧЕСКИЕ ПОКАЗАТЕЛИ, БАЗА ГЕОДАННЫХ, ДИСТАНЦИОННОЕ ЗОНДИРОВАНИЕ, ГИС СИСТЕМА, ВЕГЕТАЦИОННЫЕ ИНДЕКСЫ, МОНИТОРИНГ, АЛГОРИТМЫ ОБРАБОТКИ.

Объект исследования: Северо-Казахстанская область

Цель проекта: Разработать концепцию природно-хозяйственного обустройства территории Северо-Казахстанской области в контексте устойчивого развития

Методы исследования: Методы сбора первичной (исходной) информации. Информационной базой исследования послужат кратографические материалы, разработанные подведомственными предприятиями Комитета по управлению земельными ресурсами, Комитета геодезии и картографии, Комитета водного хозяйства, Министерства экологии, геологии и природных ресурсов, официальные данные Бюро национальной статистики Агентства по стратегическому планированию и реформам МНЭ РК, департамент статистики Северо-Казахстанской области. Для сбора данных будут применены технологии дистанционного зондирования Земли с различными инструментами наблюдения на метеорологических станциях, которые предоставляют данные о температуре, осадках и других климатических параметрах. Сбор проб воды и почвы для лабораторного анализа позволяет определить их химический и физический состав. Проведение полевых исследований для сбора данных о растительном покрове включает использование дронов и спутниковых снимков для оценки состояния и динамики растительности.

Источники данных будут включать спутниковые системы Sentinel (ESA) и Landsat (NASA/USGS) для получения мультиспектральных и тепловых снимков, метеорологические станции для климатических данных, гидрологические и гидрогеологические исследования для информации о водных ресурсах, и геологические карты для данных о почвах. Для обработки данных будут использованы информационно-аналитическая система «Талдау» и программы обработки пространственных данных ArcGIS Desktop Advanced, QGIS, PostGIS. Для обеспечения достоверности и воспроизводимости первичной информации в составе команды исследователей

предусматривается должность менеджера по качеству, в обязанности которого будет входить разработка и внедрение системы обеспечения качества научных исследований.

Полученные результаты и новизна: Составлен обзор мировой научной литературы за последние не менее 5 лет с указанием мировых практик разработки концептуальных основ обустройства территории.

Разработана структура базы геоданных проекта, в ArcGIS Pro. Она предусматривает размещение собранных тематических данных по природно-климатическим, земельным, водным ресурсам, социально-экономическому развитию, трудовым ресурсам, транспорту и инфраструктуре, свод которых составит базу пространственных данных для подготовки тематических карт, характеризующих обустройство территории Северо-Казахстанской области. Структура базы геоданных предусматривает использование космических снимков разновременных спутниковых систем: Landsat 8 (7,4-5) (30 м), которые уже скачаны и помещены в базу данных за последние 20 лет. В дальнейщем предусмотрено также размещение и использование спутниковых данных Sentinel - 1/2 (10м) (20м), MODIS (250 м), и др., набор расчетных индексов, данных локальных маршрутных обследований и съемок БПЛА.

Разработан веб-сайт, на котором указаны краткая информация о программе: актуальность, цель, ожидаемые и достигнутые результаты, имена и фамилии членов исследовательской группы с их идентификаторами и ссылками на соответствующие профили, список публикаций (со ссылками на них) и патентов, информация для потенциальных пользователей, а также другая информация.

Научная новизна исследований состоит в сочетании разных типов входной информации в пространственно-временном формате и способов ее обработки в рамках использования единой геоинформационной базы данных, разработки методик их анализа и оценочных многофакторных критериев, создания оригинального математического аппарата с применением инструментов ИИ.

Область применения результатов: Акиматы области и районов СКО, Министерства национальной экономики, науки и высшего образования Республики Казахстан, республиканские и местные органы управления, НИИ и вузы, руководители аграрного сектора различного уровня, землепользователи, страховые компании, банковские структуры.

ABSTRACT

The report consists of 332 pages, 35 figures, 42 tables, 111 sources, 10 appendices.

NATURAL AND ECONOMIC DEVELOPMENT, NORTH KAZAKHSTAN REGION, TERRITORIAL PLANNING, LAND RESOURCES, CLIMATE CHANGE, WATER RESOURCES, SOCIO-ECONOMIC INDICATORS, GEODATABASE, REMOTE SENSING, GIS SYSTEM, VEGETATION INDICES, MONITORING, PROCESSING ALGORITHMS.

Object of research: North Kazakhstan region

Project goal: To develop a concept of natural and economic development of the territory of the North Kazakhstan region in the context of sustainable development

Research methods: Methods of collecting primary (initial) information. The information base of the study will be cratographic materials developed by the subordinate enterprises of the Committee on Land Resources Management, the Committee of Geodesy and Cartography, the Committee of Water Resources, the Ministry of Ecology, Geology and Natural Resources, official data of the Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Ministry of National Economy of the Republic of Kazakhstan, the Department of Statistics of the North Kazakhstan region. Remote sensing technologies will be used to collect data, with various observation instruments at meteorological stations that provide data on temperature, precipitation and other climatic parameters. Collecting water and soil samples for laboratory analysis allows you to determine their chemical and physical composition. Conducting field surveys to collect vegetation cover data includes the use of drones and satellite imagery to assess vegetation status and dynamics.

Data sources will include ESA's Sentinel and NASA/USGS' Landsat satellite systems for multispectral and thermal imagery, weather stations for climate data, hydrological and hydrogeological surveys for water resource information, and geological maps for soil data. For data processing, the Taldau information and analytical system and ArcGIS Desktop Advanced, QGIS, PostGIS spatial data processing programs will be used. To ensure the reliability and reproducibility of primary information, the team of researchers will have the position of a quality manager, whose responsibilities will include the development and implementation of a quality assurance system for scientific research.

Results and novelty: A review of the world scientific literature for the past at least 5 years has been compiled with an indication of world practices for the development of conceptual foundations for the development of the territory.

The structure of the project's geodatabase has been developed in ArcGIS Pro. It provides for the placement of the collected thematic data on natural and climatic, land, water resources,

socio-economic development, labor resources, transport and infrastructure, the collection of which will form a spatial database for the preparation of thematic maps characterizing the development of the territory of the North Kazakhstan region. The structure of the geodatabase provides for the use of satellite images of different times: Landsat 8 (7.4-5) (30 m), which have already been downloaded and placed in the database over the past 20 years. In the future, it is also planned to place and use satellite data Sentinel - 1/2 (10 m) (20 m), MODIS (250 m), etc., a set of calculated indices, data from local route surveys and UAV surveys.

A website has been developed that provides brief information about the programme: relevance, purpose, expected and achieved results, names of the members of the study group with their identifiers and links to relevant profiles, a list of publications (with links to them) and patents, information for potential users, as well as other information.

The scientific novelty of the research lies in the combination of different types of input information in the spatio-temporal format and methods of its processing within the framework of the use of a single geoinformation database, the development of methods for their analysis and evaluation multifactor criteria, the creation of an original mathematical apparatus using AI tools.

Scope of the results: Akimats of the region and districts of the North Kazakhstan region, the Ministry of National Economy, Science and Higher Education of the Republic of Kazakhstan, republican and local authorities, research institutes and universities, heads of the agricultural sector of various levels, land users, insurance companies, banking structures.

CONTENT

LIST OF ABBREVIATIONS AND DESIGNATIONS ……..…… 12

INTRODUCTION ……..……..……..…… 13

MAIN PART OF THE RESEARCH REPORT …….……. 16

1 Theoretical foundations of territorial planning of the region …… 16

1.1 The system of state territorial planning in Kazakhstan..... 16

1.2 Review of world practices and conceptual foundations of territorial planning for sustainable development of the region..... 25

2 Natural and climatic resources of the North Kazakhstan region..... 36

2.1 Climatic characteristics of the region..... 36

2.2 Land Resource Potential and Biodiversity of the Territory……..... 45

2.3 Water resources of the region..... 67

2.4 Data collection for scaling up the technology of territory development and the development of irrigated agriculture using melt water..... 89

2.5 Ecological state of the natural environment..... 95

3 Socio-economic indicators of the development of the North Kazakhstan region..... 104

3.1 Theoretical foundations of sustainable development and data collection on socio-economic indicators of the region …… 104

3.2 Information Database and Methodological Bases for Assessment of Labor Resources of the North Kazakhstan Region ……. 115

3.3 Characteristics of transport and communications of the region..... 120

4 Development of the structure of the geoinformation database of the project..... 176

5 Development of the project website..... 190

CONCLUSION..... 195

REFERENCES..... 199

APPLICATION..... 211

APPENDIX A - Average air temperature (ºC) according to meteorological stations of the North Kazakhstan region …… 211

APPENDIX B - Amount of precipitation (mm) according to meteorological stations of the North Kazakhstan region ……..…… 222

APPENDIX C - Snow depth (cm) according to meteorological stations of the North Kazakhstan region ……...…… 233

APPENDIX G - Wind speed (m/s) according to meteorological stations of the North Kazakhstan region ……..……. 244
APPENDIX D - Reserves of productive moisture (mm) in soil layers 0-20, 0-50 and 0-100 cm according to the data of meteorological stations of the North Kazakhstan region 255
APPENDIX E - Socio-economic indicators of economic development of the North Kazakhstan region for 2004-2010 ……. 261
APPENDIX J - Socio-economic indicators of economic development of the North Kazakhstan region for 2011-2015 …….……. 269
APPENDIX I - Socio-economic indicators of the development of the economy of the North Kazakhstan region for 2016-2020 ……. 276
APPENDIX K - Socio-economic indicators of the development of the economy of the North Kazakhstan region for 2021-2023 ……. 283
APPENDIX L - Population of the North Kazakhstan region …….. 288
APPENDIX M – The project's calendar plan in russian and English…….. 314

LIST OF ABBREVIATIONS AND DESIGNATIONS

In this report on SRW, the following abbreviations and designations are used:

GIS is a geographic information system that provides collection, storage, processing, access, display and dissemination of spatial data

RSE - Remote sensing of the Earth

RSD – Remote sensing data

NDVI –normalized difference vegetation index

GDB – Geodatabase

CCHU MNE RK - Committee for Construction, Housing and Utilities of the Ministry of National Economy of the Republic of Kazakhstan

UNECE - United Nations Economic Commission for Europe

NBLR – normal backwater level of the reservoir

WMC MWRI RK - Water Management Committee of the Ministry of Water Resources and Irrigation of the Republic of Kazakhstan

INTRODUCTION

This report is an interim review of the research work on the construction of a decision support system for the natural and economic development of the territory of the North Kazakhstan region (NKR). The work is carried out within the framework of program-targeted financing for 2024-2026, on the basis of the contract No398/PCF 24-26 dated 01.10.2024 concluded with the Committee of Science of the Ministry of Science and Higher Education of the Republic of Kazakhstan, in accordance with the decision of the NSC on the priority area of development of scientific, scientific and technical activities "Ecology, Environment and Rational Nature Management" (Extract No18 to the Minutes of the meeting No5 dated August 28, 2024).

The relevance of the study is due to the need for rational use of natural resources and ensuring the sustainable development of the region. In the context of a changing climate and increasing anthropogenic loads, the development of an effective spatial and landscape arrangement is becoming critically important for the balanced development of the territory. The use of a decision support system for this purpose allows you to integrate data from various sources and conduct a comprehensive analysis of the territory, optimally allocate resources (land, water, labor resources, etc.), make informed decisions on land use, infrastructure development, and environmental protection.

The purpose of the study is to develop a concept of natural and economic development of the territory of the North Kazakhstan region in the context of sustainable development, which will allow management bodies and stakeholders to make informed decisions on the issues of natural and economic development of the territory, taking into account natural and climatic, environmental, social and economic factors. Also, the results of the study will be aimed at solving the problem of floods, from which the region was severely affected in 2024.

The study includes three interrelated stages.

The first stage (2024): analysis of world experience in the field of natural and economic development and collection of data on the current state of the North Kazakhstan region.

The second stage (2025): assessment of the state of the region and the development of several options for spatial planning and arrangement of the territory.

The third stage (2026): comparative analysis of options, selection of the most effective and development of a set of measures for sustainable development and arrangement of the territory of the North Kazakhstan region.

Thus, the following research objectives have been identified for 2024:

- review of the best world practices for the development of conceptual foundations for the development of the North Kazakhstan region on the principles of sustainable growth;

- collection of data on the state of natural and climatic conditions, land and resource potential of the North Kazakhstan region, socio-economic indicators of the region's development;

- compilation of a spatial database, where the collected materials and data will be concentrated;

- Creation of a project website to provide access to information and research results.

To solve the tasks, it is planned to use modern research methods: remote sensing data using spacecraft for large-scale sensing of the territory and UAVs for local surveys, route surveys, data processing using AI algorithms, a demographic approach to the analysis of labor resources, scientific and technological forecasting to ensure the sustainable development of the region.

The 2024 (Phase I) report contains the following research findings. The first chapter examines the theoretical foundations of territorial planning, analyzes the system of state planning in Kazakhstan and abroad. The second chapter is devoted to an overview of the natural and climatic resources of the North Kazakhstan region, including climatic characteristics, land resource potential, biodiversity and water resources. The third chapter will present the level of socio-economic indicators of the region's development. The fourth and fifth chapters are devoted to the development of a geographic information database and the creation of the project website. In conclusion, the results of the work are summarized and the prospects for further research are outlined.

The scientific significance of the research is as follows. The analysis of world experience and existing systems of territorial planning allows us to develop a scientifically based conceptual framework for the development of the territory of the North Kazakhstan region. The collected data allows you to get a complete picture of the natural, climatic and socio-economic conditions of the region and identify potential risks to sustainable development. The developed geoinformation database will provide storage and processing of spatial data. The created program website provides access to information about the program, its goals, objectives and results. This contributes to increasing the transparency of the study and attracting public attention to the problems of sustainable development of the region.

The scientific novelty of the research lies in the combination (complexation) of different types of input information in the spatiotemporal format (Spatiotemporal) and methods of its processing within the framework of the use of a single geoinformation database, the development of methods for their analysis and evaluation multifactor criteria, the creation of an original mathematical apparatus using AI tools.

Scope of application: Akimats of the region and districts of the North Kazakhstan region, the Ministry of National Economy, Science and Higher Education of the Republic of Kazakhstan,

republican and local authorities, research institutes and universities, heads of the agricultural sector of various levels, land users, insurance companies, banking structures.

MAIN PART ABOUT RESEARCH WORK

1 Theoretical foundations of territorial planning of the region

1.1 The system of state territorial planning in Kazakhstan

The development of territorial planning and forecasting has always been an urgent problem. Problems related to the spatial use of land resources lie in the search for ways of future use of land due to the presence of such conditions as limited territory, the absence of other new undiscovered lands, the emergence of new proposals for improving land use, and the growth of demand for land. Contradictions of the problem of the use of the land fund in general lie in the contradiction between man and nature. This is due to the fact that the Earth is a limited body of nature, society's need for the resource of the earth, which is growing day by day, as well as the source of the development of society and human life. Contradictions inexorably promote many unknown trends. The revealed contradictions should and can be the beginning of the basis for decision-making. At the same time, the main contradictions may lie in the use of the future strategy. The capabilities of society determine the economic strategy of spatial use and the needs of society for land resources. These contradictions are based on the rational use of land, proper land planning.

Planning - optimal allocation of resources to achieve goals; activity (a set of processes) related to the setting of goals (tasks) and actions in the future. From the point of view of mathematics, planning is a function, one of the arguments of which is time [1].

Planning at all taxonomic levels at the micro-, meso- and micro-territorial levels implies the factor of territorial development. The concept of "territory" is directly related to the concepts of "location" and "space". The concept of "location" is becoming increasingly important as competitiveness. This term "placement" takes meaning as a result of an action, a decision made. The term "space" is implied to be broader in content than territory. It includes not only territory, but also airspace. But it is not usually used in determining the prospects for the development of material objects in the socio-economic or economic sense. The combination of the concepts of "territorial development" involves the transformation of the territory. Development is understood as a change in the economy and social conditions of the population towards improvement. It is characterized by a system of various indicators. Planning is aimed at determining the prospects for development [2].

The studies study the works of many Kazakhstan and foreign authors in the field of rational use of land resources, territorial planning and management of land relations. For example, in the works of Professor Zh. K. Krykbayev on the development of land relations, the history of land management, which is relevant in Kazakhstan, is described in detail. Professor V.V. Garkushina

in her research writes about the planning of territories as a lever of real estate management. Academician M. D. Spektor in his publications describes the importance of planning and planning separately, composes in detail the elements of territorial planning as a separate type of land policy, in his own way, on the basis of his visions, divides the stages of development of territorial planning in the Republic of Kazakhstan and the CIS. Foreign scientists O.V. Tarakanov considers territorial planning as the basis for managing the development of territories. M. Burinskine, O.S. Petrakovskaya studied the legal support of territorial planning.

Modern system of administrative-territorial structure of the Republic of Kazakhstan. The system of administrative-territorial structure of the Republic of Kazakhstan includes administrative-territorial units: village, settlement, rural district, district in a city, city, district, region [3].

For the implementation of public administration on the basis of an optimal combination of republican and local interests, the territory of the Republic of Kazakhstan is divided into two main categories - regions and settlements. A region is a part of the territory of the Republic of Kazakhstan, including several settlements, formed and managed in the interests of the Republic of Kazakhstan as indicated in Table 1.

Table 1 - Characteristics of the administrative-territorial structure of the Republic of Kazakhstan

Administrative-territorial structures	Components	The total population is not less than
Region	Region, District and Rural District	-
District	Cities of district significance, villages, settlements, rural districts	-
Region	Cities of regional significance and districts	300 thousand
Rural district	two or more rural settlements	500 people

Inhabited locality is a part of the compactly populated territory of the Republic of Kazakhstan, formed as a result of economic and other public activities of citizens, with a population of at least 50 people, recorded and registered in accordance with the procedure established by the laws of the Republic of Kazakhstan, managed by local representative and executive bodies. Peasant and other settlements with a population of less than 50 people shall be included in the composition of the nearest inhabited locality.

Inhabited localities located on the territory of the Republic of Kazakhstan are divided into urban and rural:

1) urban inhabited localities include cities of republican, oblast and district significance, as well as settlements located on the territory of their administrative subordination;

2) Rural settlements include all other settlements regardless of their administrative subordination.

5. Settlements have component parts.

The components of settlements are microdistricts, districts in the city, squares, avenues, boulevards, streets, alleys, parks, squares, bridges and other parts. The population of the district in the city should be at least 200 thousand people [3]. The categories of settlements are shown in Table 2.

Table 2 - Categories of settlements

Definitions	Cities of Republican Significance	Cities of regional significance	Cities of district significance	Villages	Village
Status	of special national importance	large economic and cultural centers with a developed industrial and social infrastructure	There are industrial enterprises, public utilities, state housing stock, a developed network of educational and health care organizations, cultural, educational and commercial facilities on the territory	Settlements	Settlements
Population	more than one million people	more than 50 thousand people	at least 10 thousand people	at least 3 thousand people.	at least 50 people

The territorial division of the country into administrative units was formed over a long period of time and is explained by the influence of natural, political, economic, ethnic, national and other factors. The territory of the country is divided into 17 regions, 3 cities of republican significance, 188 administrative districts. In Kazakhstan, there are 89 cities, 29 townships and rural districts - 2,177, villages - 6,295 [4].

The content of issues developed in territorial planning schemes and projects includes the following:

- Analysis of the territory and potential of resource and urban development of the regional economy;
- Zoning of the territory and development of regulations for urban planning regulation;
- Combining the interests of industrial development, agricultural and environmental activities to ensure the sustainable development of the territory;
- Determination of the forecast and directions for the development of the territory;
- Rational use of natural potential and environmental protection;
- Substantiation of options for the development of the territory;
- Improving the development of social infrastructure;
- Development and reconstruction of infrastructure (transport, engineering, production).

The main urban planning document of the country is the General Scheme of the organization of the country's territory. In order to ensure state regulation of the system of settlement and distribution of productive forces, to establish the status, purpose and nature of the use of territories, taking into account the administrative-territorial structure of the Republic of Kazakhstan, to coordinate interregional and intersectoral state interests under programs of socio-economic and economic development through the implementation of architectural, urban planning and construction activities, the General Scheme of the Republic of Kazakhstan.

Comprehensive development of the General Scheme shall be provided by the authorized body with the participation of interested state bodies of the Republic of Kazakhstan. The General Scheme is being developed on the basis of the Development Strategy of Kazakhstan until 2050, legislation in the field of architectural, urban planning and construction activities, ecology, strategic planning, as well as taking into account integration processes, programs of territorial and socio-economic development of neighboring states and world trends.

The General Plan considers internal and external factors affecting the future organization of the territory of the Republic of Kazakhstan, the criteria for analysis, assessment of the territory and determines the list of measures necessary to ensure the sustainable development of settlements and inter-settlement territories in order to create a favorable living environment for the population of the country.

The general scheme includes:

1) the basic principles of resettlement and distribution of productive forces in accordance with the provisions of strategic and economic planning;

2) the main provisions of rational nature management and economic activity, the development of transport, engineering, social and recreational infrastructure of republican significance;

3) the main measures to improve the environmental situation in the regions, preserve territories with objects of historical and cultural heritage and (or) protected landscape objects;

4) types of use or restrictions on the use of specially protected areas, areas of occurrence of minerals exposed to the impact of dangerous (harmful) phenomena and processes of a natural and man-made nature or extreme natural and climatic conditions for the implementation of architectural and urban planning activities.

The main provisions of the General Plan are used in determining the strategic directions of the country's development, selecting investment projects for the industrialization map. According to the legislation, in accordance with the General Scheme, Interregional schemes of macroregions and agglomerations are developed. At the local level, master plans of cities and comprehensive schemes of regions are developed. At each level of design, its own issues are solved based on the

scale of the territory and the designated tasks of the document. This is how a single interconnected system of urban planning is formed. For the implementation of a unified urban planning policy of rational organization of the territory in the country, the projects being developed must comply with the documents higher in the hierarchy. According to the hierarchy of urban planning projects, each level of design solves its own issues based on the scale of the territory and the designated tasks of the document. Today, in order to solve the strategic problems of territorial planning and the effective use of the territory, a single interconnected system of urban planning is being formed through the development of urban planning documents of republican significance based on the data of the state urban planning cadastre [4,5].

The General Scheme of Organization of the Territory of the Republic of Kazakhstan is the main town-planning document for making management decisions for the development of the country's territory, including the development of production, population settlement, infrastructure, and environmental protection for a long-term period. The main provisions of the General Plan are used in determining the strategic directions of the country's development within the framework of territorial development, urban development projects of the lower level. The main provisions of the General Scheme were approved by the Decree of the Government of the Republic of Kazakhstan dated December 30, 2013 No 1434 in accordance with subparagraph 3 of Article 19 of the Law of the Republic of Kazakhstan "On Architectural, Urban Planning and Construction Activities in the Republic of Kazakhstan", as part of the implementation of the Forecast Scheme of Territorial and Spatial Development of the Country until 2020 as specified in Scheme 1.

In 2017, the adjustment of the Main Provisions of the General Scheme was completed taking into account the Strategy "Kazakhstan – 2050". In accordance with the Decree of the Government of the Republic of Kazakhstan dated January 27, 2016 No. 32 "On Approval of the Rules for Including Projects in the Industrialization Map and the Regional Entrepreneurship Support Map", the selection of investment projects for inclusion in the republican and regional Industrialization Maps is carried out taking into account the General Scheme (Figure 1). In accordance with the order of the Committee for Housing and Communal Services of the Ministry of National Economy dated June 21, 2016 No6-НҚ, the project has passed a comprehensive urban planning examination (Conclusion dated September 2, 2016). The project was approved by the Decree of the Government of the Republic of Kazakhstan dated May 12, 2017 for No 256 [4,5]

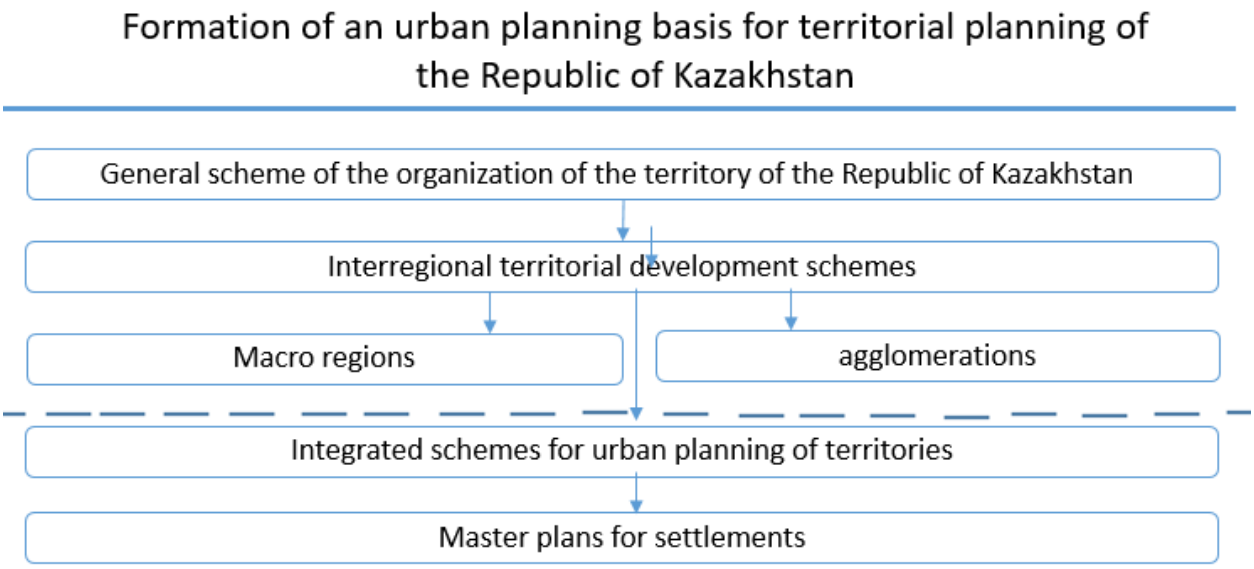


Figure 1 - Formation of the urban planning basis of territorial planning of the Republic of Kazakhstan.

.

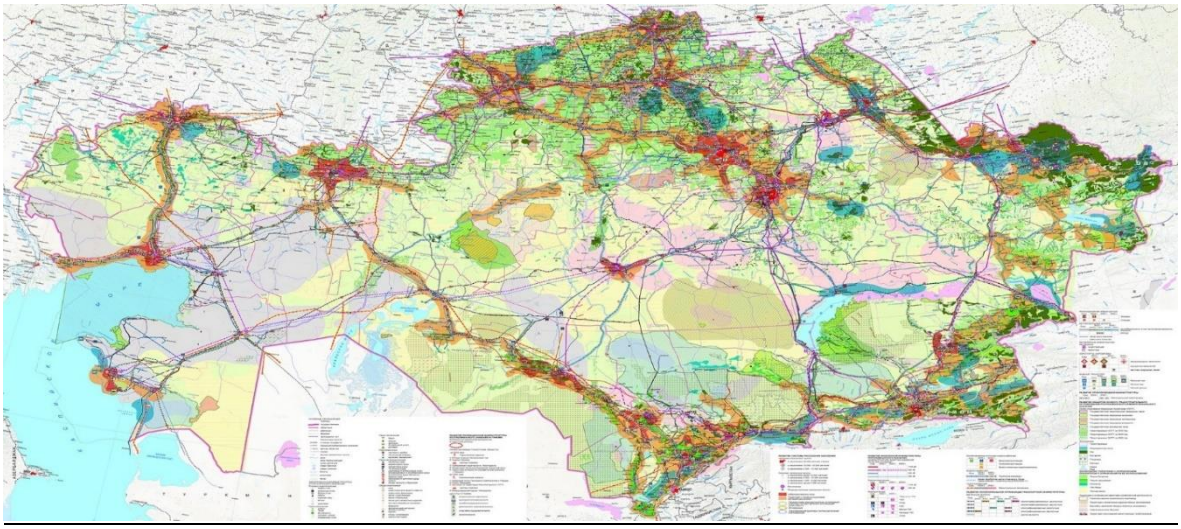


Figure 1 - General scheme of the organization of the territories of the Republic of Kazakhstan

Macroregions. Detailing of the design solutions of the General Scheme is carried out within the framework of the Interregional Schemes of Territorial Development of Regions. Interregional schemes of territorial development of regions are developed in accordance with Article 43 of the Law of the Republic of Kazakhstan "On Architectural, Urban Planning and Construction Activities in the Republic of Kazakhstan" for mutually agreed (consolidated) architectural, urban planning and construction activities in the territories of two or more regions (or parts thereof), as well as socio-economic or environmental regions without taking into account the boundaries of administrative-territorial units. Interregional schemes contain design solutions for improving the organization of the territory of macro-regions, taking into account the general economic

specialization, characteristics and the need to build interregional cooperation between the regions. The development of macro-regions is an urgent issue identified by the Head of State, in the context of the need to build interregional cooperation of macro-regions, develop production and population settlement systems, and determine the long-term need for infrastructure.

At present, the country has developed the practice of planning the socio-economic development of the territory within individual regions, which does not ensure the full use of the available resource potential, as well as the proper effect of solving the tasks. In order to deepen production ties between regions, create conditions for the integration of their resources and the formation of an interconnected engineering and transport infrastructure, the placement of productive forces and the settlement of the population, there is a need to move to a consolidated consideration of development plans for several areas with similar economic specialization and characteristics [4,5].

As part of the design work, the country's territory was divided into three macro-regions: Central, Southern, Western macro-regions. The unification of regions into these regions is due to similar regional specialization, economic ties and the presence of developing agglomerations in a particular region. In accordance with the order of the KDSZHKH MNE dated April 10, 2017 No23-NK, the project has passed a comprehensive urban planning examination. The draft has been approved by the interested state bodies, the National Chamber of Entrepreneurs of the Republic of Kazakhstan and accredited associations of private business entities.

Territorial planning abroad. In accordance with Articles 9, 10, 14, 18, 19 of the Urban Planning Code of the Russian Federation (RF), territorial planning is aimed at determining in territorial planning documents the purpose of territories based on a combination of social, economic, environmental and other factors, in order to ensure the sustainable development of territories, the development of engineering, transport and social infrastructure, and ensuring that the interests of citizens and their associations are taken into account. Territorial planning documents are mandatory for state authorities, local self-government bodies when they make decisions and implement such decisions. Territorial planning documents of the constituent entities of the Russian Federation and territorial planning documents of municipalities should not contradict the approved territorial planning documents of the Russian Federation, from the date of approval (Figure 2) [6,7].

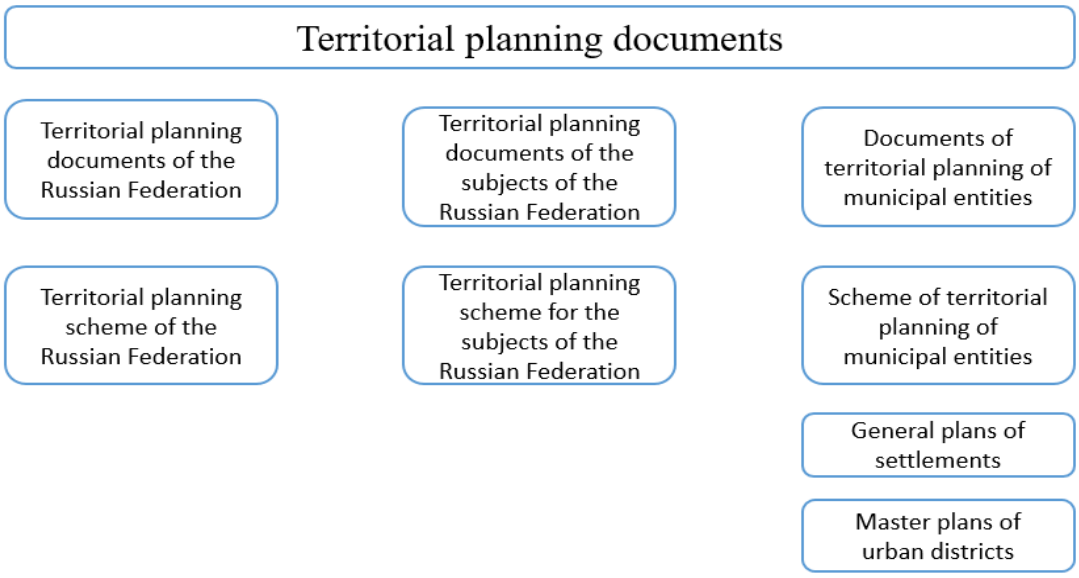


Figure 2 - Territorial planning documents of the Russian Federation

- In both Lithuania and Ukraine, the main tasks of spatial planning at the national level are:
- priorities and conceptual decisions regarding the planning and use of the country's territory as a whole;
- Improving settlement systems and ensuring sustainable development of human settlements,
- maintaining a balance in the social, economic and environmental development of the state territory;
- optimization of the existing social, transport and engineering infrastructure and the development of strategies for optimizing their development;
- rational use, protection and restoration of natural resources and cultural heritage, including recreational resources;
- coordination of public interests and the interests of individuals and legal entities related to the conditions for the use of the territory and land plots;
- ensuring the investment attractiveness of the territories.

In Ukraine, at the regional level, there are both mandatory plans and those that are developed by decision of the Cabinet of Ministers of Ukraine. Such plans are developed for territories of particular value on a national scale: border areas; the coasts of the Black and Azov Seas; mountainous territories of the Carpathians; territories that have been subjected to radioactive contamination as a result of the Chernobyl disaster and other territories with an increased man-made load or risk of emergencies. Planning schemes for the territories of regions and districts are mandatory. Their tasks are to ensure the development of territories for state purposes, taking into

account the needs of the regions and local natural, climatic, socio-demographic, economic, environmental and urban conditions. These schemes are the primary basis for the development of a system of strategic documents for the implementation of regional policy. They contain fundamental decisions regarding the predominant functional use of territories and their planning organization; integrated placement of the main objects of industry, transport and engineering infrastructure; protection of settlements from dangerous geological and hydrogeological processes; protection of the environment and cultural heritage [6,7]. Such detailing of individual parts of the country's territory is also possible in Lithuania, if it is necessary to develop plans for specific territories. It is important to note that in Ukraine there is a mandatory comprehensive state examination of urban planning documentation at the national and regional levels. In Lithuania, plans of this scale are not subject to examination. Until the end of 2013, there were three types of territorial planning in the Lithuanian territorial planning system: general; special and detailed. Since January 2014, general and detailed planning have been classified as comprehensive. In Ukraine, there is no official recognition of such types of planning, but all regulations determine the obligation of an integrated approach to planning the use of territories. The most significant changes in spatial planning in both countries have occurred at the local level. Differences in the structure of planning documentation at the local level can be explained by the size of the country's population and the structure of settlements. The obligation to develop master plans (GP) in both countries is established at the legislative level and includes an analytical and forecasting component. At the same time, the analytical component is the basis for making adequate decisions on the forecast development of cities. In both countries, before the development of SOEs, their concept is considered, and in Lithuania, a strategic assessment of the impact of master plan decisions on the environment is carried out at this stage [8].

In conclusion, it should be noted that in Kazakhstan, the goals and objectives of territorial planning are regulated by law, as in most EU countries, in Ukraine, and in Russia. Most legal regulations are supplemented by building codes and regulations.

The difference in the structure and goals of territorial planning documentation is due to the administrative-territorial structure of the countries, the scale, as well as the functional zoning of settlements.

The only similarity in urban planning of these countries can be considered:

- long-term validity of the general scheme, with the right to adjust at any stage;

- open access to familiarization with the General Plan, the General Plan of cities and districts, holding offline, online meetings with the population during the development of the Master Plan.

By studying the history of territorial planning in Kazakhstan and the basics of extensive planning abroad, it is possible to identify the factors that affect the development of land management. By studying these factors, we can determine how effective the methods, programs and schemes for territorial planning are in our country.

1.2 Review of world practices and conceptual foundations of territorial planning for sustainable development of the region

Spatial planning is related to "the problem of coordinating or integrating the spatial dimension of sectoral policies through a strategy based on the territorial principle". More complex than simple land-use regulation, it addresses inconsistencies and contradictions in sectoral policies, such as conflicts between economic development policies, environmental policies and social cohesion policies. The main objective of spatial planning is to ensure a more rational organization of activities and to reconcile conflicting policy objectives. The scope of spatial planning varies from country to country, but there are a number of commonalities in most countries. In almost all countries, spatial planning is associated with the identification of long-term and medium-term goals and strategies for territories, with land use and physical development as a specific area of government activity, as well as with policy coordination in sectors such as transport, agriculture and the environment [9].

There are different definitions of spatial planning. For example, the Compendium of European Spatial Planning defines spatial planning as methods widely used by the public sector to influence the future distribution of landscaping and land-use design.

The Compendium states that spatial planning is carried out with a view to improving the spatial organization of land use and the interlinkages between its various forms, balancing development needs with the need to protect the environment and achieving social and economic development goals. It includes measures to coordinate the effects of spatial development policies in other sectors to achieve a more equitable distribution of economic development among regions that would otherwise be subject to market forces, and to regulate the conversion of different uses of land and property. In the United Kingdom, the Government defines spatial planning as a process that goes beyond mere land-use planning, which links land development and use policies with other policies and programmes that affect both the nature and function of the territory. This includes policies that may affect land use, but which cannot be implemented solely or mainly through the granting or denial of building permits. In Slovenia, spatial planning has been described in the Law on Spatial Planning as an interdisciplinary activity involving planned land use, setting the conditions for the development and localization of various activities, identifying measures to

improve existing physical structures, and defining the conditions for the spatial location and creation of planned physical structures [10,11].

Spatial planning is essential to ensure economic, social and environmental benefits by creating a more stable and predictable environment for investment and development, guaranteeing development benefits to local communities, and promoting the wise use of land and natural resources for development, as shown in figure 2. Spatial planning is thus an important tool for sustainable development and improving the quality of life. This is increasingly recognized in international policy documents. The growing commitment to sustainable development in many countries and the growing interest in spatial planning systems and policies mean that there is now a good opportunity to adjust and strengthen spatial planning systems in UNECE member countries. Some countries have already made progress in introducing new spatial planning systems, but there is considerable room for further progress [9,10,11].

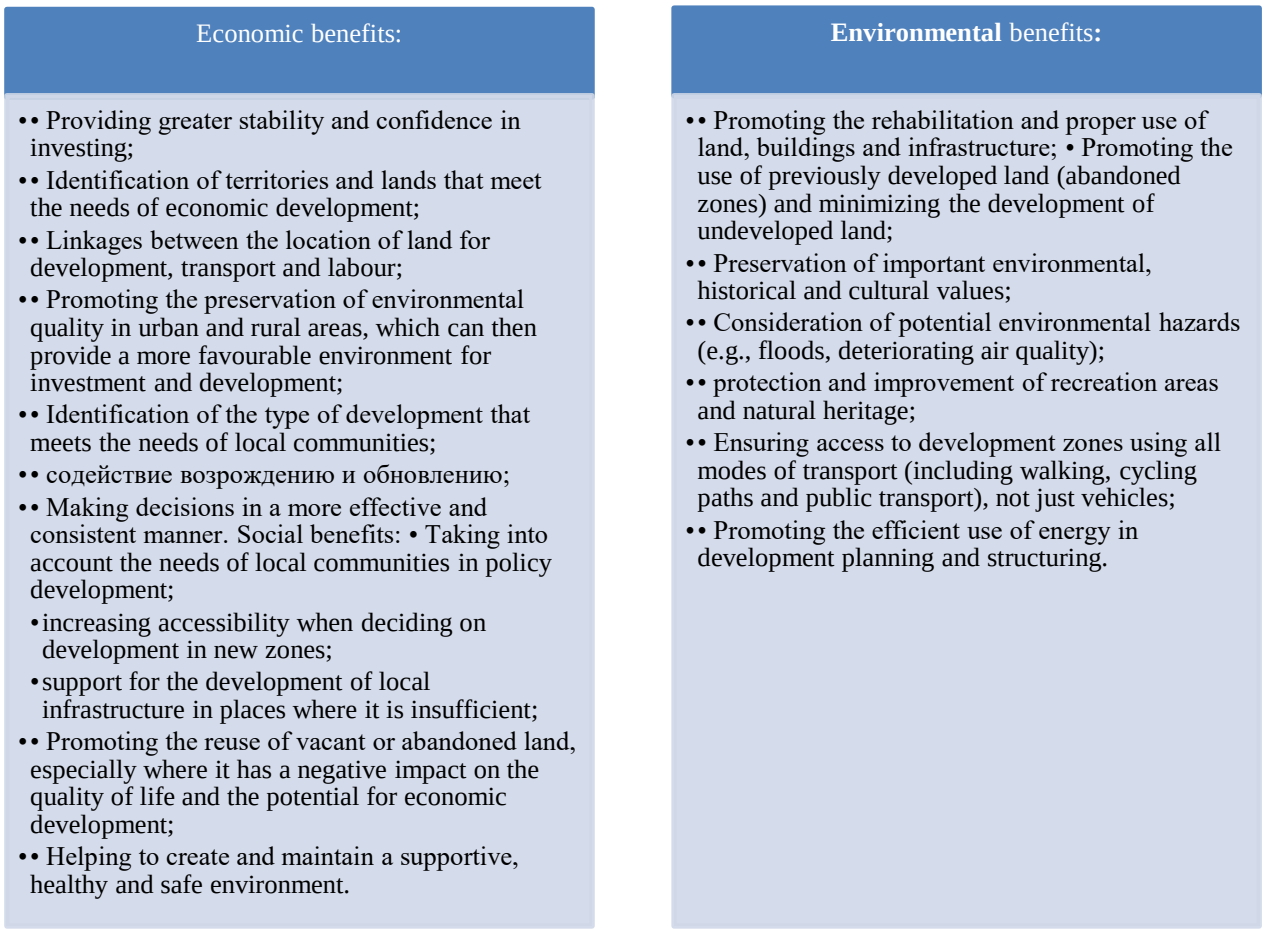


Figure 2 - Benefits of spatial planning [9]

Spatial planning plays a key role in providing a long-term development plan and coordinating cross-sectoral policies. It can provide a vision of the overall direction of policies and programmes and identify priorities, can help avoid duplication of efforts between different

departments and areas of government, and can facilitate policy coordination across sectors. Spatial planning can also promote economic growth and investment while implementing policies to protect the environment and use resources more efficiently. The eight paragraphs in Figure 3 below summarize the main reasons for the widespread use of spatial planning in most countries, and in particular in UNECE member countries with economies in transition [9,4].

Reasons for spatial planning
•1. Providing a shared vision and coherent course, as well as a strategic assessment not only of what is desirable, but also of what is possible in different contexts. •2. Protection of people's rights. By gaining access to land, people also receive certain rights and assume responsibilities. It is necessary that the changes that take place ensure that these rights and obligations are respected. •3. Protection of natural ecosystems. There are specific requirements for the use of natural ecological systems that must be met in order to achieve long-term development and to prevent or at least minimize large-scale environmental degradation. •4. Efficient use of resources. There is a shortage of resources such as land, water, energy, finance, building materials, skilled labor, etc. •5. To ensure the best quality of services provided by all areas of government. •6. Coordination of actions and investments to increase the efficiency of invested funds; the need for coordination of actions and investments in time and space. It is of two types: coordination of various forms of government and investment action, and coordination between the public and private sectors. •7. Identification of priorities. In order to achieve a significant breakthrough in effectively addressing a country's development needs, it is necessary to establish a rational framework for identifying priorities, managing resources and directing them to areas where they are most needed. •8. Avoiding duplication of efforts of various state bodies and areas of government.

Figure 3 - Reasons for the application of spatial planning [12]Figure 3 - Reasons for the application of spatial planning [12]

Most states have made attempts to "manage space", often opposing the established laws. In a number of countries, this led to inefficient spending and a return to corrective measures (the experience of Bolivia, Italy, and the USSR).

In the USSR, the directive distribution of industry and economic activity across the country led to industrial deconcentration, price distortions and supply crises, and as a result, to an increase in internal imbalances between regions.

An example of inefficient space management is the experience of Italy, when large annual injections of the "center" into the economy of the lagging southern regions were not supported by institutional and structural reforms. Ultimately, there was an outflow of the population from the south to the developed northern regions, which eventually led to greater fragmentation of regions and a distortion of economic incentives [13].

Of the foreign countries, landscape planning is most developed in European countries:

England, Germany, the Netherlands, Spain and France. The experience of European countries shows that with an effective organization and a developed scientific and methodological base, landscape planning plays a significant role in the implementation of environmental policy in the regions and at the local level [9].

England. The main tasks of landscape planning in England depend on each specific case. The main principle of this procedure is the protection of private property. Nature protection and landscape planning outside strictly protected areas are not a priority and play a secondary role. It should be noted that in England, protected areas occupy 20.4% of its territory. Landscape planning at the national level performs tasks or functions to control funding and legal disputes. The regional level plays a very weak role in landscape planning. At the local level, the tasks are divided between the districts that develop strategic plans and the municipalities that draw up special land use plans. In urbanized areas, there is no such division. Environmental planning is limited to the tasks of allocating protected areas. In the views of the British, landscape acts as a visual and aesthetic category. Therefore, landscape planning is often reduced to the formation of the appearance of the landscape and is not fixed in law.

The underdevelopment of state management of nature protection in British law and the strong position of private owners determine the conditions for the development of landscape planning in England. Landscape planning tasks are scattered across planning branches. The EU guidelines have a very strong influence on the actual steps in landscape planning in England [14].

Netherlands. Landscape planning in the Netherlands also does not have a deep tradition. This area is most advanced in the protection of sea coasts, which is one of the most urgent tasks for the Netherlands not only in the field of ecology, but above all in the field of economic policy and politics in general**.**

The tasks of landscape planning in the Netherlands are divided between three planning tools: spatial planning, environmentally oriented planning and water management. The connection between landscape planning and territorial planning is deeper here than in Germany. There is no integrated tool in landscape planning. At the same time, environmental planning in the Netherlands is clearly sectoral in nature. There are, for example, special planning for the protection of species and biotopes, and water management planning. Air and climate issues are addressed in environmental protection plans. The public in the Netherlands plays a very important role in the development of landscape planning schemes.

In the Netherlands, there are three levels of landscape planning: national, regional and local. All three levels within their competence perform integrating functions and provide procedures for coordinating planning proposals. The national level is provided by the state. Responsibility for national planning is divided among the three ministries. The national level

develops a strategy for the protection of species and biotopes, as well as the construction of a national network of biotopes. The National Territorial Planning Program is divided into four basic categories of development: "green deal" - environmental; the "yellow deal" is dedicated to intensive agriculture; The Blue Deal combines economic and environmental requirements, while the Brown Deal integrates agriculture and other development plans. Due to the fact that there is no law on nature protection in the Netherlands, there are no legal definitions of a national park in national conservation practice. The area of protected areas in the Netherlands is equal to 5.7% of the country's area. Therefore, landscape planning does not exist here as an independent tool of environmental policy.

The regional level carries out the development of nature protection plans and regional development plans. The advantage of the Netherlands over Germany is that there are more specific national and regional projects.

At the local level, there is a clear legal division of planning tasks within and outside settlements. However, landscape planning is often done in both types of areas. In general, in the Netherlands, the planning system includes all the main tasks of landscape planning and is often an integral part of spatial planning. One of the features of the Netherlands is the high degree of integration of environmental requirements into sectoral planning. In addition, there is a focus of planning on partnership and on resolving conflicts by reaching agreement at all levels. Environmental unions play an important role here.

The Netherlands is characterized by developed land planning, but there is no special program for the conservation of agricultural land. For land use planning in the Netherlands, a land allocation plan is approved at the local government level, which is not subject to change. In the Netherlands, the owner of a land plot intended for agricultural production is not entitled to transfer it from the category of agricultural land to another [15].

France. France, along with other countries, has its own specifics. The center is traditionally strong here. There is a division of powers between the centre, the regions and the communes, but the links between them are very weak. There is no developed system of landscape planning here. Projects are carried out on a case-by-case basis.

The national level (center) provides the formulation of general principles of territorial development. The regional level implements plans for the organization of the territory and development programs. At the commune level, "lead line plans" and land-use plans are being developed. In ecologically oriented planning, the principle of voluntariness is dominant. The center's decisions are stimulated by financial support.

The tasks of landscape planning in France are distributed among various tools. The description and assessment of the state of the environment is carried out by various environmental

programs and monitoring programs. On a national scale, an "ecological plan" is developed, which defines concepts in relation to individual components of nature. The main tasks of landscape protection are carried out by the planning of protected areas. Among them, national parks implement the tasks of landscape planning. The area of protected areas in France is 13.5% of its territory.

General state plans and plans of provincial corporations, which are designed to manage the development of the landscape, are considered as landscape plans. It should be noted that landscape is understood in France as a landscape and is perceived as an aesthetic category. Therefore, in planning, the task of improving the landscape is understood as improving the landscape environment. Landscape plans are developed as needed. One way or another, a landscape plan reaches the stage of implementation if it receives public recognition (practically acceptable) and reaches a compromise between the interested parties.

Land-use planning in France is carried out by identifying and allocating agricultural zones in the area where non-agricultural activities are prohibited. The country requires permission for a transaction on the transfer of rights to agricultural land, which ensures the preservation of their intended use, as well as protection from rationally unjustified changes in the maximum or minimum area of land, taking into account the priority of preserving "family farms" as a form of management on agricultural land [16].

Spain. In the Spanish planning system, the concept of landscape planning does not exist as a single system. Accordingly, there is no professional education. However, the tasks of landscape planning are largely performed by other tools. In general, there is a shift in views on the landscape not as an aesthetic category, but as a cultural and environmental value.

Spatial planning in Spain is divided into sectors and levels. Regions have the right of territorial planning in cities. The main tools are regional and subregional plans for the organization of the territory. However, there are difficulties between the center and the regions in coordinating plans and interests of territorial planning. According to the national environmental framework law, the task of the state is to develop the main lines of nature protection. This task has not yet been completed. Some regions are developing their own plans for territorial environmental development. The regions are responsible for planning the use of resources. The core of these plans is the zoning of the territory from the standpoint of the protection of species and biotopes, as well as the definition of the basic requirements for sectoral plans.

At the local level, separate plans are developed for communes within protected areas. Their area in Spain is 8.4%. But for the local level, its tasks in the field of landscape planning are not defined. Resource use plans have an advantage over territorial and sectoral development

plans. The peculiarity of resource use plans in Spain is that they are drawn up mainly for protected areas, and primarily for the largest ones. Not only environmental issues, but also some economic ones, including the development of rural tourism, are solved here [17,18,19].

Germany. Landscape planning in Germany has a long tradition. It arose in the country at the end of the XIX century as a reaction to industrialization and the destruction of nature. For example, about 90% of Germany's forests are secondary, man-made forests. Moreover, deciduous species are almost completely replaced by conifers. In the federal law of 1976, landscape planning was legally enshrined as a planning tool for the protection and maintenance of the landscape. This tool exists in practice not only at the federal, but also at the regional level. The main tasks of landscape planning are to identify and assess the functions and properties of the landscape, as well as to develop proposals for the sustainable conservation of soil, water, air and climate, plants and animals, the appearance and aesthetic qualities of the landscape. The sustainable development of landscape planning in Germany has led to the fact that 26.9% of the country's area is protected natural areas. This cannot but have a positive impact on the overall environmental situation in the country.

On the territory of Germany, territorial planning of agricultural land is carried out, which restricts the transfer of these lands for other types of use, which is reflected in federal land legislation (Federal Law on Territorial Planning). Direct land allocation is carried out at the municipal level within the established agricultural zones [16].

China. In the PRC, a spatial policy of "economic inequality of uneven growth" was applied. Regional policy was implemented in stages, territories were included in the world system at different rates and scales under the slogan: "Let some regions get rich earlier than others." In the beginning, strong "growth points" were formed on the east coast, which created a strong financial base, which subsequently made it possible to direct resources to provide basic infrastructure and services to the northern and western regions of the country [20].

Chinese scholars Qiqi Hu, Yanan Zhang, Jiabin Wang, Ran Huo and Zhe Feng write that, spatial planning is crucial for the development of green production and lifestyles, contributing to the formation of ecological civilization and creating a beautiful China. However, assessments of spatial planning in China at the global level are few and far between. In the research of scientists, a self-assessment tool for spatial planning based on the Sustainable Development Goals (SDGs) has been developed. First, a system of indicators was developed to assess spatial planning at the provincial level, taking into account the characteristics of Chinese provinces. This study then formulated recommendations for solving problems and conducted a comparative analysis. The tool is then used to assess the preparation of spatial planning in Shaanxi Province, resulting in visualized results. These results compare the content of the planning documents with the questions

asked in the tool, ensuring consistency. Their research showed that spatial planning in Shaanxi Province (2021-2035) is largely in line with the Sustainable Development Goals, while environmental restoration planning in Shaanxi Province (2021-2035) is partially in line with them. Discrepancies with global and national trends in sustainable development are noted, potentially related to the unique role of environmental restoration in national spatial planning. By integrating the SDGs, this study assesses the rationality and potential for optimizing spatial spatial planning in China's provinces. This approach aims to improve public welfare and offers practical guidance for incorporating sustainable development into provincial spatial planning strategies. It is concluded that integrated planning in China is systematically developing and determines the programs of socio-economic development of administrative-territorial entities and the placement of capital construction facilities [21].

Canada. Canada's current regional policy is aimed at ensuring equal opportunities for the well-being of the population regardless of where they live. The territorial and spatial transformation of the country has gone through several stages: from centralized management to the development of innovation and high-quality public services in all regions and sectors of the economy. At the initial stage, attempts were made to eliminate the growing difference between large cities and agricultural and mining regions. The second stage was characterized by the creation of regional development agencies with separate departmental structures for each region. At the third stage, the state focused on building up the competitive advantages of the regions and ensuring equal access to basic services [22].

Korea. The South Korean state system of government was able to successfully combine the market economic system and the national planning system. The country has gone through several stages in the formation of regional policy. If earlier the main focus of the regional development strategy was balanced development, then the new goal of "creating competitive regions with high employment and living standards", the essence of the policy was changed from "balance" to "competitiveness". Entire regions of the country are specialized high-tech clusters.

As a result, we can conclude that state intervention from the "center" was usually aimed at lagging regions mainly to ensure a basic level of quality of life for people. At the same time, advanced regions are delegated greater independence in determining development priorities with corresponding fiscal powers [23].

A similar territorial and spatial policy was also used in the EU countries, South Korea, Malaysia, Saudi Arabia and others. A review of international experience in territorial and spatial development has shown that countries go through the same processes of space development, but are at different stages, which is associated with the level of economic development and the actions of the state. Depending on the level of density, distances and disunity, 3 packages of spatial policy

instruments are distinguished in a strict sequence: territorially neutral institutions; territorial-interconnecting infrastructure; territorially targeted incentives. Insufficient elaboration of the initial tools leads to the ineffectiveness of subsequent ones [23].

Latvian Professors Volosina, M; Zarina, A, Vinogradovs, I write in their studies that in the sustainable development strategies of all five planned regions of Latvia, landscape planning is recognized as an important factor in regional sustainability. Moreover, there are now various structures that can contribute to landscape planning, the most important being the National Landscape Policy and the Thematic Plan framework. Thus, the landscape aspects of territorial planning have turned from a simple description of the landscape as part of the characteristics of the territory into a more integrative and functional part of the territorial planning process. However, landscape planning in Latvia is still a secondary activity. The purpose of this document is to analyze and expand the complex issues related to the development of landscape plans as part of spatial planning processes in Latvia through the legislative framework and planning analysis. We looked at three of the most recent examples of landscape planning, discussing different planning situations in the context of the European Landscape Convention and spatial planning in Latvia. Three planning situations are distinguished: the thematic landscape plan as a landscape policy and assessment document, the thematic landscape plan as an assessment and recommendation document, and the landscape assessment as part of the territorial plan. All three approaches demonstrate the integrity of spatial planning and reveal the benefits of sustainable spatial planning and regional development, but they still lack aspects of local participation, as well as attention to ordinary landscapes, social capital, and land-use economics [24].

Lithuania. In the article "Assessment of the Regulation of Legal Relations of Territorial Planning: A Case Study in Lithuania", it is written that land administration is inevitably related to the regulation of the activities of their owner or operator, provided for by legislation and territorial planning documents. In Lithuania, as in many European countries, spatial planning is a key measure in shaping the landscape and changing its elements. With the help of territorial planning documents, public authorities have the opportunity to regulate the location of long-term stable landscape elements and sustainable territorial development in an orderly manner. However, compared to other countries of the European Union (hereinafter referred to as the EU), the territorial planning system that was in force in Lithuania until 1 January 2014 is still "young" and has specific features of the legal regulation of the former Soviet bloc countries. The system did not provide a consistent and sustainable mechanism for territorial development: there were no measures to manage the development of residential areas and to introduce solutions into territorial planning documents (especially municipal master plans) to create a harmonious functional spatial system. The purpose of this article is to assess the regulation of legal relations of territorial

planning in Lithuania and the EU Member States. The assessment summarizes the processes of landscape formation in the course of spatial planning, opens up new opportunities for more accurate forecasting of the results of the current landscape planning process, and highlights the legitimate and sustainable elements of optimizing the spatial planning system. As can be seen from the assessment, one of the most important goals of territorial planning has been and remains the balance of interrelations (hierarchy of plans) of territorial planning documents in the formation of the cultural landscape to ensure the rational distribution of the land fund, the combination of various types of activities, as well as often the different interests of land users and the public. Thus, the implementation of the territorial planning reform in Lithuania creates opportunities for the transition to integrated spatial planning that ensures sustainable development [25].

Lithuanian scientists Salne, E., Apanavičienė, R., in the article "Territorial Planning: A Tool for the Implementation of Sustainable Regional Development" write that the implementation of the concept of sustainable regional development is one of the most difficult tasks facing society today. Spatial planning is one of the tools used to achieve this goal. Territorial planning is a complex process of determining the directions of development of both a country and a specific territory, setting priorities and restrictions in the use of the territory, the level of urbanization and expansion. This is an area in which the interests of certain actors involved in the planning of the territory compete, and their incompatibility, combined with the inconsistency of spatial planning, has a negative impact on sustainable development and does not create a favorable environment for investment. This article analyzes territorial planning as a method that contributes to the balanced and consistent development of all territories of the country. The article also discusses the system of territorial planning and its problems [26].

In conclusion, based on the experience of foreign countries, we can distinguish several methods of territory planning:

- Territorially neutral institutions play an important role at the national level, ensuring that citizens have equal access to basic public services, regardless of where they live. This includes security, social support, secondary education, basic health care and access to public infrastructure (electricity, water and sanitation);

- At the interregional level, the key role is played by the territorially connected infrastructure, which reduces transport costs and contributes to the growth of human and economic flows. This category includes transport networks (roads, railway lines, airports and ports), energy systems and digital infrastructure, which continues to grow globally;

- Area-targeted incentives are relevant at the regional level, including specific support measures such as regulations, rules and investments aimed at the development of certain territories.

Failure to implement these measures in a consistent manner can lead to inefficient spending and increased social inequalities.

Based on international experience, the following conclusions can be drawn for Kazakhstan:

- Equal access to basic services should be the basis for balanced territorial development.

- Territorial inequality in economic policy should be accepted as a pattern of spatial development.

- The main goal of state support should be aimed at eliminating gaps in access to services for socio-economically lagging territories.

For more developed regions, it is important to provide additional powers and resources to independently solve local socio-economic problems.

A positive example for Kazakhstan is the experience of the United States and China. In the United States, the federal government provides minimum standards of living through social sector funding, intergovernmental transfers, and support for economic development. This makes it possible to minimize interregional differences and effectively develop institutions.

2 Natural and climatic resources of the North Kazakhstan region

2.1 Climatic characteristics of the region

The study area of this project is the North Kazakhstan region, which is located in the very north of Kazakhstan.

The North Kazakhstan region is located on the southern periphery of the forest-steppe and steppe zones of the West Siberian lowland, and mainly in the central part of the Yesil steppe. It borders on the Kurgan, Tyumen and Omsk regions of Russia in the north, on the Pavlodar region in the southeast, on the Akmola region in the south, and on the Kostanay region in the west (Figure 3).

The territory of the North Kazakhstan region is characterized by the predominance of flat spaces, lowlands and elevated plains, the south-west of the region is occupied by the Kokshetau hill.

The North Kazakhstan Plain, located to the north of the Kazakh hills, is a flat plain with a number of large lake basins occupied by salt and brackish lakes.

The surface of the region is flat with a slight slope to the north. The entire territory of the region from the south-west to the north-east is crossed by the valley of the Yesil River. According to the nature of soils and vegetation, the territory of the region is divided into three parts. In the north there is a narrow meadow-forest belt, to the south lies a typical birch steppe, and in the south steppe spaces prevail [27,28].

Northern Kazakhstan, which is located in the forest-steppe and steppe, is the main breadbasket of the country and is of great economic value as the main agricultural region, the resources of which have been intensively used for a long time.

The geographical location and flat nature of the relief of the North Kazakhstan region influenced the pronounced features of the continental climate, manifested in sharp temperature contrasts between winter and summer, large daily amplitudes of day and night temperature.

In the summer, the territory of Northern Kazakhstan is under the influence of the removal of dry superheated tropical air masses from Central Asia and Central Kazakhstan, and in the winter months, invasions of cold Arctic polar air masses are observed, which determines the continental features of the climate and is characterized by severe long winters and moderate hot summers [28].

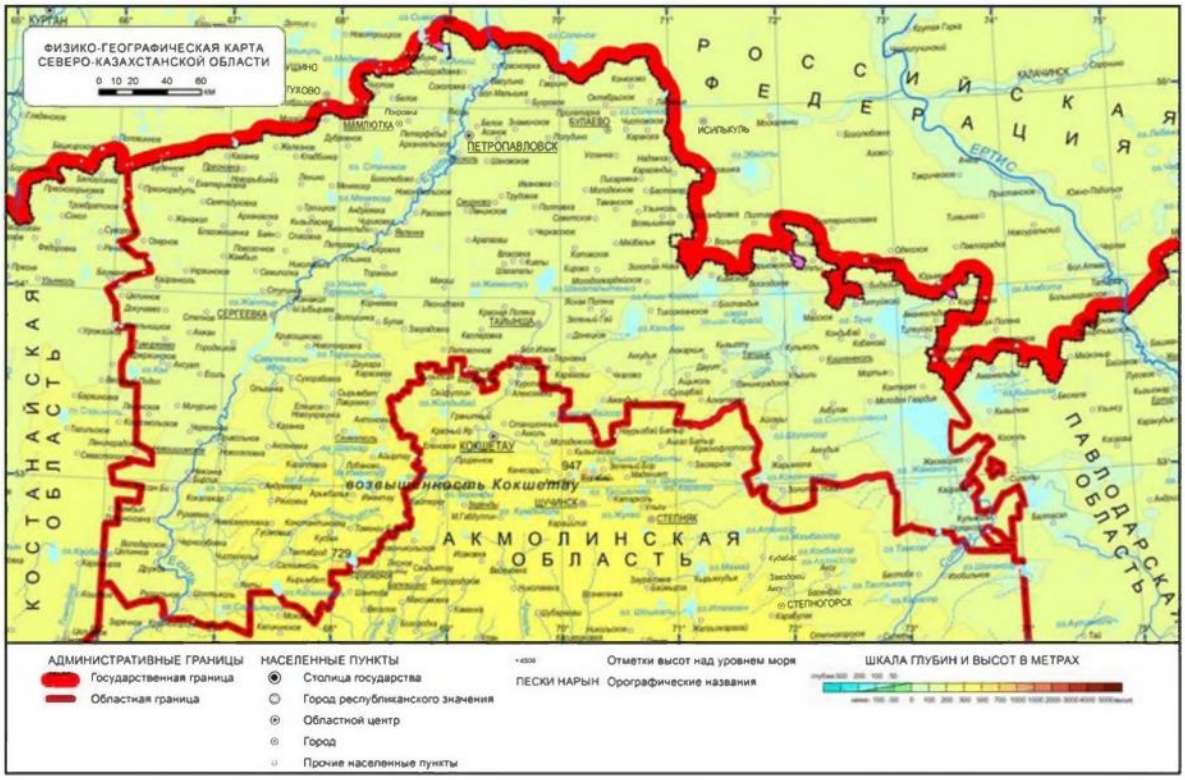


Figure 3 - Physical and geographical map of the North Kazakhstan region [3]

The study area is dominated by ordinary and southern chernozems, chestnut soils and their complexes with other soils [28].

In winter, anticyclonic types of weather prevail with the dominance of clear skies and stable negative temperatures. The winter period is long and cold, with a stable, sometimes deep snow cover, lying up to 5 months, with blizzards and windy weather, deep freezing of the soil (up to 100-150 cm). Stable snow cover usually forms in the first half of November, and reaches its highest height (20-40 cm and more) in March. Fields are freed from snow cover in spring, usually on April 5-10, but during periods of cold snaps, snow can form again in the fields until the end of April - the first days of May. The winds have a distinct south-westerly direction with average speeds of about 5.5 m/s.

Spring is relatively short (20-30 days), characterized by an unstable growth of thermal resources, warming alternates with waves of cooling to frost. Spring frosts usually stop in the second decade of May, but in cold springs they can be observed in early June. Spring is characterized by an increase in wind activity, which adversely affects the drying of the upper soil horizon.

In summer, cyclonic types of weather prevail, with northern and northwestern winds having average speeds of about 4 m/s, on some days dust storms and dry winds can be observed. Summer is quite short, with moderately hot or warm weather and rainy weather, with a July maximum of precipitation, thunderstorms, heavy downpours. In some years, in the early summer period, there

is an increase in the aridity of the climate due to the lack of precipitation and soil moisture, the establishment of hot weather.

The average daily amplitude of air temperature in summer reaches its maximum values (10-15 ºC). The warmest summer month is July, with an average monthly air temperature of 19-20 º C. On some of the hottest days, the air temperature during the day can rise to 35-40 º C. Precipitation falls much more in the summer months than in other seasons. According to climatic data, the maximum precipitation falls on July, when the amount of precipitation per month in the region is 60-80 mm. In some dry years, precipitation for the summer season can be very small (20-40 mm), and in wet years it can exceed the climatic norm by 2-3 times. Agricultural areas of the region are not guaranteed against drought and dry winds. In extremely unfavorable years, the combination of soil and atmospheric aridity can cause significant damage to agriculture.

Autumn is cool, cloudy, and often rainy. At this time, there is a mass harvesting of crops. At this time, the air temperature in the region can significantly decrease to frosts of varying intensity, which adversely affects the quality of the crop, the pace and timing of field work. On the territory of Kazakhstan, the climate of individual physical and geographical zones varies significantly. The forest-steppe and steppe zones within the boundaries of which the territory of Northern Kazakhstan is located are of great economic value as the main agricultural region, the resources of which have long and intensively been used mainly for the cultivation of cereals, legumes, oilseeds, fodder and other crops.

The climate of any territory is formed under the influence of a number of climate-forming factors. The formation of climate is mainly influenced by radiation and circulation conditions that determine the temperature regime, types of air masses and their movement, the development of frontal processes and atmospheric precipitation, and the ratio of heat and moisture [29,30].

Radiation regime. The energy base of all natural processes is solar radiation, which is also one of the main climate-forming factors. The magnitude of the influx of solar radiation is determined by such factors as: 1) geographical latitude of the area; 2) transparency of the atmosphere; 3) the duration of sunshine.

The average annual number of hours of sunshine in the study area of Kazakhstan is small (Petropavlovsk - 2184 hours, Pavlodar - 2459 hours). It can also be noted that in the study area, the maximum sunshine occurs in the summer months - June and July. The number of days without sun in Northern Kazakhstan varies from 46 (Pavlodar) to 64 (Petropavlovsk) days. The smallest number of days is observed in the summer period and ranges from 0.2 to 1 day per month. The largest number is observed in November and December (9-14 days). The number of days without sun in the annual course increases from south to north. Thus, the smallest number is observed at the Astana station - 47 days, and the largest - at the Petropavlovsk station - 64 days. Another

climate-forming factor is the atmospheric circulation system, which is formed under the influence of the general planetary circulation, local radiation conditions, and features of the underlying surface [31].

The location of Northern Kazakhstan in the depths of the largest continent determines the sharp continentality of its climate, the characteristic features of which are long cold winters with strong winds and blizzards, short but hot summers. Also, for northern Kazakhstan, frequent changes in air masses are very typical, causing weather instability. During the cold period, the study area is located on the northern periphery of the transtropical (Asian) maximum, which determines the predominance of the anticyclonic regime, weather, low winter temperatures, low amount of winter precipitation and unevenly lying snow cover. In winter, the passage of western and diving cyclones, as well as the exit of southern cyclones, cause an increase in temperature, as well as an increase in wind, accompanied by blizzards and snowfalls. In the warm period, due to the intensification of cyclonic activity and cold invasions on cold fronts, the amount of precipitation increases sharply. It is the circulation of the atmosphere that causes sharp fluctuations in temperature and precipitation from year to year.

As part of the project's objectives for 2024, it is planned to collect the main meteorological parameters from meteorological stations in the North Kazakhstan region. For these purposes, meteorological stations of the region were selected, which are freely available on the website of Kazhydromet https://meteo.kazhydromet.kz/database_meteo/. The list of meteorological stations involved in data collection in 2024 is given in Table 3, their location by districts of the region is shown in Figure 4.

Table 3 - List and coordinates of meteorological stations in the region

№	Name of the Meteorological Station	Altitude, m	Latitude	Longitude
1	Blagoveshchenka	150	$54^0 22'$	$66^0 48'$
2	Vozvyshenla	125	$54^0 26'$	$70^0 56'$
3	Kishkenekol	130	$53^0 38'$	$72^0 20'$
4	Petropavlovsk	140	$54^0 51'$	$69^0 08'$
5	Ruzaevka	226	$52^0 49'$	$66^0 57'$
6	Saumalkol	314	$53^0 17'$	$68^0 06'$
7	Sergeevka	152	$53^0 52'$	$67^0 24'$
8	Taiynsha	155	$53^0 50'$	$69^0 45'$
9	Timiryazevo	137	$53^0 44'$	$66^0 29'$
10	Chkalovo	165	$53^0 37'$	$70^0 25'$
11	Yavlenka	112	$54^0 20'$	$68^0 27'$



Figure 4 – Location of meteorological stations in the North Kazakhstan region

A brief physical and geographical description of the location of meteorological stations in the region is given in Table 4. In the future, the list of meteorological stations and the list of meteorological parameters for the collection, processing and assessment of agro-climatic conditions will be expanded. Data from meteorological stations in the adjacent regions of Northern Kazakhstan (Kostanay, Akmola, Pavlodar regions) and additional meteorological parameters characterizing the duration and more detailed assessment and characteristics of the hydrothermal conditions of the territory during the growing season will be used.

Table 4 – Physical and geographical description of meteorological stations

№	Name of the meteorological station	Station Location	Groundwater level (m)	Underlying surface	Soil type
1	2	3	4	5	6
1	Blagoveshchenka	in the south of the West Siberian Lowland, in the flat steppe region	5-7	Meadow and steppe vegetation	gray forest chernozems, mechanical composition – loam
2	Vozvushenka	in the flat steppe region of the West Siberian Lowland	15-20	carrot-red feather grass steppes, in some places thickets of shrubs	black soils, mechanical composition of soils – loam
3	Kishkenekol	in the south of the West Siberian lowland, in the zone of moderately dry fescue-feather grass steppes	6-7	forb-fescue-feather grass vegetation	medium loamy black soil, in low places solonets appears
4	Petropavlovsk	n on the right bank of the Ishim River, in the plain region of the West Siberian Lowland	3-5	feather-grass grasses, birch spikes (start after 1000 m)	black soils, mechanical composition of soils – loam
5	Ruzaevka	in the north of the Kazakh hills, in the dry steppe region of Kazakhstan	approx. 10	steppe, feather-grass, in some places with an admixture of wormwood elements	black soils, salt marshes in places, mechanical composition of the soil - loam, clay

continuation of table 4

1	2	3	4	5	6
6	Saumalkol	on the southern border of the plain steppe region of the West Siberian lowland, which passes further to the south into the gravelly steppes of the Kazakhstan hills	7 –12	Meadow and steppe vegetation	gray forest, chernozem, meadow-chernozem
7	Sergeevka	in the plain forest-steppe region of the West Siberian Lowland, in its southern part, on the left bank of the Ishim River	10-15	Meadow and steppe vegetation	gray forest, meadow-chernozem, chernozem, Mechanical composition – loam, clay
8	Taiynsha	it is located in the south of the West Siberian Lowland	11-15	steppe forbs (feather grass, fescue, bluegrass).	chernozem, saline, strongly saline, heavy loamy
9	Timiryazevo	in the south of the West Siberian lowland, in the flat steppe region of Kazakhstan	10-15	Steppe vegetation	Black soils
10	Chkalovo	in the south of the Ishim steppe, in the northern part of the Kazakh hills	4 -18	Meadow and steppe vegetation	chernozem, meadow-chernozem, mechanical composition of soils loam and clay
11	Yavlenka	in the south of the West Siberian Lowland, in the flat steppe region of Kazakhstan, in the wide valley of the Ishim River on the second terrace above the floodplain	10-12	meadow-steppe forbs	black soils, the mechanical composition of soils is clay, loam, alluvial-meadow soils are developed in the floodplain of the Ishim

The collection of meteorological information from meteorological stations of the Kazhydromet network in 2024 provides for the formation of a primary database on air temperature and precipitation over the past 20 years (from 2003 to 2023). These data will be further used to analyze and assess hydrothermal conditions, determine climate change trends in the modern long-term period, agroclimatic zoning of the region, and assess climate aridity in the agricultural region.

Air temperature and precipitation are the most important meteorological parameters that determine the nature and mode of weather types. Air temperature and precipitation have a significant impact on the timing and quality of field work, on the growth, development and formation of yields and ripening of all crops. The total thermal resources and precipitation assess the need and availability of heat and moisture for various crops, the possibility of their zoning in the territory of the region under study.

Average long-term climatic reference data [32] on the average air temperature are given in Table 5. Long-term data on average air temperature by year for the period from 2003 to 2023 are given in Appendix A

Table 5 – Average monthly and annual air temperature, °C [32]

Station	Months												Year
	1	2	3	4	5	6	7	8	9	10	11	12	
Blagoveshchenka	-17,4	-16,4	-9,7	3,5	12,3	17,9	19,5	16,7	11,0	2,6	-7,7	-14,2	1,5
Vozvyshenka	-18,1	-17,3	-10,6	2,8	11,9	17,7	19,5	16,5	10,6	2,2	-8,6	-15,1	1,0
Kishkenekol	-17,2	-16,6	-9,5	3,9	12,6	18,9	20,6	17,2	11,2	2,6	-7,8	-14,1	1,8
Petropavlovsk	-17,9	-16,6	-10,0	2,8	11,6	17,3	19,2	16,4	10,6	2,1	-8,0	-15,0	1,0
Ruzaevka	-16,7	-16,2	-9,9	3,8	12,6	18,2	19,8	17,1	11,2	2,6	-7,5	-13,9	1,8
Saumalkol	-16,1	-15,6	-9,1	3,4	11,9	17,4	19,0	16,5	10,8	2,4	-7,8	-13,6	1,6
Sergeevka	-17,1	-16,2	-9,7	4,2	12,5	18,6	20,0	16,9	11,1	3,0	-7,6	-13,6	1,8
Taiynsha	16,8	-16,1	-9,2	3,8	12,2	18,2	19,7	16,9	11,1	2,9	-7,6	-14,1	1,8
Timiryazevo	-16,8	-16,3	-9,4	4,1	12,7	18,4	20,1	17,0	11,1	2,6	-7,3	-13,5	1,9
Chkalovo	-15,4	-14,7	-8,3	4,6	12,7	18,7	20,1	16,9	11,1	3,0	-6,8	-12,4	2,4
Yavlenka	-17,2	-16,4	-9,6	3,4	12,2	17,9	19,5	16,7	11,0	2,6	-7,6	-14,4	1,5

Climatic reference data [33] on monthly precipitation (mm) and total for the year are given in Table 6. Precipitation data collection by year (2003-2023) is provided in Annex B.

Barico-circulation conditions of the warm half of the year favor significant precipitation in most of Kazakhstan. The thermal contrast of interacting air masses is significant, especially in spring. Against the background of high air temperatures, the moisture content of air masses also increases significantly, additional moistening of which occurs due to the evaporation of moisture from the water surface and soil and vegetation cover [28]. In the cold half of the year (November-March), the amount of precipitation in the study area ranges from 68 to 94 mm.

Table 6 - Average monthly and annual precipitation (mm) [33]

Station	Months												Yea
	1	2	3	4	5	6	7	8	9	10	11	12	r
Blagoveshchenka	15	12	11	21	34	46	64	45	33	30	23	18	352
Vozvyshenka	14	11	10	19	27	42	65	46	27	26	19	15	321
Kishkenekol	17	13	12	17	29	37	55	46	26	24	22	18	316
Petropavlovsk	16	12	11	20	31	49	61	50	32	30	24	20	356
Ruzaevka	16	11	13	22	32	41	56	39	29	33	23	18	333
Saumalkol	18	13	15	23	35	48	68	47	35	37	27	21	387
Sergeevka	19	16	13	22	31	38	59	46	32	32	24	22	354
Taiynsha	13	10	11	19	32	43	69	48	27	27	19	15	333
Timiryazevo	14	11	11	20	29	41	53	45	28	28	21	18	319
Chkalovo	13	10	11	19	30	39	68	53	26	23	20	15	327
Yavlenka	13	11	10	20	31	49	68	49	30	30	20	16	347

In the cold period of the year, invasions of cold and moisture-poor arctic air masses and air masses of temperate latitudes of continental origin predominate everywhere. Due to the stable snow cover and low temperatures, the air is almost not enriched with moisture due to evaporation from the earth's surface [28].

Snow cover. In the North Kazakhstan region, a stable snow cover is formed in the first decade of November and lies for about 5 months. The maximum height of the snow cover and the water reserve in it is formed, as a rule, at the end of winter (March). The height of the snow cover

is 25-40 cm. In general, the natural and climatic conditions of the North Kazakhstan region are quite favorable for the conduct and development of agricultural work. In terms of the production specialization of agriculture, the study area belongs to the zone of developed wheat and grain farming. The collection of data on snow depth (cm) for the last 20 years is given in annex B.

Wind. The wind regime is determined by the general barico-circulation situation and changes significantly during the transition from the warm half of the year to the cold one. In winter, the nature of the prevailing air currents in most of the country is determined by the presence of the western spur of the Siberian anticyclone, the axis of which is located south of the region under consideration, in the area of latitudes of 48-50 ° N. Therefore, in Northern Kazakhstan in winter, winds of southwestern and western directions prevail. In the warm part of the year, the features of the wind regime are largely determined by the mild pressure depression that is forming over Kazakhstan at that time. In this regard, northwest winds prevail in the north.

Annual wind speeds in the forest-steppe and steppe zones of Northern Kazakhstan are determined mainly by the high frequency and activity in this part of the republic of cyclonic processes accompanied by precipitation, often of a downpouring nature, especially in the warm season. In the study area, the average annual wind speeds range from 2.9 to 4.5 m/s (Table 7). The collection of data on the average wind speed for a long-term period by year (2003-2023) is given in Appendix D. From the table it can be seen that in the territory under consideration the average monthly wind speed in the cold period of the year reaches 3–5 m/s. The average monthly wind speed in the study area in June-August is 2–4 m/s. long-term data were collected from the network of meteorological stations of the North Kazakhstan region on the main characteristic of soil moisture - reserves of productive moisture (mm) in soil layers 0-20, 0-50, 0-100 cm during the growing season (Appendix D).

Table 7 - Average monthly and annual wind speed (m/s) [34]

Station	Months												Год
	1	2	3	4	5	6	7	8	9	10	11	12	
Blagoveshchenka	4,2	4,2	3,6	4,0	3,9	3,4	2,9	2,9	3,4	3,9	4,0	4,1	3,7
Vozvyshenka	4,5	4,5	3,9	4,5	4,3	3,7	3,0	3,1	3,6	4,1	4,5	4,6	4,0
Kishkenekol	4,3	4,3	3,8	4,3	4,2	3,7	3,2	3,3	3,8	4,1	4,5	4,4	4,0
Petropavlovsk	4,9	4,8	4,5	5,0	4,8	4,2	3,6	3,6	4,1	4,5	4,8	4,8	4,5
Ruzaevka	3,4	3,2	2,8	3,2	3,0	2,7	2,2	2,2	2,5	3,1	3,2	3,1	2,9
Saumalkol	3,8	4,0	3,4	3,7	3,4	3,0	2,6	2,6	3,0	3,6	3,8	3,9	3,4
Sergeevka	4,5	4,5	4,0	4,1	3,9	3,4	2,7	2,8	3,4	3,9	4,3	4,5	3,8
Taiynsha	4,6	4,7	4,1	4,8	4,7	4,4	3,6	3,6	3,9	4,2	4,4	4,5	4,3
Timiryazevo	4,6	4,7	4,0	4,3	4,3	3,6	3,2	3,1	3,5	4,0	4,3	4,4	4,0
Chkalovo	3,8	3,9	3,4	3,9	3,7	3,3	2,7	2,6	3,0	3,4	3,8	3,7	3,4
Yavlenka	3,3	3,4	2,9	3,7	3,5	3,0	2,5	2,4	2,8	3,2	3,2	3,5	3,1

Soil moisture reserves in both arable and meter layers of soil in the territory, by years and during the growing season vary significantly. The dynamics of the content of productive moisture

in the soil (mm) according to the data of meteorological stations of the North Kazakhstan region is shown in Table 8.

Table 8 - Dynamics of the content of productive moisture in the soil according to the data of meteorological stations of the North Kazakhstan region, 2024

District, MS	Horizon, cm	May			June			July			August		
		decade			decade			decade			decade		
		1	2	3	1	2	3	1	2	3	1	2	3
Smirnovsky rural district	0-20	14	31	33	35	25	18	16	19	20	19	23	19
	0-100	153	152	146	189	147	110	120	100	123	120	122	110
Ualikhanovsky Aktuesai	0-20	39	35	29	28	30	28	40	33	34	38	33	30
	0-100	176	160	139	137	136	128	171	153	150	154	138	128
Mamlyut Mamlyutka	0-20	42	36	34	32	42	34	30	31	31	27	24	1
	0-100	146	145	140	138	146	140	134	149	121	115	109	90
Kyzylzhar Nalobino	0-20	33	33	37	44	32	33	47	34	51	45	48	43
	0-100	151	182	211	169	176	169	197	166	210	171	178	168
Yesil Korneevka	0-20	16	21	23	25	19	9	22	7	0	0	10	15
	0-100	76	97	97	90	85	60	60	24	5	2	13	16
Zhambyl Presnovka	0-20	21	21	43	39	40	29	40	38	43	30	35	37
	0-100	117	129	215	190	216	170	197	196	210	142	156	160
named after M. Zhumabayev Vozvyshenka	0-20	33	25	29	42	26	22	27	24	36	24	28	-
	0-100	148	146	138	159	138	124	141	117	168	142	111	-
named after G. Musrepov Ruzaevka	0-20	32	28	30	26	9	20	31	45	35	45	55	43
	0-100	169	123	106	101	80	83	110	166	116	165	230	138
Aiyrtau Saumalkol	0-20	27	21	33	25	21	19	31	32	28	27	32	34
	0-100	169	120	162	138	138	104	141	142	148	133	129	122
Taiynshinsky Taiynsha	0-20	29	23	27	28	31	10	25	37	31	20	32	37
	0-100	150	117	134	128	173	109	120	96	164	124	89	170
Timiryazevsky Timiryazevo	0-20	34	33	45	31	34	22	47	23	26	28	32	48
	0-100	176	168	186	169	171	156	203	147	146	120	126	138
named after Shal akyn Sergeevka	0-20	36	34	33	41	29	22	34	38	41	36	37	40
	0-100	184	179	175	188	176	163	165	156	155	147	145	156

The collection of climate data and long-term meteorological parameters is organized into a primary database, which will further form an information structural basis for the formation of a geoinformation database. The collected data, along with satellite data, will be used to conduct spatial analysis to assess climate resources, determine climate change trends in the current multi-year period, assess the degree of climate aridity, and will be involved in solving subsequent tasks of the project.

2.2 Land resource potential and biodiversity of the territory

Land and land resources are the most important part of the natural environment, the spatial basis for the location of branches of economic activity of man and society. Land plots can be an economic, environmental and social asset of the region, i.e. an important resource for its development. The quantitative and qualitative characteristics of the structural components of the land potential of the region make it possible to analyze the dynamics of the regional economy, identify disproportions between individual elements of the potential, as well as identify priority areas of regional policy in the field of land use. With the correct balance of different types of land use, compliance with the principle of rationality, the main condition for the sustainable development of the region will be fulfilled - the gradual transition of the economy to a qualitatively new state, taking into account modern trends in society, this transition meets the needs of potential consumers.

The land resource potential of people's life is significant and invaluable. Its role is especially active in agriculture, where land resources are both an object and a means of labor at the same time. At the same time, the land performs a variety of functions that mediate its connection with the life of people and the existence of society. In the process of studying the land resource potential, the following main functions of the land resource potential are distinguished:

- ecological - land resources, in this direction, are related and are a product of nature, exist independently of man;

- social - land is both a place and a condition for the existence of man as a biological species;

- political - the land on which the territory of a particular state is located embodies the "limit of state power";

- economic - land resources are the object of economic relations [35].

The availability of natural resources, including land, their quantitative and qualitative characteristics determine the natural resource potential of a particular territory. The latter is the leading factor influencing the location of the population, economic activity and specialization of enterprises in the region [36]. Rational use of land and resource potential is the basis for the socio-economic development of the constituent entity of the Republic of Kazakhstan, ensures the competitiveness of production and individual territories of the region.

To study the concept of "land resource potential", it is necessary to first consider the basic concepts of "resource potential" and "land resources". For example, A. P. Potapov writes: "... Resource potential is the basis for the implementation of the strategy for the development of the agro-food complex..., solving the problem of increasing domestic agricultural production and

increasing export potential..." [37]. This interpretation rightly determines that it is expedient to include land resources in terms of content, since the latter refers to resources of natural origin. Also, the concept of "resource potential", as a rule, is used to characterize various production systems and, in accordance with the most common interpretations of the above term in the scientific literature, are:

- the volume of resources corresponding to the needs of the national economy, taking into account the possible increase and replenishment of these resources in the long term and associated with the source of this type of resources;

- material and material basis of the production process, which is in a static state before the involvement of resources in the production process;

- a set of different types of resources used to achieve the final result of the national economy;

- a unified system of labor, natural and material costs, determined by the quantity, quality and internal structure of each specific resource.

Consequently, approaches to the definition of the concept of "resource potential" are changing from views on it as a "quantitative assessment of the totality of resources" to presenting it as a basic element of the production process, that is, having both quantitative and qualitative characteristics [38].

As for the general concept, the interpretations of land resource potential are more unambiguous and definite, in most cases they are understood as resources created naturally (by nature itself) and not having a fixed cost. This part of the resource potential is intended for wide and versatile use in the country's economy. Land resources are also understood as the surface of the earth's crust suitable for human habitation and life, as well as the surface of the bottom of water bodies, etc. But in any interpretation, land resources have such specific characteristics as relief, composition and quality of soil. In addition, the concept of "land resources", in addition to the land proper, includes land plots covered with vegetation and water, mineral deposits, and real estate objects functionally connected with the land (buildings, structures, oil and gas wells, stationary mining equipment) [39,40,41,42,43].

Thus, the land resource potential in the Republic of Kazakhstan, its administrative-territorial units and individual economic entities belong to one of the main places, since it is "... a universal means of production and one of the main and main means of production in agriculture and forestry" and in other sectors [35,36].

Studying the foreign experience of managing land and resource potential from the standpoint of rational land use, it should be noted that in all countries, including the North

Kazakhstan region, the priority of agricultural land is recognized (Table 1). There are three levels in land management in foreign countries:

1) State. Management is carried out in order to preserve agricultural landscapes and settlement territories;

2) Regional. The Department combines land policy with regional policy, streamlines the land use system;

3) District. The department focuses on obtaining maps and plans of the area, preserving agricultural land [44].

Countries of the world differ in land area, area of agricultural land, and the amount of arable land. Russia occupies the largest area - 1709.8 million hectares, Brazil, Canada, China, the USA - about 900 million hectares, France - 55 million hectares. If we consider the North Kazakhstan region of the republic, where the area of the land fund is 9.8 million hectares, it is more than in Austria by 1.8 million hectares and Hungary by 0.8 million hectares. In Canada, there is less agricultural land - 7%, more land in the UK, Kazakhstan - 76%. In Brazil, forested areas occupy more than 60% of the state. There are fewer forests in Kazakhstan - 1%. In the North Kazakhstan region, it is 5.5%. The largest water area is in Canada (9%), the least in France (0.3%). In Kazakhstan it is 1%, in the North Kazakhstan region 1.4% (Table 9).

The land fund of the country, according to the Land Code of the Republic of Kazakhstan, in accordance with the intended purpose, is divided into the following categories:

1) agricultural land;

2) lands of inhabited localities (cities, settlements and rural inhabited localities);

3) lands of industry, transport, communications, for the needs of space activities, defense, national security and other non-agricultural purposes;

4) lands of specially protected natural areas, lands of health, recreational, historical and cultural purposes;

5) lands of the forest fund;

6) lands of the water fund;

7) reserve lands.

Table 9 - Land fund of individual countries of the world and the North Kazakhstan region

№	Country name	Total area, million ha	Including		
			agricultural land %	Forest %	Water %

1.	Austria	8.4	38	46	2
2.	Brazil	851.6	32	60	2
3.	Hungary	9.3	57	22	3
4.	Great Britain	24.4	71	12	1
5.	Kazakhstan	272.5	76	1	1
6.	Canada	998.5	7	31	9
7.	China	9600	54	22	2
8.	Germany	35.7	47	31	2
9.	Russia	1709.8	13	47	4
10.	USA	983.2	42	31	7
11.	France	54.9	53	29	0.3
12.	North Kazakhstan region	9.8	73,6	5,5	1,4
Source: Developed based on data from [44,45]					

In the structure of the country's land fund, agricultural land dominates-116.4 million hectares (42.7%) and reserve land – 84.0 million hectares (30.8%). As of November 1, 2023, 73.5% of the land fund is concentrated in these categories, and 26.5% in all other categories (Table 10).

The availability of land resources is the first condition for placing productive forces on the territory of the region. The quantity, quality and combination of land resources determine the land and resource potential of the territory, which is an important factor in the placement of population, production and economic activity.

The main hypothesis of this study is aimed at studying the availability of land and resource potential of the region of the North Kazakhstan region, as well as effective and rational use of land based on the use of digital technologies, which will improve the quality of life and increase the degree of satisfaction of the ever-increasing needs of society, as the degree of sustainable development of the region.

The land resource potential also depends on the effectiveness of the land management system, namely, the functioning of its organizational and economic mechanism. Land management is a complex system that covers a wide range of public relations. Therefore, when organizing the management of this system, it is necessary to rely on the interaction of the state and society. Consequently, the development of a long-term plan to improve the efficiency and efficiency of land use is one of the main tasks of the overall strategic planning of sustainable territorial development of the North Kazakhstan region and the country as a whole.

Table 10 -Dynamics of the Land fund of the Republic of Kazakhstan by land category (thousand hectares)

Designation категорий of land categories	19911991	2022 г.	2023	Changes (+ , -)	
				2023 to 1991 г.	2023 2023 to 2022 2022

1. Agricultural land	218 375.8	115 966.2	116 447.8	-101 928.0	+481.6
2. Land inhabited of localities	3 747.2	24 592.8	25 037.4	+21 290.2	+444.6
в including including:					
cities and towns	2 053.5	4 106.2	4 112.4	+2 058.9	+6.2
rural localities localities	1 693.7	20 486.6	20 925.0	+19 231.3	+438.4
3.Industrial, transport, communications, for space activities, defense, national security, and other non-agricultural land	18 796.8	2 273.0	2 436.3	-16 360.5	+163.3
4. Lands of specially protected natural territories, lands for health, recreation , historical and cultural purposes	775.1	7 811.3	8 154.3	+7 379.2	+343.0
5. Forest fund lands	10 179.2	22 963.5	22 965.0	+12 785.8	+1.5
6. Water fund lands	819.9	4 209.4	3 907.8	+3 087.9 - 301.6	301.6
7. Reserve lands	18 952.3	85 114.6	83 982.2	+65 029.9	-1 132.4
Total land	use 271 646.3	262 930.8	262 930.8	-8 715.5	-
в including including land used on the territory of other states	149.8	0.9	0.9	-148.9	-
Land used by other States	993.7	9 561.1	9 561.1	+8 567.4	-
Territory of the Republic	272 490.2	272 491.0	272 491.0	+0.8	-

Source: Consolidated Analytical Report on the state and Use of land in the Republic of Kazakhstan for 2023. [45]

Justification of the task of developing land and resource potential for sustainable land use statistical data on the state and use of land of all categories were collected based on statistical data and a consolidated analytical report on land resources of the North Kazakhstan region from 2004 to 2023. The land fund of the North Kazakhstan region is represented by all land categories.

The total area of the land fund (as of January 1, 2023) is 9804.3 thousand hectares. In the structure, the territory of agricultural land in 2023 amounted to 74%, the land of settlements 11% and reserve land 6%.

Agricultural land has a specially protected status aimed at limiting its withdrawal from circulation, preserving and improving soil fertility. The collection of information on land categories of the North Kazakhstan region for 2004-2023 according to the consolidated analytical report is shown in Table 11.

The area of agricultural land in 2023 (compared to 1991) decreased by 1.8 million hectares. In 1991, it was 9.0 million hectares or 91.8% of the entire territory of the region. At the same time,

it should be emphasized that the land of settlements mainly reflected built-up areas, which amounted to 3.6 thousand hectares. In 2023, the area of agricultural land amounted to 7.2 million hectares, or 73.8 % of the total area (Table 11).

Table 11-Dynamics of land resources of the North Kazakhstan region by land category for 2004-2023 (thousand hectares)

Year	of the Category of land							total land
	of agricultural purpose	Inhabited -tion points	of Industry, transport, communication and other not with/x destination	of Specially protected natural areas	of the Forest Fund	Water Fund	Stock	
1991	9000,0	3,6	0	0	640,4	0	of 160.3	9804,3
2004	5901,3	of 926.4	63,0	0,2	681,2	142,4	2089,8	9804,3
2005	5790,4	922,4	63,6	0,2	681,5	142,4	2203,8	9804,3
2006	5951,3	921,9	63,9	0,2	681,5	142,4	2043,1	9804,3
2007	6117,6	922,3	64,5	0,2	681,2	142,4	1875,9	9804,3
2008	6675,5	919,1	71,2	0,2	681,2	142,4	1314,7	9804,3
2009	6914,2	915,9	70,7	0,2	681,2	142,4	1079,7	9804,3
2010	7149,3	920,1	70,4	0,2	681,2	142,4	840,7	9804,3
2011	7219,0	915,4	71,7	0,2	681,2	142,4	774,4	9804,3
2012	7267,2	933,8	71,7	0,2	681,4	142,4	707,6	9804,3
2013	7331,6	959,8	71,4	134,7	549,6	142,4	614,8	9804,3
2014	7168,5	956,8	73,6	134,7	549,6	142,4	778,7	9804,3
2015	7228,5	950,4	73,9	134,7	549,6	142,4	724,8	9804,3
2016	6917,0	947,3	73,5	134,7	549,6	142,4	1039,8	9804,3
2017	7014,5	985,2	73,0	134,9	549,6	142,4	904,7	9804,3
2018	7154,8	983,4	69,6	134,9	549,6	142,4	769,6	9804,3
2019	7198,6	989,4	72,1	134,9	549,6	142,4	717,3	9804,3
2020	7342,3	1004,1	65,3	134,9	of 545.2	142,4	570,1	9804,3
2021	7287,5	1016,4	66,2	134,9	of 545.2	142,4	611,7	9804,3
2022	7271,2	1041,5	66,6	134,9	of 545.2	142,4	by 602.5	9804,3
2023	7232,5	1051,1	66,8	134,9	545,1	142,4	631,5	9804,3
Source: analytical Summary reports on the status and use of lands of the Republic of Kazakhstan [45].								

The composition of agricultural land by type of land for the multi-year period from 2004 to 2023 is shown in Table 12. The share of agricultural land in the regional land fundis 73.8%.

Table 12. Composition of agricultural land (thousand hectares) by type of land in the North Kazakhstan region for 2004-2023

Year	Total area	Total farmland	Arable	land Perennial plantings	Fallow	Hayfields	Pastures	Vegetable gardens etc. plots
2004	5901,3	5689,3	4031,1	4,2	196,6	16	1440,7	0,7
2005	5790,4	5614,1	4032,4	2,8	168,7	14,8	1395,0	0,4
2006	5951,3	5782,8	4195,8	2,6	124,5	15,8	1443,7	0,4
2007	6117,6	5948,8	4319,9	2,5	123,6	15,6	1486,7	0,3
2008	6675,5	6470,2	4462,6	2,6	101,2	16,3	1887,2	0,3
2009	6914,2	6690,5	4628,2	2,6	79,3	16,6	1963,5	0,3
2010	7149,3	6912,3	4785,1	2,6	82,2	15,1	2027,1	0,2
2011	7219	6977,3	4848,9	2,6	77,1	15,7	2032,8	0,2
2012	7267,2	7023,5	4865,7	2,6	74,5	16,8	2063,7	0,2
2013	7331,6	7084,1	4868,5	2,6	71,9	15,9	2125,1	0,1
2014	7168,5	6946	4855,1	2,7	70,3	16,1	2001,5	0,3
2015	7228,5	6986,8	4815,9	2,7	72,5	16,3	2079,1	0,3
2016	6917	6709,3	4862,1	2,6	57,3	16,6	1770,0	0,7
2017	7014,5	6798,8	4891,7	2,6	57,3	15,7	1830,9	0,6
2018	7154,8	6924,6	4918,0	2,6	57,3	15,7	1930,4	0,6
2019	7198,6	6967,3	4926,9	2,6	57,4	16,7	1963,2	0,5
2020	7342,3	7103,2	4944,1	0,8	57,4	17,1	2083,8	-
2021	7287,5	7051,9	4956,2	0,8	57,3	17	2020,6	-
2022	7271,2	7035,5	4959,5	0,8	57,3	16,5	2001,4	-
2023	7232,5	7000,7	4987,5	0,8	40,8	17,6	1954,0	-

As part of the lands of settlements, As can be seen from Table 13, agricultural land occupies the largest part of the land of localities. So in 2023, the share of agricultural land in the structure of land in localities amounted to 81.8% or 859.6 thousand hectares, of which pastures account for 820.4 thousand hectares or 78% of the total territory of localities.

Table 13. Dynamics of land composition in settlements of North Kazakhstan region for 2011-2022 (thousand hectares)

Land composition of localities	By year												
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Total area	915,4	933,8	599,8	956,8	956,8	947,3	985,2	985,2	989,4	1004,1	1016,4	1041,5	1051,1
Including: Arable land	18,0	18,9	18,7	18,1	18,1	18,1	25,2	25,2	25,3	29,3	29,7	30	29,7
Perennial plantings	0,8	0,8	0,8	0,8	0,8	0,9	0,9	0,9	0,9	3,2	3,2	3,2	3,2
Deposits	2,4	2,4	2,7	2,6	2,6	2,1	2,2	2,2	2,4	2,6	3,0	3,4	3,7
Hay	1,8	1,8	2,0	2,0	2,0	2,0	2,4	2,4	2,3	2,4	2,4	2,6	2,6

continuation of table 13

1	2	3	4	5	6	7	8	9	10	11	12	13	14
Pastures	722,6	738,5	761	758,4	758,4	749,5	775,5	775,5	779,2	780,7	791,7	812,4	820,4
Gardens and official holdings	2,7	2,7	2,7	2,6	2,6	2,6	2,8	2,8	2,8	0	0	0	0
Total agricultural lands	748,3	765,1	787,9	784,5	784,5	775,2	809,0	809,0	812,9	812,2	830,0	851,6	859,6
of Forest area and wood-kustarnikinew plantations	7,5	7,6	7,8	7,8	7,8	7,7	8,4	8,4	8,5	12,0	12,0	12,3	12,4
Swamps	Of 17.8	18	18,5	18,8	18,8	18,7	19,7	19,7	19,7	20,3	20,4	20,9	21,3
Under water	43,4	44	46,5	46,7	46,7	46,7	47,6	47,6	48,3	49,2	49,3	52,0	52,7
Under spaces roads, streets, parks	15,5	15,6	16,1	13,5	13,5	15,8	15,9	15,9	15,6	14,1	14,2	14,4	14,4
Under the buildings	of 63.5	63.3 per	62,4	62,3	62,3	62,7	63,2	63,2	63	65,3	65,3	65,2	65,3
other land including channels and disturbed land	19	19,8	20,6	23,2	23,2	20,5	21,4	21,4	21,4	25,0	25,2	25,1	25,4

Source: Consolidated analytical report on the status and use of lands of the Republic of Kazakhstan [45].

In the region, there is a positive trend in the direction of allocating land resources for planting perennial plantings in settlements from 2.4 thousand hectares in 2011 to 3.2 thousand hectares in 2023. Perennial plantings include land plots used for artificially created tree and shrubby perennial plantings intended for harvesting fruit and berry, technical and medicinal products, as well as for decorative design of the territory. There is also a slight expansion of territories under construction (63.5 thousand hectares in 2011, 65.3 thousand hectares in 2023).

During the period of years from 2011 to 2023, land on the lands of localities expanded under deposits from 2.4 thousand hectares to 3.7 thousand hectares. Wetlands in localities also increased from 17.8 thousand hectares to 21.3 thousand hectares, respectively. The rational use of land under squares, roads, streets, parks decreased from 15.5 thousand hectares to 14.4 thousand hectares, the territories of other lands, including canals and disturbed lands, increased from 19.0 thousand hectares to 25.4 thousand hectares . The dynamics of land use in settlements of the North Kazakhstan region shows that in 20 years from 2004 to 2023 the development of territories for rural settlements has changed from 926.4 thousand hectares to 1051.1 thousand hectares (an increase of 124.5 thousand hectares or 13.5 %). The territory of cities and towns has changed,

respectively, from 23.5 thousand hectares to 37.1 thousand hectares (an increase of 13.6 thousand hectares or 36.6% over 20 years) (Table 14).

Table 14-Land areas of localities by North Kazakhstan region (thousand hectares)

Year	Settlements total	Cities and towns	, Rural settlements
2004	of 926.4	23,5	902,9
2005	922,4	24,2	898,2
2006	921,9	24,1	897,8
2007	922,3	24,2	898,1
2008	919,1	24,1	895,0
2009	915,9	24,0	891,9
2010	920,1	24,0	896,1
2011	915,4	22,8	892,6
2012	933,8	22,7	911,1
2013	959,8	23,0	936,8
2014	956,8	20,7	936,1
2015	950,4	21,1	929,2
2016	947,3	21,1	926,2
2017	985,2	22,3	962,9
2018	983,4	22,3	961,1
2019	989,4	22,5	966,9
2020	1004,1	37,2	966,9
2021	1016,4	37,2	979,2
2022	1041,5	37,1	1004,4
2023	1051,1	37,1	1014,0

The land of localities in the North Kazakhstan Region is subdivided into the land of cities and towns, as well as into the land of rural localities, and their increase is observed in dynamics over the years (Figure 5).

As part of the project for 2024, information was collected on the land resources of the North Kazakhstan region in the context of land categories. For this purpose, the materials of the annual report of the Committee on Land Resources Management of the Republic of Kazakhstan for the last 20 years (2004-2023) were used. In the future, it is planned to collect additional data by districts, as well as by land categories to study the economic use of all categories of land, especially agricultural land, including arable land and pastures, according to their quality condition, the yield of leading crops in the region – this will be the object of further study. Land analysis and evaluation will be carried out by land category, by each district, and separately by quality composition.

Based on the results obtained, it can be concluded that there have been significant changes in the structure of land distribution by category over the past 20 years. The most significant of them are related to agricultural land. In the early 90s of the twentieth century, they accounted for

91.7 % of the total area of the region, while as of January 1, 2023 – 73.7%, i.e. their area decreased by 18%.

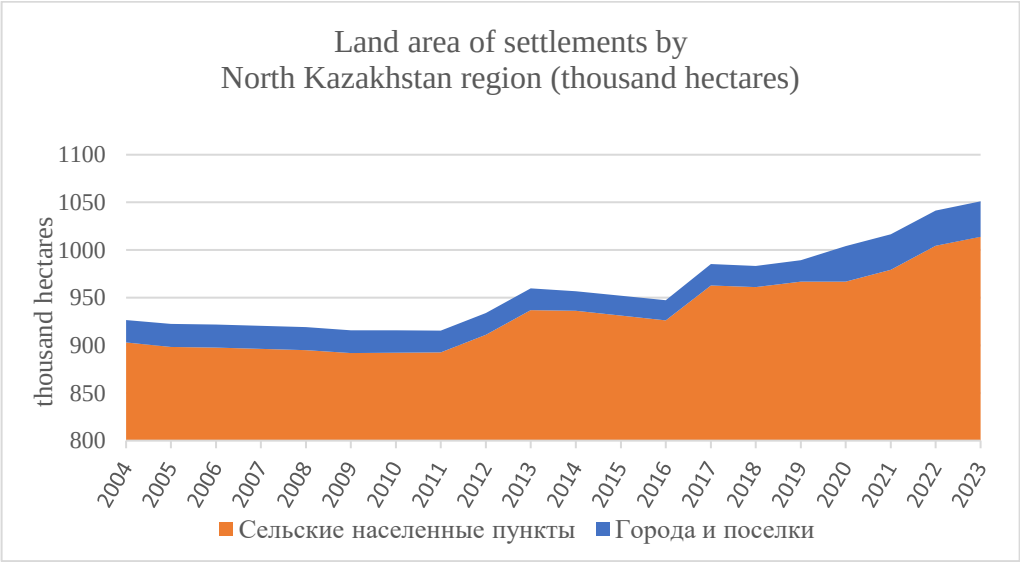


Figure 5-Dynamics of land of settlements in the North Kazakhstan region for the period from 2004 to 2023

The main reason for these changes is the massive withdrawal of land from the category of agricultural use, in the category of land in localities. The remaining minor changes are of a different nature, often associated with negative consequences of operational activities, or their loss occurred due to redistribution to other categories of land.

In general, the current state of the land of the most valuable category of agricultural land in the North Kazakhstan region is changing, but only slightly (in territorial terms). The changes mainly relate to the quality condition and use, where such phenomena as overgrowth, overgrowth, abandonment, and non-involvement in agricultural production prevail.

We note the great difficulties that arise when determining a comprehensive land assessment due to the lack of information about land not only for agricultural purposes, but also for other categories, or the fragmented and chaotic nature of this information. Therefore, the issues of information support for land management in the region require a special solution, which involves specific developments in the development and formation of a land information system, on the basis of which it is possible to make a qualitative socio-ecological and economic assessment of land.

Soil characteristics. Changes in the soil cover on the territory of the North Kazakhstan region are observed from north to south due to changes in climatic and soil zones and subzones. Changes are also observed in soil types in areas of water bodies, rivers, and watersheds. Soils in the region are mainly represented by ordinary chernozems of heavy mechanical composition, with varying degrees of salinity. They are characterized by low water permeability, high moisture capacity, and low aeration. The water-physical properties of soils in spring lead to a long mud condition, which interferes with the spring processing of fields. In summer, when dry conditions

and windy weather are established, such soils are strongly cemented, deep cracks can form on the surface, which contributes to a significant loss of moisture from the soil, impairs the growth and development of agricultural crops. A number of soil types and subtypes are distinguished on the territory of the region [46]. When analyzing the current state of the soil cover of the territory of the North Kazakhstan region, published and stock materials were used [47-53].

Types of soils. Soil cover of the North Kazakhstan region on the territory of two soil zones and three subzones [49-53]:

1. Forest-steppe zone of gray forest soils and associated soils;

2. Steppe zone with 3 subzones:

- moderately moist steppes on ordinary chernozems and associated soils;

- moderately arid steppes on southern chernozems and associated soils;

- dry steppes on dark chestnut, including low-humus (medium-chestnut), and their associated soils.

Each soil zone and subzone is characterized by the predominance of a certain type and its accompanying soils. To reflect the nature of the spatial distribution of soils in the region, we used a soil classification based on taxonomic categories developed by A. A. Sokolov, O. G. Erokhina, K. M. Pachikin, and M. M. Kusainova for the territory of Kazakhstan and reflected by them on soil maps [49, 50].

The territory of the North Kazakhstan region is represented by a number of zonal soil types, subtypes and genera of soils, the distribution of which is shown on the map (Figure 6):

1) Type, subtype: gray forest. Genus: gray forest rejuvenated.

2) Type: chernozems.

Subtype: common chernozems. Genus: ordinary carbonate chernozems; ordinary saline chernozems; poorly developed ordinary chernozems; incompletely developed (xeromorphic) gravelly chernozems;

Subtype: southern chernozems. Genus: southern carbonate chernozems; southern solonetzic chernozems; poorly developed southern chernozems; incompletely developed (xeromorphic) gravelly chernozems.

3) Type, subtype: meadow-chernozem. Genus: meadow-chernozem solonetzic.

4) Type: chestnut.

Subtype: dark brown. Genus: dark chestnut salty, dark chestnut poorly developed, dark chestnut incompletely developed (xeromorphic) gravelly. In addition to zonal soils, intrazonal soils are widespread in the region: meadow, floodplain, malt and solonets.

The territory of the North Kazakhstan region is characterized by a high complexity of the soil cover, especially widespread complexes of saline chernozems with malt.



Figure 6-Soils of the North Kazakhstan region

Characteristics of the soil condition. Gray forest -aged soils occupy a relatively small territory on an area of 76 thousand hectares, in the northern part of the region, mainly within the Zhambyl, Mamlyut and Kyzylzhar districts. Soils develop under grassy birch, birch-aspen forests and kolki. They have a humus horizon thickness of 30-40 cm. The humus (nitrogen) content at the surface reaches 8-13% (nitrogen - 0.4-0.7%), but decreases sharply in depth. The upper horizons of soils have a slightly acidic reaction, while the lower horizons have a neutral or slightly alkaline reaction.

Ordinary normal chernozems create the main background of the soil cover of the territory of the region. They are distributed mainly in the territories of Kyzylzhar, G. Musrepov, M. Zhumabayev, Shal akyn, Timiryazevsky, Yesilsky, Mamlyutsky, Tayynshinsky, Ualikhanov, Ayyrtau districts. The average thickness of the humus horizon is 45 cm. The content of humus (nitrogen) from above reaches 7.5-8.0% on virgin land (nitrogen-0.4-0.5%), and decreases to 6.2% on old - field land (nitrogen-0.3-0.4%), respectively. They are poor in phosphorus, their total content in the soil is about 0.1%. The depth of carbonate occurrence is 35-40 cm, gypsum is detected from a depth of 140-160 cm. The amount of exchangeable sodium in the profile does not exceed 1%, which indicates the absence of salinity.

Ordinary carbonate chernozems are distributed mainly in the territories of Akkayynsky, Yesilsky, Timiryazevsky, Ayyrtausky, Tayynshinsky, Mamlyutsky, Akzharsky, named after M. Zhumabayev districts. They are characterized by a high content of carbonates in the upper horizon. The humus content is 6-8%. Soils contain calcium carbons in all their horizons, the upper horizon

boils violently from hydrochloric acid, and the lower part of the profile contains easily soluble salts.

Common solonetzic chernozems are located in depressions of the relief, spread mainly in the territories named after G. Musrepov, Akkayynsky, M. Zhumabayev, Shal Akyn, Timiryazevsky, Yesilsky, Zhambylsky, Kyzylzharsky, Tayynshinsky, Akzharsky, Ayyrtausky, Mamlyutsky, Ualikhanov districts. A characteristic feature of soils is the presence of a saline horizon in the lower part of the profile. Salinization is mainly of a sulphate nature. The accumulation of gypsum is found at a depth of 80-120cm. In terms of nutrient reserves, saline chernozems are somewhat inferior to normal and carbonate soils, with the exception of mobile phosphorus, whose reserves are higher. It is marked by a high content of total nitrogen in comparison with unsalted ones.

Ordinary low-developed and incomplete (xeromorphic) gravelly chernozems are confined to small-scale areas, located on the territories of the Ayyrtau district within the Kokshetau upland. In the south-east of the district. Within the Kokshetau upland on ordinary chernozems with outcrops of bedrock. deluvial yellow-brown cartilaginous loams and quaternary carbonate clays serve as soil-forming rocks. Therefore, their profile is shortened and is characterized by stony conditions. The difference between them lies in the depth of the bedrock: in underdeveloped soils, the bedrock lies from a depth of 30-80 cm, and in underdeveloped soils - from 10-30 cm. On the gravelly slopes of the hills - poorly developed chernozems.

Southern normal chernozems develop in arid steppe conditions. They are distributed mainly in the southern part of the region. The thickness of the humus horizon of soils is 45-47 cm. The content of humus on virgin land is from 5-6 to 7%, nitrogen 0.3-0.35%, on old-field 4-5 and 0.25- 0.30%, respectively. They are characterized by a low phosphorus content.

Southern carbonate chernozems are distributed mainly in the territories of Akzhar, Ualikhanov, Gabit Musrepov, Magzhan Zhumabayev, Mamlyut, and Ualikhanov districts. Carbonate content is detected from the surface or from a depth of 28-30 cm, gypsum-in the range of 100-120 cm. A characteristic feature of soils is the large reserves of nitrate nitrogen in the profile. In terms of chemical and agrophysical parameters, these soils are close to ordinary chernozems.

Southern solonetzic chernozems are found in various complexes with solonets. Humus in the upper horizon contains about 4%. Sodium also takes part in the composition of the absorbed bases, which confirms the salinity of soils. The salt accumulation horizon is often located at a depth of 70-90 cm. The type of salinity is mainly sulfate. They are distributed mainly in the territories of Gabit Musrepov, Akkayyn, and Ualikhanov districts.

Meadow-chernozem soils occupy low relief elements of the plains, are distributed mainly in the territories of Zhambyl, Akkayyn, and named after M. Zhumabayev. Yesil, Kyzylzhar, Mamlyut, Akzhar, Ualikhanov, and Ayyrtau districts. Morphological features of these soils are the darker color of humus horizons, the presence of rusty spots and bluish spots in the lower horizons. The soils are mainly medium-humus (7-9, 6-8% on arable land), but there are low-humus (4-7, 4-6% on arable land) and multi-humus (over 9%, more than 8% on arable land). Total nitrogen in them is 0.4-0.5%, gross phosphorus-0.1- 0.2%.

Dark chestnut soils are formed in the steppe zone on elevated plains along the slopes of hills. They are distributed in the south-eastern part of the region mainly on the territory of the Ualikhanov district. The thickness of the humus horizon varies in the range of 38-45 cm. The humus content on top of virgin land is 3.5-4.5%, on staropashne-2.5-3.5%, nitrogen 0.2-0.32 and 0.15-0.2%, respectively. A characteristic feature of these soils is the increased sandiness of the profile. Easily soluble salts are present at a depth of 130-150 cm, i.e. the profile of these soils is practically not saline.

Dark chestnut solonetzic soils are developed in low relief mainly in a complex with solonets. Gypsum and easily soluble salts are found in soils from a depth of 90-110 cm. Dark chestnut undeveloped and incompletely developed (xeromorphic) gravelly soils are significantly distributed on the elluvium of the bedrock of the hills.

Meadow soils are quite widespread in both forest-steppe and steppe zones, where they occupy significant areas in river valleys. The thickness of the humus layer is usually up to 25 cm, but it can also be high. Often there are small areas with humus content up to 12%, but mostly there is a humus content of 6-8%.

Floodplain soils develop in the floodplains of large rivers on layered alluvial deposits, and vast tracts of these soils are confined to the river floodplain. Yesil. The structure of these soils depends on many factors, including the duration of the flood, the occurrence of ground water, etc. The humus content is from 1% in young floodplain soils, up to 5-6% in floodplain meadow sedimentary soils. The floodplains have saline, saline, and hydromorphic soils in low near-terrane areas.

Malts are distributed on the territory of the region mainly in the black earth zone of the forest-steppe and steppe zone, they are widely distributed in the territory of M. Zhumabayev and Kyzylzhar districts. They develop in conditions of excessive surface moisture. The soil profile has sharply differentiated horizons. The humus content horizon is 40-45 cm. The upper horizon of 0-5 and up to 10 cm is a forest floor of semi-decomposed leaves, branches and grasses. The content of humus (nitrogen) in the sod horizon is 6-7% (0.3% nitrogen), in the rejuvenated and illuvial horizon - 0.5-0.6% (0.05 - 0.06% nitrogen).

Solonets are widely distributed in the region, mainly in combination with zonal soils, mainly in the territories of Akzhar and Ualikhanov districts. Solonets usually contain 2-3% or more of humus in the upper horizon. Depending on the humus content, the total nitrogen content varies, but its content is not more than 0.2%. Solontsy is typically poor in gross phosphorus, only hundredths of a percent.

Distribution of soil types by administrative districts:

1) Kyzylzhar district. The structure of the soil cover is dominated by meadow-chernozem soils, ordinary chernozems, in the extreme south-eastern part of the region - ordinary solonetzic chernozems, in the northern part - gray forest-aged, in the extreme northern part - large massifs of solonets.

2) Zhambyl district. The soils are mainly represented by ordinary chernozems, ordinary solonetzic chernozems, meadow-chernozems, in the western part of the region - ordinary solonetzic chernozems in combination with malt.

3) Mamlyut district. The northern part of the region is dominated by meadow-chernozem soils in combination with malt and spots of ordinary chernozems, large massifs of solonets. The entire eastern part of the region is represented by ordinary solonetzic chernozems in a complex with malt, the western part is represented by ordinary normal chernozems, and the southwestern part is represented by ordinary carbonate chernozems.

4) Akkayyn district. The structure of the soil cover is dominated by ordinary normal chernozems. In the western, north-eastern and south-eastern parts of the region, ordinary solonetzic chernozems developed, and in the eastern part, ordinary carbonate chernozems developed.

5) M. Zhumabayev district. The structure of the soil cover is dominated by ordinary normal chernozems, with separate massifs of solonets. Meadow-chernozem soils in combination with malt are common in the northern part of the district, while small areas of ordinary chernozems are common in the northwestern part. In the south-western and southern parts, ordinary solonetzic chernozems and ordinary carbonate chernozems are widely represented. The rest of the territory is characterized by the development of ordinary carbonate chernozems.

6) Timiryazevsky district. In the northern and north-western part, ordinary normal chernozems, ordinary solonetzic chernozems and complexes of solonetzic chernozems with malt are mainly developed. Ordinary solonetzic chernozems are also found in the south-eastern part of the region, while ordinary carbonate chernozems are common in the rest of the territory.

7) The district named after him. Shalakyna. The structure of the soil cover is dominated by ordinary normal chernozems, while meadow-chernozem and floodplain soils are of subordinate

importance. In the western part of the region, common solonetzic chernozems are developed in combination with malt, in the south-western part - mainly ordinary carbonate chernozems.

8) Esil district. On the territory of the district, the soils are represented by ordinary normal chernozems, patches of meadow-chernozem soils, and floodplains. In the north - western, western part of the territory, common solonetzic chernozems in combination with malt are widely distributed. In the northern part of the region, common solonetzic chernozems have developed.

9) Tayynshinsky district. The structure of the soil cover is dominated by ordinary normal, carbonate and saline chernozems, ordinary saline chernozems in combination with malt. To the southeast, the soils of the common chernozem subtype pass into the southern chernozem subtype. The soils of the south-eastern part are southern normal chernozems and southern solonetzic chernozems. In the subzone of ordinary chernozems, large areas of individual solonets massifs are represented. In the southern part of the territory of the district, ordinary chernozems are widespread, poorly developed and incompletely developed gravelly soils of small hills.

10) Akzhar district. The soil cover is represented by ordinary solonetzic chernozems in the northern and north-western parts of the region, in the north-eastern part - ordinary solonetzic chernozems in a complex with solonets, in the south - ordinary solonetzic chernozems pass to southern solonets and southern solonets in a complex with solonets. In the southern chernozem subzone, meadow-chernozem soils in combination with malt were developed among solonets. Large areas of individual solontsy massifs are distributed throughout the district.

11) Ualikhanov district. The soil cover is characterized as transitional from ordinary chernozems to southern chernozems and from southern chernozems to dark chestnut soils. In the subzone of ordinary chernozems in the north-western part of the region, the soils are represented by ordinary normal chernozems, the rest by ordinary solonetzic chernozems in combination with malt. In the zone of southern chernozems, southern chernozems, carbonate chernozems, and southern solonetzic chernozems are distributed in a complex with solonets. Southern solonetzic chernozems are represented in the south-western part of the district, in the southern part large areas are occupied by solonets. In the subzone of dark chestnut soils, in the south-southeastern part of the district, the soils are represented by dark chestnut normal, salty in combination with malt, meadow-chernozem in combination with malt.

12) G. Musrepov district. The soil cover is characterized as transitional from ordinary chernozems to southern chernozems with the presence of solonetzic complexes. In the northern part of the region, in the subzone of ordinary chernozems, normal chernozems, carbonate chernozems, saline chernozems are developed in a complex with malt. Southern carbonate chernozems are widely distributed in the southern chernozem subzone, southern solonetzic

chernozems are slightly developed in the northwestern part, and southern solonetzic chernozems in combination with malt are represented in the south-southeastern part.

13) Ayyrtau district. Common chernozems are ordinary normal. In the northern part of the district, ordinary solonetzic chernozems in combination with malt and ordinary solonetzic chernozems are mainly developed, in the southern part - ordinary carbonate chernozems, in the eastern part, on the peaks and slopes of hills, ordinary chernozems are poorly developed and incompletely developed gravelly soils. Meadow-chernozem, meadow soils and some solonets massifs are also widespread in the district.

Mechanical composition of soils. Soil varieties are determined by the mechanical composition of the upper soil horizons and soil-forming rocks. The mechanical composition of the upper horizons of the soil profile depends on the thermal, water and food regime of the soil, its chemical, physical and air properties. Usually, the amount of nutrient content decreases from heavy to light soils. The soil-forming rocks in the North Kazakhstan region are mainly Quaternary clays and heavy loams, which cover mainly saline clays. In this regard, saline soils are widespread on saline-bearing tertiary clays and their eluvium [47, 48].

According to the mechanical composition of the North Kazakhstan region, the following types of soils are identified and reflected on the map (Figure 7): clay and heavy loam; clay and heavy loam, carbonate and saline; medium loam and light loam; sandy loam; gravelly.

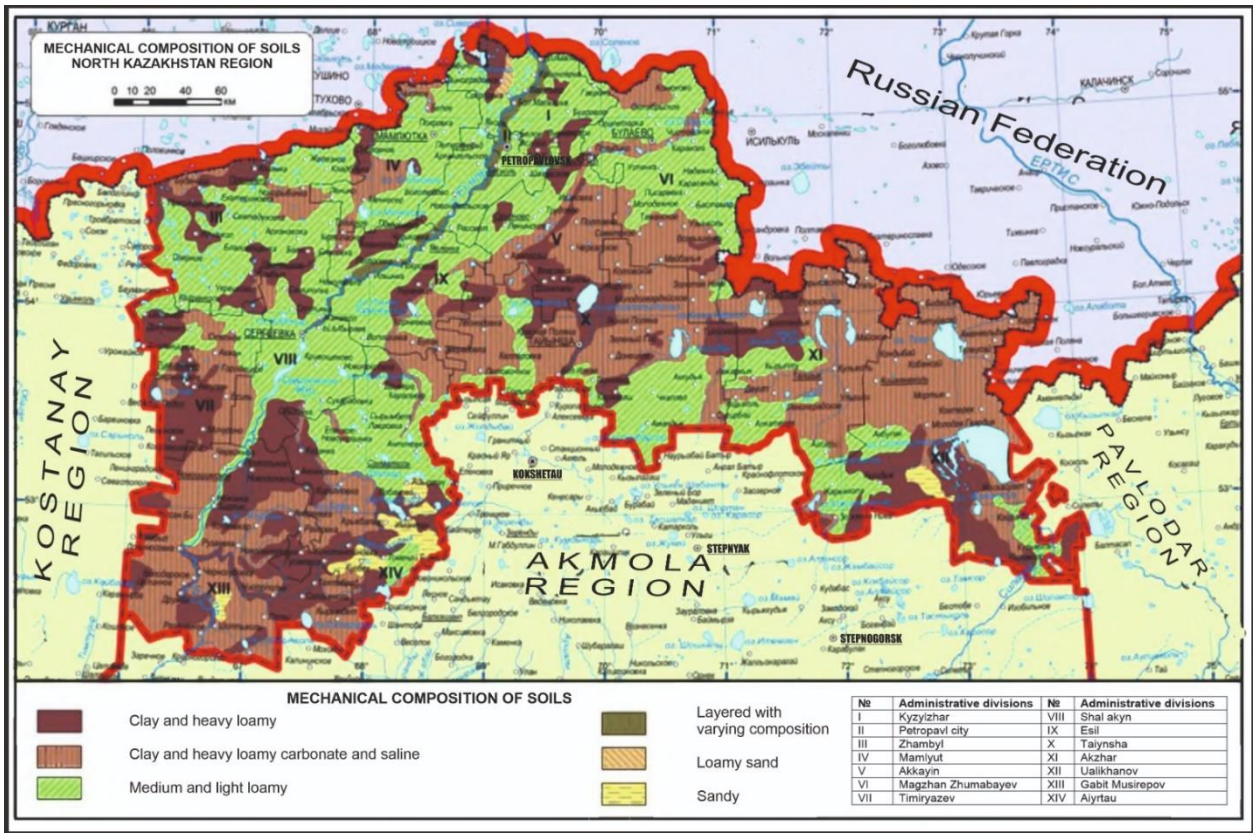


Figure 7-Mechanical composition of soils in the North Kazakhstan region

Most of the region's chernozems are clayey and heavy loamy. The content of physical clay particles in them varies mainly from 55-66%. They are distributed mainly on drained and poorly drained slopes of watersheds adjacent to the river valley. Yessil, mainly in the territories of Kyzylzhar, G. Musrepov, M. Zhumabayev, Shal Akyn, Timiryazevsky, Yessil, Mamlyut, Tayynshinsky, Ualikhanov, Ayyrtau districts.

Clayey and heavy loamy carbonate and saline soils are distributed mainly over watershed plains composed of carbonate loams and clays. They are distributed mainly in the territories of Akkayynsky, Yesilsky, Timiryazevsky, Ayyrtausky, Tayynshinsky, Mamlyutsky, Akzharsky, named after M. Zhumabayev districts.

Lighter in mechanical composition, medium-loamy and light-loamy rocks with a physical clay particle content of about 25-30% are distributed mainly in the valleys of the Yesil River. Soil formation here occurs on ancient alluvium. They are also found on low relief elements, sometimes on low floodplain terraces of rivers and lakes. They are distributed mainly in the territories of Zhambyl, Akkayyn, and named after M. Zhumabayev. Esil, Kyzylzhar, Mamlyut, Akzhar, Ualikhanov, Gabit Musrepov, Ayyrtau districts.

Sandy loam often develops in the floodplains of large rivers on layered alluvial sediments, extensive massifs of these soils are confined to the floodplain of the river. Yesil. Soil-forming rocks are more often ancient alluvial. They are distributed mainly in the territories of Zhambyl, Mamlyut and Kyzylzhar districts.

Gravelly by mechanical composition soils are distributed in the territories of Aiyrtau, G. Musrepov and Ualikhanov districts in the southern and south-eastern parts of the region.

The characteristics of the soil cover of the territories of the North Kazakhstan region by soil types and mechanical composition, as well as the compiled soil maps allow not only to assess their current state, but also can serve as a basis for developing recommendations and measures for the rational use of agricultural land.

Biodiversity of the territory. Forest fund. The forest cover of the North Kazakhstan region is one of the highest in the republic (5.5%) [54]. The main forest-forming species is birch – 85%, aspen occupies 6% of the total volume, about 11% is occupied by stands of pine, larch, elm, maple, ash. As of 01.01.2023, the state forest fund under the jurisdiction of the Akimat of the North Kazakhstan region is 549.5 thousand hectares, of which 75 % are covered with forest.

There are 12 municipal state forestry institutions operating on the territory of the region, the main purpose of which is to preserve biodiversity and develop the system of specially protected natural territories. To achieve positive results, existing scientific, technical, human, legal and economic opportunities are used. Forest resources are provided to forest users for long-term or short-term use, depending on the type of forest use [54].

Specially protected natural areas (SPNAs). The total area of protected areas in the North Kazakhstan region is 601,772 ha, including 6 nature reserves with an area of 467,140 ha [55]:

- 4 nature reserves of national significance (Sogrovsky, Smirnovsky, Mamlyutsky, Orlinogorsky), with an area of 429,950 hectares;

- 2 local nature reserves (Aksuatsky (zoological) – 10,508 ha, Akzhansky (zoological) – 26,682 ha);

- 12 natural monuments of national significance with a total area of 181.4 hectares.

On the territory of the region there are Arykbalyk, Ayyrtau and Shalkar branches of SSPE "Kokshetau", covering an area of 134.9 thousand hectares, which includes natural monuments of republican significance [54]:

- Kazachy Island on the lake. Imantau has an area of 34.4 hectares, covered with natural relict pine ;

- the hill "Obozrenie" in the south-west of the village of Gorny, the area of 3.8 hectares is covered with natural relict pine;

- the rock deposit "Kotelok" in the forest area of "Karauyltobe", an area of 3.9 hectares, is an exotic rock and stones covered with relict pines;

- the relict massif in the territory of the "Karauyltobe" forestry area, covers an area of 2 hectares, is covered with relict pine forest, under the shade of which a rare species of fern-eagle grows;

- the "Two Brothers" hill in the "Kostobe" forestry area of 10.5 hectares, consists of two hills with a common saddle, relict pines grow here;

- "Sharp hill" in the forest district "Kostobe" with an area of 3 hectares, covered with relict pine;

- "Waterfall with a cave" in the forest district "Kostobe", an area of 0.5 hectares, where relict pines grow;

- "Split hill" in the forest district "Kostobe", an area of 2 hectares, covered with relict pines.

4 nature monuments of national significance cover an area of 121 ha: Sosnovy Bor – 26 ha, Serebryany Bor – 83 ha, Zhanazhol – 9 ha, Orlinaya Gora and Rodnikovy Klyuch-3 ha [54]. Table 7 provides information on specially protected natural areas (Table 15).

Local nature reserves are intended for the protection and reproduction of the steppe marmot population and have very peculiar landscapes located within the steppe zone with a specific vegetation cover and the presence of large lakes. Due to this, 161 species of animals belonging to 24 orders are located within the territory.

Table 15-Protected areas of the North Kazakhstan region

n/	a Name of protected	areas Area, ha
1	Protected areas of national significance	429 950
1.	Sogrovsky (zoological)	134 100
2.	Smirnovsky (zoological)	240,000
3.	Mamlyutsky (Zoological)Museum	52 400
4.	Orlinogorsky (Botanic)	3 450
2	Local nature reserves	37 190
1	Aksuatsky (zoological)reserve	10 508
2	Akzhansky (Zoological)	26 682
3	Branches of the State Enterprise "Kokshetau" Arykbalyksky, Ayyrtausky and Shalkarsky	134,900
4	Nature monuments of national significance	181,1
1.	Kazachy Island on the lake. Imantau	34.4
2.	Sopka "Obozrenie"	3.8
3.	Rock deposit "Kotelok"	3.9
4.	Relict massif in the territory of the"Karauyltobe" forestry	2
5.	Hill "Two brothers" in the forest district "Kostobe"	10,5
6.	"Sharp hill" in the forest district "Kostobe"	3
7.	"Waterfall with a cave" in the forest district "Kostobe"	0.5
8.	" Split hill " in the forest district "Kostobe"	2
9.	Sosnovy bor	26
10.	Zhanazhol	83
11.	Serebryany bor	9
12.	Orlinaya Gora and Rodnikovy Klyuch	3

By the number of species, the most representative is the Bird class, which includes 129 species. The main mass of birds consists of geese, swans, river and diving ducks, sandpipers and gulls migrating through this territory. 9 species from the International Red Book and the Red Book of Kazakhstan (Curly Pelican, Red-throated Goose, Whooper Swan, Steppe Eagle, Burial Ground Eagle, White-tailed Eagle, Gray Crane, Belladonna Crane, and Strepet) are regularly found within the protected area [56].

Steppe areas are inhabited by groundhog-baibak, whose number is increasing annually due to conservation measures-Akzhansky 2820 individuals, Aksuatsky-2304 individuals (accounting for 2019). The baibak is one of the largest squirrels: its body length is 50-70 cm, the weight of the fattened males reaches 10 kg. The body of the baibak is thick, with short, strong legs armed with large claws. The head is large, flattened, and the neck is short.

The predominant species in forests on the territory of state natural monuments, including the Orlinogorsk Botanical Reserve, are relict pine stands, and in the territory of state nature reserves (zoological) – birch.

Animal world. At least 378 species of vertebrates live on the territory of the North Kazakhstan region, including 57 species of mammals, 283 species of birds, 5 species of reptiles, 6 species of amphibians, and about 30 species of fish [56].

Among invertebrates of the North Kazakhstan region, insects are distinguished by the highest species diversity.

The zooplankton of lakes and rivers in the North Kazakhstan region is most diverse in three groups that play a leading role in aquatic ecosystems: rotifers, branchipods and copepods, as well as a number of benthic representatives (leeches, mollusks, water mites, beetles, fly larvae and other insects, caddis flies and crustaceans).

Amphibians include gray and green toads, Siberian frogs, and others. Among reptiles, there are quick and viviparous lizards, common grass snakes, steppe and common vipers.

The bird fauna is most diverse among the vertebrates of the region and includes 20 orders. The most numerous among them is the order passerinaceae, which includes about 100 species (1/3 of all birds in the region). The most common among them are the house sparrow, rook, gray crow, blackbird-rowan, etc. About 40 species are represented by the order ploveriformes. The order geese, which includes about 26 species that nest and fly during spring and autumn migrations, is of great economic and biocenotic importance. Among its representatives are 5 species of geese, 18 species of river, diving and ground ducks and 3 species of baby birds. The breeding population includes the grey goose, mallard, grey duck, 2 species of teal, red-headed and crested cherneti, etc. All these species are objects of amateur hunting. Among other orders of interest from the point of view of biodiversity conservation, it is necessary to mention diurnal birds of prey, numbering about 20 species, 5 of which are listed in the Red Book of the Republic of Kazakhstan.

The mammalian fauna is represented by 6 orders: insectivores, bats, hares, rodents, carnivores and artiodactyls. The most numerous and diverse in distribution are the order rodents – more than 12 species, among which there are representatives of both the forest fauna, for example, the common squirrel and the forest mouse, and the steppe groundhog, reddish and red-cheeked ground squirrels, etc. Muskrat and water vole are found among the inhabitants of water bodies. There are also synanthropic species-house mouse and gray rat. Among the representatives of the order of hares, the white hare and the hare-hare live on the territory of the region.

The predatory group includes 12 species of animals, of which the most common are the fox, korsak, steppe polecat and kolonok, badger. All representatives of this group, with the exception of the forest marten, beaver and mink, are objects of hunting.

The composition of other orders includes: insectivores-7 species, artiodactyls-4 species, hares-2 species and bats-1 species. The most poorly studied of these orders are representatives of bats. Meetings with them in the region are constantly recorded, but it is not possible to say exactly

which type is characteristic of the North Kazakhstan region. The situation is similar with insectivores, some of whose species are missing.

From birds among the rare and endangered species of birds, the belladonna crane, gray crane, and whooper swan nest in the territory of the region.: flutterer, eagle owl, white-tailed eagle and burial ground (Table 16). In recent years, nesting of the curly pelican has been noted, and meetings of the black-headed giggler have been noted. During the spring migration, the white-fronted goose, red – throated goose, white-fronted goose, small swan, single-osprey, savka, golden eagle, turpan, and owl are found on the flight. Of the hunting species, 4 species of ungulates, 12 species of fur-bearing animals, 14 species of hog and waterfowl constantly inhabit the territory of the region [56].

Table 16-Number of animal and bird species listed in the Red Book of the Republic of Kazakhstan in the North Kazakhstan region in 2022 [54]

№	Name	Quantity, units
1.	Forest marten	2 173
2.	Grey Crane	8 522
3.	The Whooper Swan	9 282
4.	Krasavka Crane	2 964
5.	Strepet	779
6.	Curly pelican	241
7.	Golden Eagle	79
8.	White-tailed Eagle	76
9.	Filin	65
10.	Osprey	17
11.	Burial ground	90
	Total	24 288

In 2022, the number of wild animals was recorded throughout the entire territory of the North Kazakhstan region, including on assigned hunting farms, territories of the reserve fund, reserves and the Kokshetau State Nature Reserve (Table 17).

Table 17-Number of hunting animal species in the territory of North Kazakhstan region for 2021-2022, units [54]

	Name	Quantity, units	
		2021	2022
1	2	3	4
1.	Elk	535	674
2.	Ascanian deer	51	56
3.	Maral	1 661	1 683
4.	Siberian roe deer	18 093	18 858
5.	Wild boar	2 401	2 707
6.	The Fox	10 332	10434
7.	Corsac	4 106	4 223
8.	Raccoon Dog	1 141	1 172
9.	Lynx	16	21
10.	Hare	24 572	25 817
11.	Steppe Ferret	3 385	3 289

continuation of table 17

1	2	3	4
12.	Tenderness	1 219	1 245
13.	Columns	1 566	1 519
14.	American Mink	854	887
15.	Ermine	1 054	1 176
16.	Badger	5 399	5 701
17.	Groundhog baibak	17 130	17 012
18.	Muskrat	32 008	31 736
19.	River Beaver	805	879
20.	Squirrel	183	186
21.	Pigeon	14 119	14 541
22.	Quail	44 121	44 233
23.	Grouse	12 508	12 691
24.	Partridge	14 244	14 992
25.	Duck	443 030	445 630
26.	Coot	121 928	122 652
27.	Goose	63 906	65 942
28.	Kulik	69 347	70 891
	Total:	909 714	920 847

Fishing industry. There are 2,426 reservoirs on the territory of the North Kazakhstan region, 501 of which are included in the list of fishery reservoirs as the most promising for fishing. Of these, 318 reservoirs were transferred to the use of 144 fisheries entities, and 183 reservoirs are in reserve [54].

2.3 Regional water resources

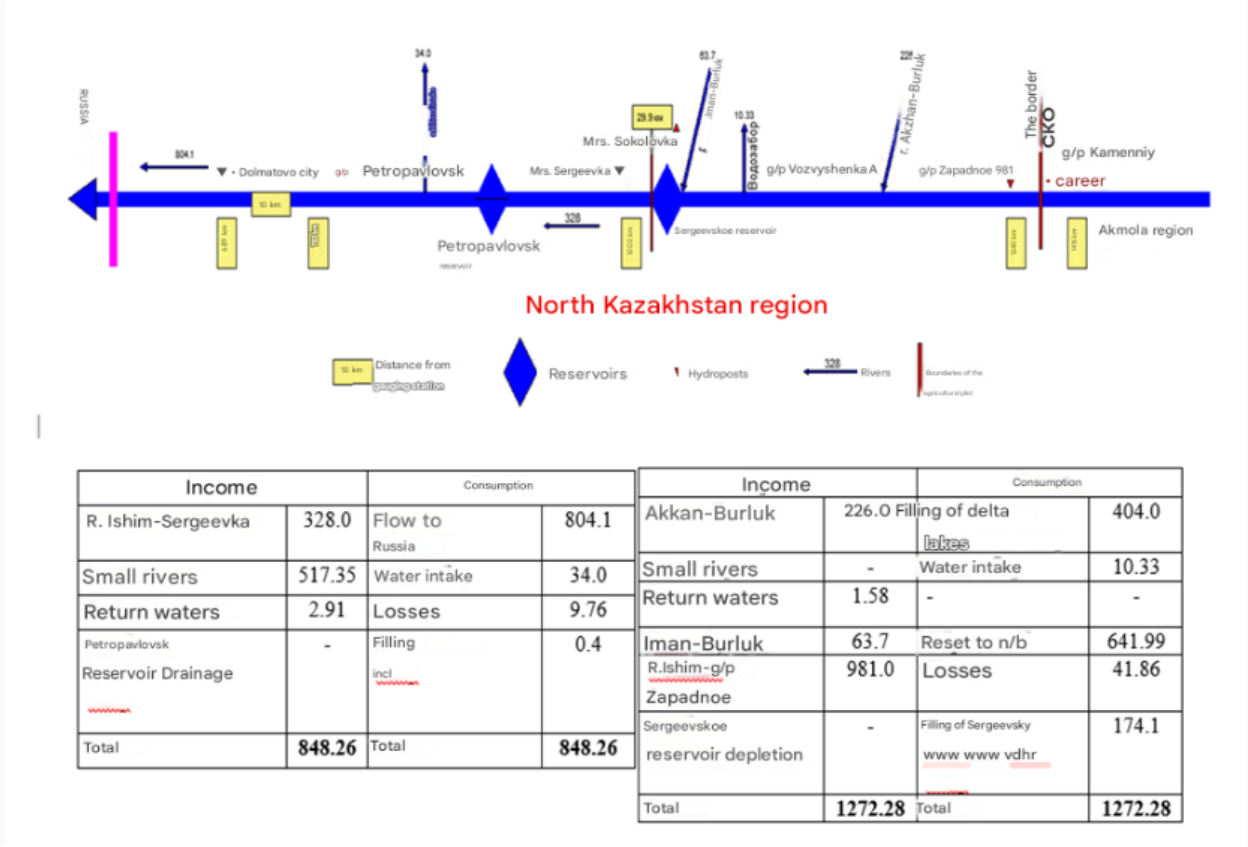
According to the surface structure, the North Kazakhstan region is a low-lying, slightly undulating, poorly divided plain with a large number of shallow depressions occupied by lakes and an extremely insignificant development of the river network. Located in the middle of the steppe, lake depressions sometimes form weakly expressed hollows, of which the largest is the system of the former Kamyshlovka River.

The flat surface of the former North Kazakhstan region caused a peculiar hydrographic appearance of the latter, characterized by the almost complete absence of a river network and the presence of a large number of lakes. On the territory of the region there are about 3500 lakes with a total area of 3.44 thousand^{km2}, the number of swamps is about 450 units with a total area of 0.86 thousand^{km2}. The lakes are mostly drainless, while temporarily flowing bodies of water are found in the valley of the river. Similarly, in ancient river valleys, for example, in the Kamyshlovka River valley, the existence of a large number of local lakes is due to the surface runoff of meltwater, atmospheric precipitation, and in some cases also ground water.

The predominantly flat terrain of the North Kazakhstan region has led to the fact that the hydrographic profile is characterized by the absence of a river network and a significant number of lakes. There are about 2,120 lakes in the region, with a total area of 3.44 thousand km2; in addition, there are about 92 swamps with a total area of 0.86 thousand km2. Most of these lakes are characterized by a drainless nature; temporarily flowing reservoirs are found in the valley of the river. Similarly, in ancient river valleys, for example, in the Kamyshlovka River valley, the existence of a large number of local lakes is due to the surface runoff of meltwater, atmospheric precipitation, and in some cases also to ground water [57].

The main waterway is the r. Yesil, which is located after the confluence of the Lower Burluk River, flows in transit. A 690 km long section of the river is located within the region. The Yesil River within this region receives only a few temporary watercourses with a length of 5-10 km. The natural hydrological regime of the river has been changed since the late 60s with the commissioning of a cascade of reservoirs. These are the Sergeyevskoye reservoir of long-term regulation and the Petropavlovsk reservoir of seasonal regulation.

Water resources of the North Kazakhstan region consist of the resources of the river basin. Esil (Figure 8), including its constituent basins: Babyk-Burluk, Iman-Burluk River, Akan-Burluk River [57].



Income		Consumption	
R. Ishim-Sergeevka	328.0	Flow to Russia	804.1
Small rivers	517.35	Water intake	34.0
Return waters	2.91	Losses	9.76
Petropavlovsk Reservoir Drainage	-	Filling incl	0.4
Total	**848.26**	Total	**848.26**

Income		Consumption	
Akkan-Burluk	226.0	Filling of delta lakes	404.0
Small rivers	-	Water intake	10.33
Return waters	1.58	-	-
Iman-Burluk	63.7	Reset to n/b	641.99
R.Ishim-g/p Zapadnoe	981.0	Losses	41.86
Sergeevskoe reservoir depletion	-	Filling of Sergeevsky www www vdhr	174.1
Total	**1272.28**	Total	**1272.28**

Figure 8-Layout of the Esil River in North Kazakhstan region

63 rivers flow through North Kazakhstan region, including 18 rivers in Ayyrtau district with a total area of 582 hectares of water mirror, 9 rivers in Akzhar district with a total area of 715 hectares of water mirror, 2 rivers in Esil district with a total area of 3 hectares of water mirror, and 9 rivers in Kyzylzhar district with a total area of 3 hectares of water mirror. the area of the mirror of the Yesil River is 1,510 hectares, in Musrepovsky district-8 rivers with a total area of the water mirror-218 hectares, in Tayynshi district-3 rivers with a mirror area of 119 hectares, in Ualikhanov district - 20 rivers with a total area of the water mirror - 877 hectares, in Shal Akyn district - 2 rivers with a total area of the water mirror - 877 hectares. the total area of the water mirror is 1,612 ha.

Table 18 shows the list of rivers by districts of the North Kazakhstan region.

Total water bodies in the North Kazakhstan Region - 2339, including: lakes with an area of more than 100 hectares-464, olakes with an area of 50 to 100 hectares-491, lakes with an area of 30 to 50 hectares-458, small lakes-707, total lakes: 2120, swamps-92, other reservoirs (ditches, small reservoirs, ponds, tracts, staritsy) – 127, rivers-63 (ablitsa 19) [58].

Data on water resources are placed in the general web register:

(https://drive.google.com/drive/folders/10Dk9lGr_MvG-ftHxcQs_DBlPajFtzspH?usp=drive_linkc)

The Esil River originates from aquifers located in the Niyaz Mountains in the Karaganda region, on the northern edge of the Kazakh Upland. The total length of the river is 2,450 km, of which 1,027 km - in the Akmola region, 690 km-in the territory of the North Kazakhstan region, and then - through the Tyumen region and part of the Omsk region. The most notable tributaries in terms of hydrological capacity and length include the Koluton, Zhabai, Ters-Akkan Rivers located in the Akmola region, as well as the Akan Burluk and Iman-Burluk Rivers located in the North Kazakhstan region. The catchment area of the river basin is 155 thousand^{km2}. The total elevation difference from the source of the river to its confluence is 513 meters, resulting in an average slope of 0.21% [57].

The Akkan-Burluk river originates from the lake. Yakshi-Yangiztau from the western bank, flows into the river. Yesil on the right at 1280 km from the mouth of the river length is 176 km. The catchment$^{area\ is\ 6,720\ km2}$, including 731 km2 of drainless^{2}water. The total drop of the river is 188 m, with an average slope of 1.0%. The main tributaries are the Babyk – Burluk, Kulay-Ayyr, Sharyk and other rivers. The river serves as an important reservoir for domestic drinking water supply and aquaculture. In addition, limited amounts of water are used for irrigation of agricultural land.

Table 18 - List of rivers by districts of the North Kazakhstan region

n /	a River name	Length (km)	Water mirror area in (ha)	Width of the water protection zone (m)	Width of the water protection strip (m)	Number of installed water protection signs
1	2	3	4	5	6	7
Ayyrtau district						
1	Kamysakty	121	27			
2	Iman-Burluk (Imanburluk)	177	236	500	100	32
3	Saryozek	66	27			
4	Badger	5	25			
5	Babykburluk	84	83			
6	Kurkaragash	18	35			
7	White Clay	2	19			
8	Taisary	9.8	8			
9	Snake	15	7			
10	Tusun	1	7			
11	Chaglinka	234	7			
12	Solyanka	1	12			
13	Akan-Burluk (Akanburluk)	222.36	18	500	100	32
14	Kargasayka	1.5	6			
15	Karasu	1.5	24			
16	Jumangulka	1.5	15			
17	Karamendy	22	26			
18	Araltobe					
Total:		982.66	582			
Akzhar district						
19	Ashiken	15	216			
20	Mukyrazen	2	8			
21	Shat	15	38			
22	Karashat	0.5	17			
23	Uzbay	3	2			
24	Aschisu	80	157			
25	Talshchik	3	20			
26	Karasu	5.2	252			
27	Kursay	3	5			
Total:		126.7	715			
Esil district						
28	Baskarasu	1	2			
29	Kashpakty	1	1			

Continuation of table 18

1	2	3	4	5	6	7
Total:		2	3			
Kyzylzhar district						
30	Yesil (Ishim) flows through the region	690	1510	1000	100	550
Total:		**690**	**1510**			
Musrepov District						
31	Kozhirsu	3	22			
32	Sharyk	14.2	90			
33	Beshtomak (Beshtomar)	5	10			
34	Zhembarak	5	41			
35	Mukur	3	17			
36	Talsay					
37	Kulaigyr					
38	Bitek	5,5	38			
Total:		35.7	218			
Taiynshinsky district						
39	Zhanasu	15	28			
40	Ashchikarasu	30	91			
41	Zharyk	18				
Total:		63,119	119			
Ualikhanov district						
42	Kzousay	1	12			
43	Tleusay	1	47			
44	Taldysay	30	121			
45	Selety (Selity)	35	378			
46	Kopa (Kola)	37	238			
47	Karamola (Karatkol)	4.5	4			
48	Saga	0.8	6			
49	Sarym	0.6	4			
50	Koshbaykol	0.5	11			
51	Karshchirbay	0.7	14			
52	Karatal	0.6	1			
53	Baishegir	0.5	1			
54	Sekpa	0,8	4			
55	Aksuat	0,7	4			
56	Sholaksay	3	8			
57	Kyzemdik	1	4			
58	Kyzdyn-Karasu (Kyzdynkarasu)	6	20			
Total:		123.7	877			
Shal akyn						
district 62	Shudasay (Chudosay)	14.6	19			
63	Boganats	15	19			
Total:		245,1612	1612			
Total: 63 rivers						

Table 19-Water bodies of the North Kazakhstan region as of June 24, 2021

№	Districts	Total water bodies	Lakes with an area of more than 100 hectares	Lakes with an area of 50 to 100 hectares	Lakes from 30 to 50 ha	Small Lakes	Bolot	Other reservoirs
1	Ayyrtau district	93	28	6	2	46	4	7
2	Akzhar district	41	13	3	9	11		5
3	Akkayyn district	115	31	31	31	12	5	5
4	Yesilsky district	143	13	17	13	68	21	11
5	Zhambyl district	813	140	195	215	226	22	15
6	Kyzylzhar district	253	62	48	43	83	12	5
7	M. Zhumabayev district	123	31	26	15	21	14	16
8	Mamlyut district	375	44	95	86	132	4	14
9	G. Musrepov District	31	11	3	3	9	2	3
10	Tayynshi district	72	30	11	3	10		18
11	Timiryazevsky district	91	27	22	14	24		4
12	Ualikhanov district	73	25	17	7	17		7
13	Shal Akyn District	84	4	10	15	38	5	12
14	Petropavlovsk	9	3				2	4
15	Total water bodies in Yessil-Kyzylzhar-Mamlyut districts	23	2	7	2	10	1	1
	Total	2339	464	491	458	707	92	127

The Iman-Burluk River originates in the hilly forest area of the lake. Imantau, flows into the river. Yesil from the right bank at 1119 km from the mouth. The river is 177 km long and has a catchment[area of 4,630 km2]. The river has several small tributaries ranging in length from 19 to 60 km, the most significant of which is the Sary-Uzek river. The river serves as the most important reservoir for domestic, drinking and aquaculture purposes. Although previously water was used for irrigation of agricultural land, currently irrigated areas are practically not used.

The Chaglinka River originates from the Kokshetau upland, 8 km southwest of the village of Tsurikovka, and flows into the lake. Shagly-Tengiz. Length-234 km, catchment area-9,220 thousand km2. The total fall of the river is 314 m. The average slope is 1.3% [57].

It has several tributaries with a length of 15 to 50 km, the largest rivers are Teris-Butak and Kylshakty. Near the town of Kokshetau, the Chaglinka River flows through the lake. The cop, feeding it.

Near the town of Kokshetau, on the Chaglinka River, there is the Chaglinskoye reservoir, which is one of the main sources of water supply in the city. The Chaglinka River flows through the territory of two regions - NorthKazakhstanand Akmola.

For all the listed rivers, Table 20 shows the actual volumes of runoff and percentages of the average annual rate of runoff, the module of annual runoff for 2023 for the main rivers.

In the area of activity of the Yesil basin Inspection, 5 integrated reservoirs with a capacity of more than 1.0 million m3 are operated[3], including: in the North Kazakhstan region-2, and in the Akmola region – 3. Of these, with a capacity of more than 100 million m3[3] – 3, two of which, Astana and Seletinsky, are located in the Akmola and Almaty regions. one, Sergeyevskoe, in the North Kazakhstan regions. The total total capacity of the five integrated reservoirs under the project is 1386.4 million[m3], the actual capacity as of 01.01.2024 was 1078.49 million[m3].

Table 20-Annual flow module for 2023 by major rivers

River, hydropost	Catchment area, thousand km2[2]	Fact. runoff, million m3[3]	Flow modulus[m3]/ sec at 1 km[2]
North Kazakhstan Region			
Total actually for 2022	471,34		
Esil River – Zapadnoye village, Sergeyevka, Petropavlovsk, Dolmatovo village	459	8424	0,58
Akkan-Burluk River (s.Uplift)	6,25	351	1,77
Iman-Burluk River (Sokolovka village)	4,07	52,8	0,41
Chaglinka River – Severnoye village	1,75	72,7	0,31

Esil river pool. Territory of the river basin Esil includes the entire North Kazakhstan region, Astana, 83.2 % of the area of Akmola region and small parts of Karaganda (4.8%) and Kostanay (2.9%) regions (Figure 9). The area of activity of the Yesil Basin Inspection for regulating the use and protection of water resources includes the river basin. Yesil within the Republic of Kazakhstan (water management areas: 04.01.06.01-Istok-Vyacheslav vdhr, 04.01.06.02-Vyacheslav vdhr. – Zhabay River mouth, 04.01.06.03-Zhabay River mouth-Kamenny Quarry village, 04.01.06.04-Kamenny Quarry village-Sergeyevskoye vdhr, 04.01.06.05-Sergeyevskoye vdhr-border of the Republic of Kazakhstan and the Russian Federation), Chaglinka River basin (section 04.02.00.01), Shat, Karasu, Ashchisu river basins (section 04.02.00.02), Selety River basin (section 04.02.00.03).

101 hydraulic structures are located on the territory of the basin, including 19 GTS in republican ownership, 74 GTS in municipal ownership, and 8 GTS in private ownership. Out of 101 GTS, a multi-factor survey was carried out on 9 GTS, including 5 main reservoirs with a dam safety declaration and assigned registration codes. The main supervisory body for water resources in the North Kazakhstan region is the Yesil Basin Inspectorate. It conducts work on regulation, control, monitoring, implementation and protection of objects related to the water fund. In the area of activity of the Yesil basin Inspection, 5 integrated reservoirs with a capacity of more than 1.0

million m3 are operated[3], including: in the North Kazakhstan region-2, and in the Akmola region – 3. Of these, with a capacity of more than 100 million m3[3] – 3, two of which, Astana and Seletinsky, are located in the Akmola and Almaty regions. one, Sergeyevskoe, in the North Kazakhstan regions. The total total capacity of the five integrated reservoirs under the project is 1386.4 million[m3], the actual capacity as of 01.01.2024 was 1078.49 million[m3].



Figure 9-Scheme of integrated use and protection of water resources in the river basin.. Yesil [59].

Sergeyevsky hydroelectric complex with a reservoir was commissioned in 1969, located in the Shal Akyn district of North Kazakhstan region, and was built by the design organization Institute "Gidroproekt" named after A. A. Shal Akyn. Zhuka, Moscow. The length of the reservoir is 100 km, the maximum width is 5 km, the average depth is 7 m, and the maximum depth is 20 m. Water level markers: NPU -135.0 m; UMO -128.0 m. The throughput capacity is 7600[m3]/ s, the length of the coastline is 282.8 km [57]. As of 01.01.2024, the volume of the Sergeyevsky reservoir was69,0million[m3] of water, the useful volume -635 million[m3], the NPU -138 m.

The operating mode of the Sergeyevsky reservoir during the flood passage for the period of its operation is given in Table 21 [60]. Data on water resources are placed in the general web register:

https://drive.google.com/drive/folders/10Dk9lGr_MvG-ftHxcQs_DBlPajFtzspH?usp=drive_linkc

RSE on PHW "Kazvodkhoz" KVH of the Ministry of Internal Affairs of the Republic of Kazakhstan. Excess runoff, if the water level in the reservoir exceeds the NPU – 138.0 m mark, is automatically discharged through the crest of the spillway dam. In 2022, maintenance was carried out. The condition of the reservoir is satisfactory. The length of the reservoir is 28 km, the maximum width is 120 m, the average depth is 2 m, the maximum depth is 7.2 m. Water level markers: NPU -92.2 m; UMO-89.7 m, the length of the coastline is 56 km. It is on the balance

sheet of the North Kazakhstan branch of the RSE on the PHV "Kazvodkhoz" KVH of the Ministry of Internal Affairs of the Republic of Kazakhstan. The highest water levels and flow rates in the Petropavlovsk hydroelectric site are shown in Tables 22, 23 [60]. Data on water resources are placed in the general web register:

https://drive.google.com/drive/folders/10Dk9lGr_MvG-ftHxcQs_DBlPajFtzspH?usp=drive_linkc

Petropavlovsk hydroelectric complex with a reservoir was commissioned in 1973, located in the Kyzylzhar district of the North Kazakhstan region, the dam site in Petropavlovsk. Built by the design organization "Gidroproekt" Institute. Zhuka, Moscow.

During the flood period, it operates in transit mode, does not interfere with the passage of flood waters and does not affect the passage of floods. This reservoir, working in a cascade with Sergeyevsky, forms a single water management complex intended for domestic drinking and technical water supply to consumers in the region.

Due to the accumulation of spring meltwater and the implementation of guaranteed releases in the required volume for downstream consumers, it provides the North Kazakhstan and partially Akmola, Kostanay, and Tyumen regions. Water withdrawal from the river. Esil is carried out by large head water intakes of group water supply systems of the Esil su branch of the Nurinsky Group Water Supply RSE - 4 units, the Akmola branch of the Kazvodkhoz RSE, Kyzylzhar Su LLP (water supply of Petropavlovsk), SevKazEnergo JSC (PTPP-2), regulated riverbed releases to the Tyumen region, and also independent water intakes of small water users. At the same time, the share of withdrawals from the Sergeyevsky reservoir would be much higher if the number of settlements connected to group water supply systems increases. The water resources of the Esil river basin were estimated based on observations at the posts of the RSE "Kazhydromet". Monitoring of this water basin is carried out at 63 gauging statio

Table 21 - Operation mode of the Sergeevskoye reservoir during the flood during the period of its operation

№	Year	Level (m)	Volume of the reservoir before the flood, million m3	Highest Level Date	The highest level,m	Maximum flow m3/s	The volume of the reservoir is the largest, million m3	The volume of water is saccumul. to the peak of the flood, million m3	Volume of discharges during the flood, million m3	Flood duration		Overflow start date	Overflow end date	Duration of overflow: day	Duration without overflow	
										Days	Dam overflow height, m				day	month
1	2004	136,04	483,8	13.04.	138,87	431,3	798,7	314,9	672	89	0,87	9.04.	28.06.	81	285	9,5
2	2005	135,32	417	24.04.	140,35	2018,4	997,5	580,5	2548	111	2,35	20.04.	9.08.	111	254	8,5
3	2006	136,82	562,6	22.05.	138,02	15,9	695,4	132,8	14,2	70	0,02	21.05.	2.06.	11	354	11,8
4	2007	134.94	383.7	21.04.	140.25	1888.4	983.6	599.9	3041.6	108	2.25	17.04.	2.08.	108	257	8.6
5	2008	136.39	518.5	25,04	138.21	61.4	718.0	199.5	147.5	49	0.21	20,04	10,06	50	315	10,5
6	2009	135,09	396,7	25.05	136,72	13,4	552,2	155,5	70,6	61					365	12,0
7	2010	132.00	183.1	9.06	136.89	9,3	569.6	437,6	43,6	59					365	12,0
8	2011	133.92	304.2	07.05	138.38	128.1	738.3	434,1	406,08	89	0,38	21.04	06.07.	76	289	9,6
9	2012	135,68	449,9	11.04.	138.94	461,0	807,4	357,5	560,8	73	0,94	04.04	16.06	73	292	9,7
10	2013	134,64	358,7	08.05	138,39	137,4	739,5	334,3	369,9	90	0,39	20.04	06,07	47	318	10,6
11	2014	137,22	605,3	23.04	139,98	1543	944,3	87,7	3496,4	136	1,98	04.04	14.08	132	233	7,7
12	2015	136,97	578,2	10.05	138,99	502,9	813,6	114,8	2203,4	173	0,99	15.04	05.10	173	192	6,4
13	2016	137,49	634,8	02,05	138,98	495,9	812,4	58,2	2731,1	125	0,98	03.04	06,09	125	240	8
14	2017	137,52	638,2	18.04	141,32	3478,6	1136,6	54,8	5227,1	176	3,32	14.04	24.09	132	233	6,7
15	2018	137,37	621,7	19,04	139,68	1138,4	903,9	71,3	1801,4	141	1,68	14.04	25,09	133	232	6,7
16	2019	137,60	647,3	25,04	139,32	822,4	856,4	45,7	2409,2	158	1,32	04,04	02,09	150	215	7,1
17	2020	137,59	646,2	11.04	139,95	1501,8	940,3	46,8	2833,1	138	1,95	13,04	18,08	127	238	7,9
18	2021	137,01	582,4	07.05	138,57	229,4	761,4	110,6	835,0	121	0,57	14,04	06,08	114	251	8,3
19	2022	136,43	522,4	28.04	138,48	178,4	753,3	170,6	564,6	109	0,48	18.04	22.07	94	271	9
20	2023	136,06	485,8	08.04	139,96	1519,4	941,6	207,2	2117,9	123	1,96	05.04	30.07	116	249	8,2
21	2024	136,88	568,8	09.04	142,25	5860	1261,8	124,2			4,25	05.04				

Table 22-Highest water levels and flow rates in the Petropavlovsk hydroelectric site

№ p/p	Year	date lowest level	Highest level, m	the Highest flow rate, m^3/s
1	2004	22.04.	92,99	of 385.00
2	2005	6.05.	95,08	1 040,00
3	2006	27.05.	92,67	of 13.00
4	2007	10.03	of 95.35	1 420,00
5	2008	23.03	of 92.54	40,00
6	2009	30.03	92,69	24,00
7	2010	01.04	92,67	18,00
8	2011	07.04	92,70	of 105.00
9	2012	02.04	92,92	of 343.00
10	2013	07.04	92,56	of 117.00
11	2014	22.03	of 95.20	1 300,00
12	2015	31.03	94,30	of 572.00
13	2016	19.03	95,00	1 160,00
14	2017	08.04	96,31	2 620,00
15	2018	06.04	94,60	of 820.00
16	2019	29.03	94,54	650,00
17	2020	11.03	92,02	1 090,00
18	2021	05.04	94,42	608,80
19	2022	31.03	92,67	of 136.00
20	2023	22.03	94,43	620,00
21	2024	27.03	97,95	4 800,00

Table 23-Data on waterworks during flood periods 2014-2024

Year	Sergeyevsky Hydroelectric				complex Petropavlovsk Hydroelectric				complex Note
	Date (start/max. level rise)	WB level, m	Volume million m3	Flow m3 / sec	Date (start/max. lifting the level)	The level of WB, m	millio n m3 Volum e	Flow rate m3/h	
1	2	3	4	5	6	7	8	9	10
2014	31.03.2014	137,22	605,30	13,4	31.03.2014	92,45	of 21.27	13,4	
	23.04.2014	139,98	944,30	1543,0	03.05.2014	numbe r- 95.22	28,12	1300,0	
2015	10.04.2015	136,98	579,20	13,4	06.04.2015	92,46	loss of 21.16	14,0	
	20.04.2015	139,37	862,80	867,3	03.05.2015	94,30	28,12	572,0	

Continued table 23

1	2	3	4	5	6	7	8	9	10
2016	30.03.2016	137,49	634,80	13,4	29.03.2016	of 92.47	21,90	16,0	
	28.04.2016	139,09	826,60	584,5	21.04.2016	of 95.00	28,12	1160,0	
2017	30.03.2017	137,52	638,20	13,4	08.04.2017	92,44	21,60	15,0	
	18.04.2017	141,38	1136,60	3478,6	06.05.2017	96,31	28,12	2620,0	Level was held 8 hours
2018	07.04.2018	137,40	621,70	15,8	06.04.2018	92,43	21,50	15,0	
	19.04.2018	139,68	903,90	1138,4	04.04.2018	94,60	28,12	820,0	
2019	28.03.2019	137,60	647,30	15,8	24.03.2019	92,46	21,80	15,0	
	25.04.2019	139,32	856,40	820,0	09.04.2019	94,54	28,12	650,0	
2020	23.03.2020	137,63	650,70	15,8	01.04.2020	92,60	23,30	15,0	
	11.04.2020	139,95	940,30	1501,8	25.04.2020	of 95.20	28,10	1090,0	
2021	08.04.2021	137,01	582,40	15,8	08.04.2021	of 92.47	21,90	15,6	
	17.04.2021	139,65	899,90	1140,8	30.04.2021	94,42	28,12	608,8	
2022	03.04.2022	136,43	522,40	13,4	04.04.2022	92,44	21,60	15,0	
	30.04.2022	138,48	750,30	178,4	04.05.2022	92,67	24,20	only 114.2	
2023	31.03.2023	136,13	492,70	6,5	01.04.2023	92,50	22,20	18,0	
	08.04.2023	139,96	941,60	1519,4	21.04.2023	94,43	28,10	620,0	
2024	29.03.2024	136,88	568,80	8,4	28.03.2024	92,46	21,80	16,1	
	08.04.2024	142,25	1261,80	4870,8	16.04.2024	97,95	28,12	4800,0	Level kept-Xia 28 hours
Note - When the level of above 93 m Peter and Paul dam is transferred to the transit mode (the volume is not taken into account).									

This table shows the average annual indicators of each hydropost that has data for the last 5 years (Table 24). Data on water resources are placed in the general web register: https://drive.google.com/drive/folders/10Dk9lGr_MvG-ftHxcQs_DBlPajFtzspH?usp=drive_linkc

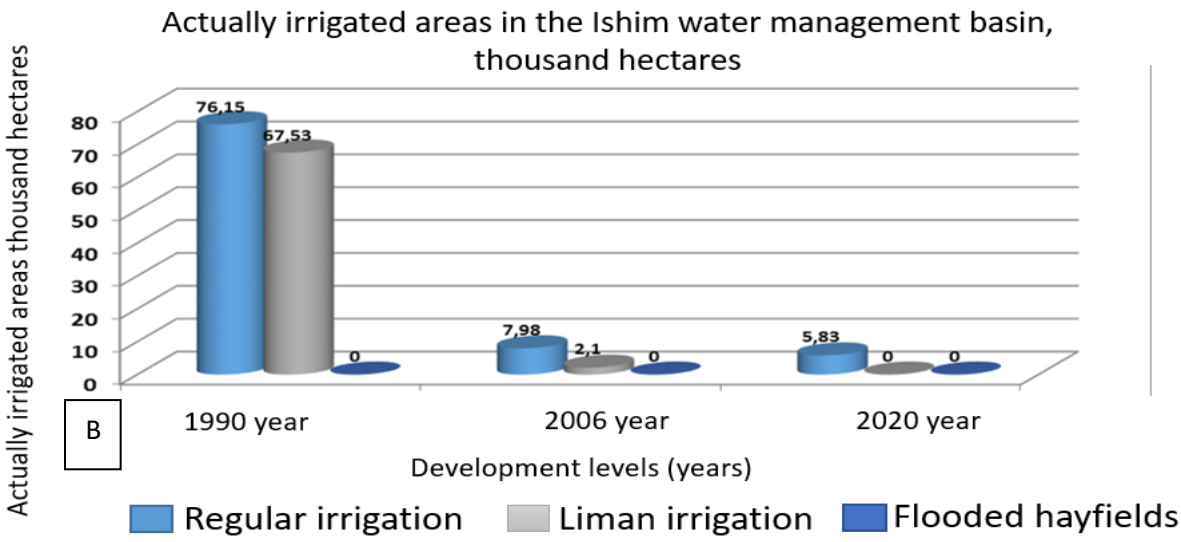
Table 24-Average annual indicators of hydraulic posts for the period 2018-2022

No	. Name of the hydropost	Average annual indicators of the hydropost for the last 5 years by water consumption (l/sec)				
		2018	2019	2020	2021	2022
1	Babyk-Burlyk. S. Gusakovka	0.915	1.53	2.08	1.99	1.66
2	Iman-Buplyk. S.Sokolovka	1.99	1.89	2.27	4.25	3.45
3	Akkan-Burlyk.Kovylnoye village	2.39	2.39	2.99	2.68	2.26
4	Akkan-Burlyk.village of Voskhodenka	6.71	7.01	9.07	8.80	7.53
5	Zhylandy. Shuyskoe village	-	-	1.49	2.29	-
6	rubles.Sharyk. S. Andreevka	-	-	1,82	2	2
7	Sharyk. Ruzaevka village	-	-	4,28	4,3	-
8	Arshaly. S. Budenovka	--	-	3.10	2.89	2.06
9	Yesil. Volgodonovka	village 7.23	8.88	6.41	6.60	5.42
10	Yesil. Dolmatovo village	60.62	66.82	74.31	67.79	58.74
11	Zhabay. Atbasar	7,11	19,39	17,70	15,99	13,77
12	Zhabai . S. Balkashino	1.87	1.95	2.05	2.05	1.99
13	Mukyr. S. Mukyr	--	-	3.03	3.68	2.87
14	Kalkutan. Novokubanka village	-	-	-	17,76	11,49
15	Kalkutan. Kalkutan village	14.46	14.25	13.71	13.19	12.77
16	Moyildy. Nikolaevka	village 1.55	1.51	1.51	1.55	1.52
17	Yesil. Arshaly village	-	-	7.86	7.34	7.02
18	Yesil. Novoishimka village	29.62	23.0	19.86	17.56	15.90
19	Yesil. S. Koktal	6,36	7,44	-	-	-
20	Yesil. Petropavlovsk	68.32	69.11	71.0	69.80	67.38
21	Yesil. Above C. Pokrovka	63,50	64,38	67,26	66,81	64,48
22	Yesil (Vdhr Sergeevskoe). Sergeyevskaya (HPP)	78.15	79.10	81.50	78.70	73.76
23	Yesil. Toksan bi village(Western)	71,30	72,93	74,33	72,66	70,65
24	Yesil. Stone quarry	33.09	35.43	37.33	36.83	35.87
25	Yesil. Derzhavinsk	72.51	74.55	76.80	67.69	59.66
26	Yesil. Turgen village	5.34	5.60	5.76	5.91	5.93
27	Yesil.Priishymskoye village	0.58	0.58	0.58	0.57	0.57
28	Shagalaly. Severnoye village	3.62	3.73	3.79	3.58	3.36
29	Shagalaly. Pavlovka village	3.95	4.27	4.48	4.36	4.20
30	Kamysakty. Yasnovka Village	-	-	7.82	8.62	-
31	31 Villages. Izobilnoye Village	24,38	23,28	21,67	20,83	20,13
32	32 Villages. Prirechnoye village	5.05	5.49	5.63	5.77	5.83
33	Boksuk. Zhuravlevka village	-	-	-	11,81	13,03
34	Selets. Above the Seletinsky vdhr	76.72	82.59	79.09	78.54	76.62
35	Selets. Novomarkovka	village 15.48	20.31	18.90	16.88	16.46
	Average Annual rate	76.72	82.59	79.09	35.50	28.90

Basin hydrography, hydrological regime, and estimated river flow. A characteristic feature of the rivers of this basin is the uneven distribution of runoff, which varies not only depending on seasonal cycles, but also from year to year. The difference in water consumption from year to year can vary by several orders of magnitude, which makes it difficult to effectively use these river resources economically. Current data show that the average annual runoff in this basin is

approximately 2.6 cubic kilometers, and the volume of runoff from local rivers is also estimated at 2.6 cubic kilometers. Initial comprehensive studies of hydrography and hydrological dynamics of watercourses in the Ishim River basin were conducted by the State Hydrological Institute in the 1950s in the respective administrative territories [6-1]. At the same time, their recommendations for estimating annual and peak runoff values have remained relevant and are considered normative in scenarios where hydrometric observations are not available. The main phase of the water regime is characterized by a pronounced spring flood, followed by a long period of decrease in runoff in the summer, autumn and winter months. Spring runoff is formed mainly as a result of melting snow cover. Rains play a role in the formation of spring runoff, and in autumn they contribute to an increase in humidity in the catchment area, while in spring and summer their influence is insignificant, which leads to a slight increase in runoff. Spring floods usually start in April and last for one and a half to two months, during which time approximately 85-95% of the annual runoff falls. At the same time, the river has a peak water consumption. The flood hydrograph configuration is mostly single-modal. In late May-early June, there is a period of low water runoff lasting 9-10 months. From the hydrometric point of view, the Ishim River and its tributaries are insufficiently studied. The longest-running data on water runoff on the Ishim River in Kazakhstan are kept at hydrometric stations located in Petropavlovsk (since 1893) and Astana (since 1932). This basin is recognized as one of the least water-rich regions. The total water resource is estimated at 5.34 km3. Most of the water reserves are concentrated in lakes (55%), river runoff is 34%, and reservoirs — 7%. Groundwater reserves are the lowest in Kazakhstan — 0.19 km3 and account for only 4% of the hydrological balance of the basin [62]. Currently, there are 24 river hydrological control posts in the zone to monitor the dynamics of surface waters. One of the features of the long-term hydrological regime of the Ishim River and its tributaries is the tendency to cluster years characterized by rising and falling water levels, which creates serious problems for use in various areas of the economy. Currently, conditions have improved due to the regulation of hydrological runoff in reservoirs. Statistical indicators of the flow of the Ishim River indicate that the source flows from the Vyacheslav reservoir. The average annual water consumption is 5.89 m3 / s and is 0.186 km3. The coefficient of variation is calculated by the formula Cv = 0.66; Cs = 1.25. The river's flow corresponds to 50%, 75% , and 95% of the water reserve, respectively, in km3: 0.161; 0.095, and 0.035. [63] The intra-annual distribution of the flow of the Ishim River, especially in the Astana reservoir and the Seleta River in the Akmola region, has been established for 50%, 75% and 95% of water reserves, and according to current studies [64]. The average annual flow of water resources of the Istok-Astana reservoir (Vyacheslav) was Wo = 0.186 km3. Thus, the river flow is distributed as follows: 50%, 75% , and 95% with values of 0.161, 0.095, and 0.035, respectively. In total, the volume of water resources of rivers and ephemeral watercourses under the jurisdiction

of the Ishim Agricultural District is 2.59 km3. In particular, in the Ishim River basin, the volume was recorded at the level of 2.23 km3 [56-57].



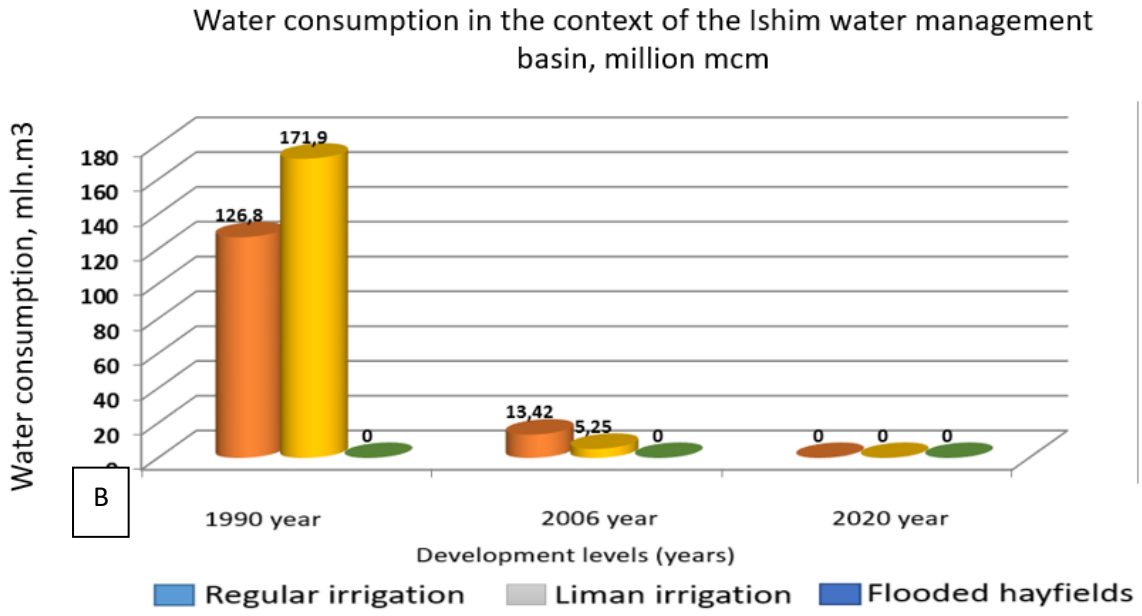


Figure 10 - Actually watered irrigation areas and their water consumption in North Kazakhstan region: A – watered areas; B - pool water consumption

The main water sources in the basin are surface runoff coming from the Yesil River and its tributaries. Groundwater resources are mainly used to meet the needs of the population for domestic and drinking water, while a smaller part of the water is used for industrial purposes. Currently, wastewater is practically not used. The total volume of water taken from the Yesil River in 1990 was estimated at 650.94 million cubic meters, while in subsequent years it decreased to

only 153.47 million cubic meters. The agricultural sector accounts for the most significant share of water consumption: 461.09 million cubic meters and 61.50 million cubic meters, respectively. The demand for water for municipal and industrial water supply for the same period was 97.20 million cubic meters. m and 60.27 million cubic meters, 76.13 million cubic meters. Water intake from natural sources in the North Kazakhstan region in 2014 amounted to 59.7 million cubic meters. m and 62.6 million cubic meters, respectively [57].

The area of land under regular irrigation in the Esil River basin is 48,703 thousand hectares, of which in the North including 17,043 thousand hectares in the North Kazakhstan region. The area allocated for estuary irrigation in the Esil River basin is 84,436 thousand hectares, including 0.396 thousand hectares of estuary irrigation in the Akzhar district of the North Kazakhstan region. Figure 10 shows graphs showing the irrigated areas and corresponding water consumption indicators. In 2020, a total of 5,832. 36 hectares were irrigated in the Esil River basin with a water intake volume of 10,206 thousand cubic meters, including: in the North Kazakhstan region, irrigation covered an area of 2,125. 2 hectares, while the corresponding water intake was1,745. 8 thousand^{m3} [57].

Main water pipelines of the North Kazakhstan region. There are almost но underground sources on the territory of the region, so the water of the river is used for agricultural water supply. Yesil. On the basis of water resources of the river. Yessil and partly the Tobol River are built here such major group water pipelines as Presnovsky (1,414 km long), Bulaevsky (1,500 km long), Yessilsky (597 km long), Sergeyevsky (156 km long), with a total length of 3,669 km. The North Kazakhstan region in the 70s and 80s became famous for having the longest Bulaevsky water supply system in the world. The length of the main water pipeline is 1,694 km, part of which is now in disrepair. Over the past 30 years, the supply of water to residents of the North Kazakhstan region has fallen sharply due to the fact that thousands of kilometers of group water pipes have fallen into disrepair. Currently, according to the concept of development of housing and communal infrastructure of the Republic of Kazakhstan, only 82.1% of residents of the North Kazakhstan region have access to water supply. This category includes not only those citizens who have running water in their homes, but also those who have rural street water supply (pumps), public wells, and imported water. Only 56.6% of households have running water in their homes [6, 6].

The North Kazakhstan region, like many other regions of Kazakhstan, faces the problem of providing high-quality water supply and efficient sanitation. To solve this problem, a set of measures is being implemented aimed at modernizing the existing infrastructure and building new facilities. Main areas of work:

– Reconstruction and construction of water supply networks: Replacement of worn-out pipes, increasing the diameter of networks to increase throughput, construction of new water pipelines.

– Modernization of water treatment facilities: Installation of modern equipment for water purification from mechanical impurities, bacteria and chemicals.

– Construction of new water intakes: To increase the volume of extracted water and ensure stable water supply.

– Development of water disposal systems: Construction and reconstruction of sewage networks, sewage treatment plants.

– Introduction of water-saving technologies: Use of modern irrigation systems in agriculture, installation of water meters, conducting awareness-raising activities among the population.

– Search for new sources of water supply: Study of the possibility of using underground water and seawater desalination.

Examples of specific projects:

- Reconstruction of group aqueducts: Large-scale reconstruction of group aqueducts is being carried out in the region, which makes it possible to improve the quality of water and increase its accessibility to the population of rural areas.

- Construction of new water treatment plants: New water treatment plants equipped with modern equipment are being built in some localities.

- Introduction of a water supply system based on subscriber columns: In some rural localities, a water supply system based on subscriber columns is being introduced, which allows for more efficient use of water and reduces losses.

- Inventory of water supply networks: To determine the technical condition of networks and plan repairs.

Problems and prospects. Despite the measures taken, there are still unresolved problems related to water supply and sanitation in the region. These include:

- Deterioration of water supply networks: A significant part of the networks were built several decades ago and need to be replaced.

- Insufficient funding:Significant financial resources are required to fully modernize the water supply and sanitation system.

- Inefficient use of water: many agricultural enterprises do not use modern irrigation systems, which leads to large water losses.

Historical archive data. The most important factors contributing to the growth of the productive forces of Northern Kazakhstan are water supply to agriculture through regular and

estuary irrigation, irrigation of pastures, provision of household and drinking water and other needs of rural settlements and enterprises. The principal direction of providing water to agriculture here is the construction of group and local water supply systems based on surface and underground water resources, which has yielded good results. Group and local water pipelines with a total design length of 11241 km have been built and are being successfully operated in the region (Table 25).

Table 25-Indicators of large agricultural water supply systems built before 2000

Region	Water	supply Source of water supply	Length, km	Productivity		Number of watershed points	Flood area, thousand hectares	Electricity consumption million kWh
				Thousand^{m3}/ day.	Million^{m3}/ year			
North Kazakhstan	Presnovsky	RiverTobol, Yesil	1414,0	76,0	27,74	188	80	40,28
	Bulaevsky	-	1500,9	34,40	12,60	218	74	18,23
	Yesilsky	Yesilsky-	597,02	18,40	6,72	75	50	9,75
	Sergeyevsky	Vdhr.Sergeyevskoe	155.6	4.30	1.45	9	20	2.27

Underground water. In the North Kazakhstan region, there are about 20 underground water deposits that are used as alternative sources of water supply to settlements through drilling and well development (Figure 11).

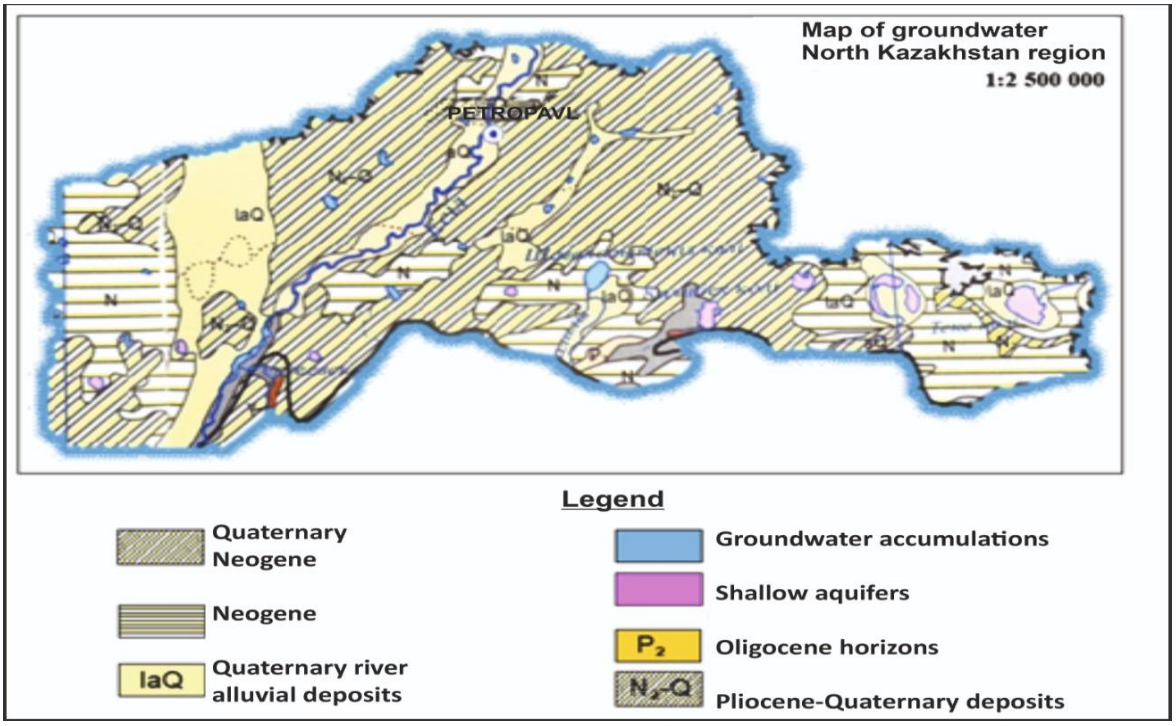


Figure 11-Map of underground waters of the North Kazakhstan region [69]

In general, 87.3% of the region's population is provided with centralized water supply, including tap drinking water from group water pipes — 69%, underground sources-18.3%. 12.5% of the region's population uses decentralized water supply, and 0.2% uses imported water [66-6] (Figure 12).

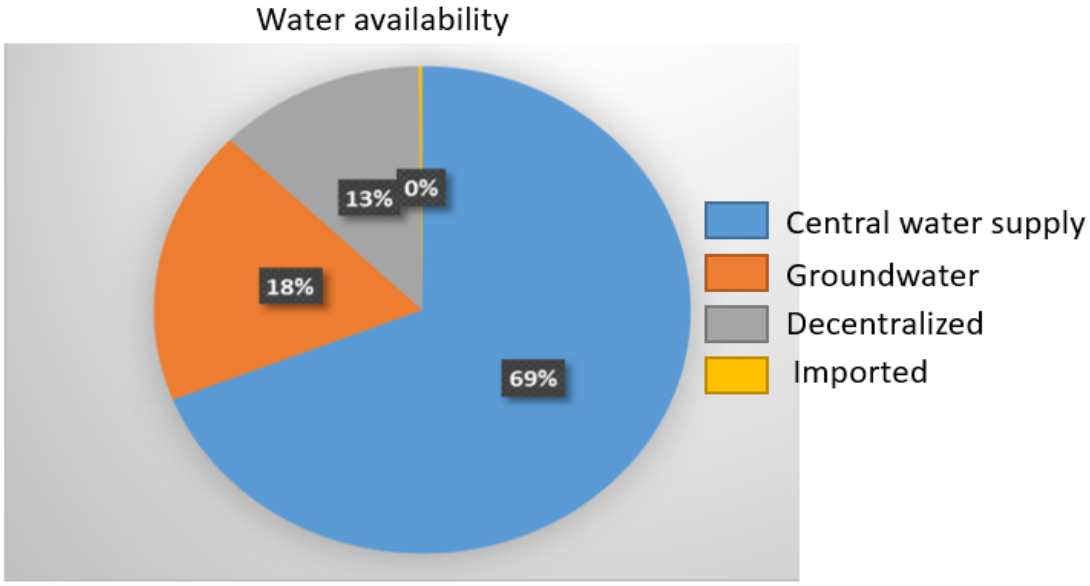


Figure 12-Water availability of people with drinking water in North Kazakhstan region (%)

In the North Kazakhstan region, deposits are explored in the basins of the Yessil River, the Yessil-Irtysh interfluve. Hydrologically, the North Kazakhstan region belongs to the southern part of the Irtysh and Torgai Central Asian basins. The territory of the region is poor in good-quality and scarce water supply sources, especially in the northern half of the region, so underground water cannot serve both for industrial and guaranteed water supply for agriculture. Underground waters are opened by shaft and tube wells with a depth of 30-50 meters of aquifers. In the region, there are branches of the Esil Su RSE "Nurinsky Group Water supply" that provide drinking water to many rural settlements of the North Kazakhstan region.

In 201.33 год по Северо-Казахстанской области забрано – , 4382.66 million m3 of underground water was withdrawn in the North Kazakhstan region[3], and 4306.9 million m3 was used·At the end of the reporting 202.3year, the Yesilской Basin Inspection lists68.5 sites with approved underground water reserves, of which 26.5 in the North Kazakhstan region5. Underground water was used for household and industrial and technical needs, agricultural water supply, and regular irrigation.

The quality of groundwater largely depends on the degree of pollution of rivers, soil, atmosphere, self-cleaning ability of soils, protection of aquifers and other factors. For the needs of the economy for the period from 2009 to2023 г. in the Esil River basin, the abstracted volumes of underground water according to the data of [57]are shown in Table 26 and Figure 1-33.

The explored deposits are confined to Artesian basins (10 deposits with reserves of 104 thousand ^{m3} /day) and massifs of fractured and fractured karst groundwater (11 deposits with reserves of 58.34 thousand ^{m3} /day). The North-Kazakhstan region is characterized by small proven reserves of the underground water field. Thus, 14 fields have reserves of up to 10 thousand m3 / day. They account for 50.9 thousand ^{m3} / day. underground water reserves. 7 fields have reserves from 10 to 50 thousand ^{m3} / day. They are characterized by reserves of 109.4 thousand ^{m3} / day. Most of the deposits explored for domestic drinking purposes are confined to the massifs of fractured waters (7 out of 11), which are common in the southern part of the region [67].

20 underground water deposits were explored in the region with a total amount of proven reserves of$^{162.34 \text{ thousand } m3}$/day, including 53 thousand m3/day with mineralization up to 1 g/l – 53 тыс. м ^{3}(0.07 ^{m3}/ day per person). Specifically, 68.7 thousand ^{m3} /day (0.09 ^{m3} /day per person) were explored for CPV.

Table 26. Volume of underground water withdrawn in the Esil River basin for the needs of the economy in the period from 2009 to 2023 (thousand$^{m3)}$

Years	Taken away Total	Used								Losses of all
		Total	Household/household needs	Proc.needs	of Reg. irrigation	of agriculture vodosnab.	Prado va-fish	the flood pastures	other needs	
2009	928,40 35	34 517,50	5 245,20	1 of 989.00	241,1	26 753,20	0	289	0	1 410,90
2010	593,30 37	36 541,40	5 461,90	1 908,60	172	28 686,90	0	260	0	1 052,00
2011	37403,40	36 748,80	5 244,70	1 988,80	181	29 130,30	0	101	0	654,6
2012	600,10 36	36 002,70	4 690,20	2 347,20	350	28 400,70	0	0	0	631
2013	344,60 36	35 353,20	4 274,20	1 689,50	0	12 792,20	0	0	0	765,40
2014	32 006,10	31 032,90	5 770,70	931,70 1	0	23 330,50	0	0	0	820,20
2015	31 797,80	30 821,70	6 621,90	2 154,20	7	23 045,50	0	0	0	842,10
2016	33499,7	31375,09	10612,5	3 481,0	0	14974,6	0	0	0	0
2017	25697,11	25185,96	7525,58	6127,88	of 32.43	10258,47	0	0	0	511,15
2018	19079,63	18431,98	7225,94	5448,54	of 23.87	4136,68	0	0	0	647,65
2019	16722	15827	8695	3945	2,86	2920	0	0	0	895
2020	15507	11993,13	5918,53	2996,21	0	3000	0	0	0	3513,87
2021	15369,05	14381,67	6097,78	4433,94	of 7.57	3623,77	0	0	218,61	987,38
2022	14365,86	12738,02	5573	3314,48	0,55	3848,75	0	0	1,24	1627,84
2023	17373,91	16635,94	6574,74	6693	0,1	3380,24	0	10,4	7,16	738,26

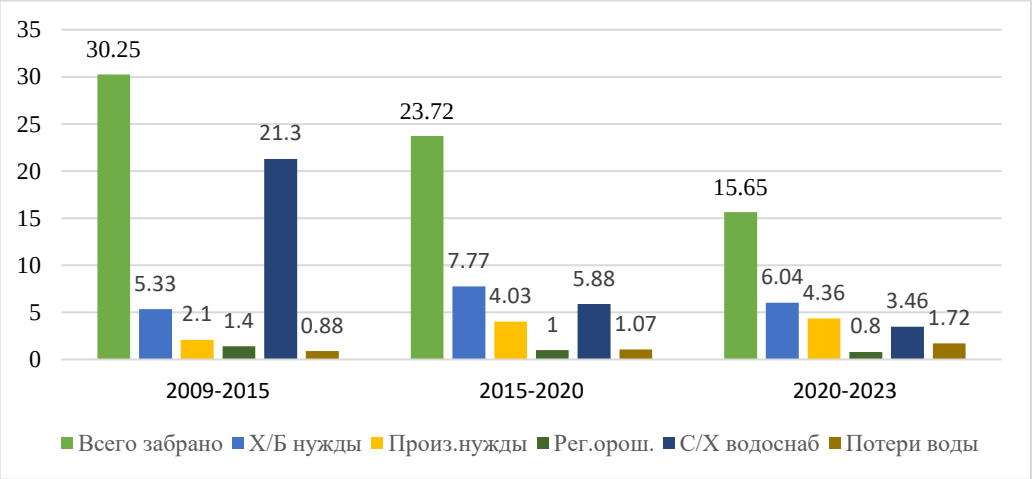


Figure 11-3-Average multi-year data set of withdrawn waters,thousand^{m3}, for the last 20 years

On the territory of the North Kazakhstan region, fresh groundwater has a limited distribution and is mainly developed in the southern part of the region. Household and potable water supply of the region is carried out at the expense of surface and underground waters, but the priority belongs to surface waters. Modern water sampling of surface water for CPW is 174.5 thousand m3 /day, and underground water-64 thousand ^{m3} /day (32% of the total water consumption). At the same time, only 7 thousand^{m3} /day of underground water is taken from explored deposits and 57 thousand^{m3} / day from areas with undiscovered underground water reserves.

Surface water resources of r. Esil generally covers the population's need for domestic drinking water. At the same time, they are narrowly localized, often polluted, which makes it necessary to build group water pipes of considerable length, as well as to carry out measures to improve the quality of river water. Naturally, this will require a significant investment of funds and materials.

Household and potable water supply of all cities of the North Kazakhstan region Petropavlovsk, Bulaevo, Mamlyutka, Sergeevka, Tayynsha, Bishkul district centers, Vozmozhenka, Blagoveshchenka, Presnovka, Smirnovo, Sokolovka, Timiryazevo, Aksuat, etc., is carried out at the expense of surface waters of the Petropavlovsk and Sergeevsky reservoirs, as well as water pipes based on the waters of the Yesil River [68].

The North Kazakhstan region faces serious problems in the field of water supply and sanitation. The main reasons for these problemsare:

Infrastructure deterioration: A significant part of the water supply network was built several decades ago and needs to be replaced.

- Insufficient funding: A complete modernization of the water supply and sanitation system requires significant financial resources.

- Inefficient use of water: Many agricultural enterprises do not use modern irrigation systems, which leads to large water losses.

- Lack of centralized water supply in a number of localities: This problem is particularly acute in rural areas.

The problem of water supply in the North Kazakhstan region requires a comprehensive and systematic approach. It is necessary to continue investing in infrastructure modernization, introducing modern technologies and improving the efficiency of water resources use. Only in this case it is possible to provide reliable and high-quality water supply for all residents of the region.

In conclusion, we will summarize**,** that in the North Kazakhstan regionthere are numerous lake systems, a relatively small number of rivers and reservoirs that create unique conditions for water use. Hydrological regime of the main waterway of the r. Yesil has changed significantly as a result of anthropogenic impact, after the construction of a cascade of reservoirs, which has had a significant impact on the water content and ecology of the region. The main mass of water is p. Yesil falls on the spring flood associated with snowmelt. The summer, autumn, and winter months are characterized by low runoff. Climate change is an additional factor affecting the hydrological regime of the Yessil River, increasing the intensity of extreme hydrological events - floods and droughts.

The main part of the region's population is provided with water from surface sources, primarily from the Yesil River. Groundwater in the North Kazakhstan region plays a significant but limited role in the region's water supply. Total groundwater reserves in the region are relatively small and cannot fully meet the needs of the population. The low potential of underground water use is primarily associated with the geological structure of the earth in this region, the presence of a large number of cracks of different sizes in the structure of the earth do not allow the accumulation of underground water. The presence of underground minerals, as well as their extraction, affect the radiative state of groundwater. High contamination of underground water with heavy metal ions reduces the possibility of further use of underground water reserves. Many underground springs have high salinity, which limits their use for drinking purposes. Underground water is mainly used for the decentralized water supply of small settlements and in agriculture.

To ensure sustainable water use, it is necessary to conduct comprehensive studies of the hydrological regime, develop adaptive water management strategies and take measures to protect the environment. To solve these problems, it is necessary to strengthen monitoring of the state of water bodies, develop and implement comprehensive water resources management plans, and raise the level of environmental awareness of the population. The Esil Basin Inspectorate plays a key role in coordinating these efforts. However, to achieve long-term goals, closer cooperation between government agencies, businesses and public organizations is needed. Underground waters

of the North Kazakhstan region are an important, but not the main source of water supply. Providing the population with high-quality drinking water requires a comprehensive solution to the problem, including rational use of existing resources, search for new sources of water supply and environmental protection.

2.4 Data collection formapping the technology of territory development and development of irrigated agriculture using meltwater

For the territory of Northern Kazakhstan, where most of the land is used for non-irrigation agriculture, critical situations often arise due to intense snowmelt and heavy precipitation. Creating a methodology for modeling the water reservation system is the most effective way to increase the productivity of agricultural crops. The development of a technological process for reserving and managing meltwater and floodwaters will increase the productivity of agricultural crops, reduce the impact of climate factors, and create an early warning system for spring floods.

The initial data for the study are field results of snow measurement surveys, Sentinel-2 satellite images, soil data of the territory, historical meteorological data, digital terrain model SRTM, as well as data from integrated field monitoring, including measurements of the height and density of snow cover.

The content of the conducted research for 2024 includes the following:

1. Preparation of satellite radar data for terrain mapping (DEM);
2. Digitization of the soil map of the North Kazakhstan region (SHAPEfile);
3. Creation of a GIS database, data collection to develop a methodology for selecting optimal locations for meltwater and floodwater reservation;
4. Collection of snow survey data and weather data.

Preparing data for a digital terrain model (DEM)

Data from the Shuttle Radar Topography Mission (SRTM) were obtained with a resolution of 30 meters for the North Kazakhstan region, which provides detailed terrain information with high detail (approximately 30 meters, or 1 arc second). These data are radar images taken from the space shuttle Endeavour in 2000, created by NASA together with the National Geospatial Intelligence Agency of the United States. The purpose of the mission was to create a global map of the Earth's topography to support a wide range of scientific, research and applied tasks. Radar mapping of the Earth's surface (SRTM 30 m), as an example, is shown in Figure 14.



Figure 14. Radar mapping of the Earth's surface (SRTM 30 m)

The obtained data allow us to create high-precision digital elevation models (DEM) for the North Kazakhstan region, which opens up wide opportunities for analysis and practical application. These models provide a digital description of the terrain's topography, including detailed information about the elevation, shape, and slope of the surface. As a result, the following tasks can be solved based on SRTM data.

Analysis of water runoff and determination of water accumulation zones**.** Topography data can reveal the direction and intensity of water runoff, and identify areas subject to accumulation of meltwater and floodwaters. This is critical for assessing the hydrological behavior of the Territory and for developing flood prevention and mitigation measures.

Assessment of the risks of flooding and soil erosion.

High-altitude models allow you to identify areas with a high risk of flooding and areas subject to erosion processes. Based on these data, it is possible to assess the threat to infrastructure, agricultural land and human settlements, as well as make decisions to improve the resilience of territories to adverse natural events, such as heavy precipitation or heavy snowmelt.

Planning of agricultural activities**.**

Digital elevation model is important for agriculture: it helps to determine suitable land for cultivation, select areas for sowing, taking into account slopes, flow directions and conditions to prevent water erosion. This allows you to minimize soil loss and improve yields, especially in areas with a risk of erosion or insufficient precipitation. Terrain models can also be used for planning land reclamation activities.

Modeling of landscape changes under the influence of climatic factors.

The use of digital terrain models allows you to track the dynamics of changes in the earth's surface and predict the consequences of climate change. These models can show how changes in temperature and precipitation affect the landscape, as well as allow you to model changes in the

level of reservoirs, the position of watersheds, and the shape of riverbeds, which are important for long-term environmental management planning.

Design and justification of engineering structures related to water resources management.

Engineering features such as dams, reservoirs, canals, and irrigation systems require consideration of terrain to ensure safety and durability. Height models help you place such structures optimally, take into account possible water impacts on structures, and calculate parameters for efficient drainage and flood protection.

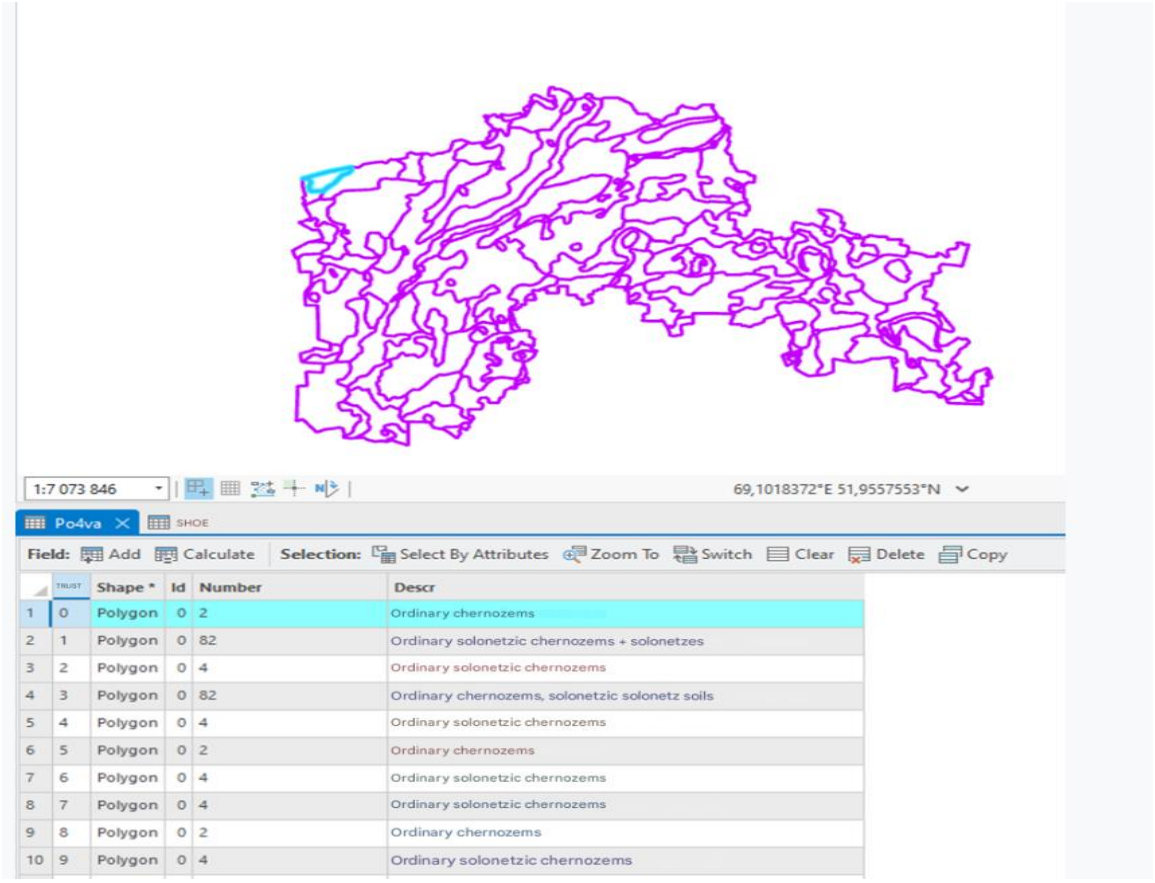
Environmental monitoring and protection of natural territories. SRTM data can be used for monitoring and protecting ecologically significant territories. For example, they help identify areas with unique landscape characteristics, identify areas that need protection from erosion and pollution, and promote environmental protection measures.

Taken together, SRTM data can not only create an accurate picture of the topography of the North Kazakhstan region, but also actively use this data in a variety of areas: from protecting natural resources and improving the sustainability of agriculture, and ending with the construction of safe infrastructure, such data contribute to the rational use of natural resources and sustainable development of the region.

Digitization of the North Kazakhstan Region soil map (SHAPEfile).

The North Kazakhstan region is located in the northern part of Kazakhstan, bordering the Russian Federation. The region is characterized by a temperate continental climate with cold winters and hot summers, which has a significant impact on the formation of soil cover.

As part of the project, the soil map 96-97 was digitized at a scale of 1:5,000,000 (Figure 15).



	TRUST	Shape *	Id	Number	Descr
1	0	Polygon	0	2	Ordinary chernozems
2	1	Polygon	0	82	Ordinary solonetzic chernozems + solonetzes
3	2	Polygon	0	4	Ordinary solonetzic chernozems
4	3	Polygon	0	82	Ordinary chernozems, solonetzic solonetz soils
5	4	Polygon	0	4	Ordinary solonetzic chernozems
6	5	Polygon	0	2	Ordinary chernozems
7	6	Polygon	0	4	Ordinary solonetzic chernozems
8	7	Polygon	0	4	Ordinary solonetzic chernozems
9	8	Polygon	0	2	Ordinary chernozems
10	9	Polygon	0	4	Ordinary solonetzic chernozems

Figure 15-Digitization of the soil map of the North Kazakhstan region

According to the soil map, the following main types of soils are distinguished in the North Kazakhstan region:

- Chernozems: this soil is one of the most fertile and covers significant areas in the region. Chernozems are characterized by a high humus content, which contributes to the successful cultivation of grain crops such as wheat, barley and other agricultural crops.
- Dark chestnut soils: they are also common in the area and have moderate fertility. These soils require additional irrigation and fertilization measures to maintain high yields.
- Solonets and salt marshes: in some low-lying areas, there are saline and saline soils. These soils have a high salt content, which limits their agricultural use without prior reclamation.

Chernozems covering a significant part of the North Kazakhstan region are the basis for agriculture, primarily for growing grain and industrial crops. However, to maintain their fertility, it is important to use crop rotation and organic fertilizers. Dark chestnut soils require extra effort to maintain moisture and nutrients.

Solonets and salt marshes, which are found in low-lying areas, are less suitable for agriculture due to their physical and chemical properties. To improve their condition, land reclamation methods are used, such as gypsum casting and soil washing.

The region's soil resources are subject to erosion and degradation due to intensive farming and insufficient use of soil protection methods. It is important to apply agrotechnical methods aimed at preventing erosion and restoring soil structure.

Thus, the soil cover of the North Kazakhstan region is diverse, with a predominance of fertile chernozems, which are actively used in agriculture. However, in order to preserve soil fertility and prevent soil degradation, it is necessary to introduce modern agricultural and land reclamation practices. These measures will help maintain high agricultural productivity and environmental sustainability in the region.

Creation of a GIS database, data collection for the methodology of selecting optimal locations for meltwater and floodwater reservation. The Geographic Information System (GIS) database contains a variety of spatial data, including terrain data based on the Shuttle Radar Topology Mission (SRTM) elevation model, as well as detailed soil maps obtained by digitization. These data make it possible to analyze the features of topography and soil cover for various studies and tasks.

The database will be expanded in 2025-2026 by integrating images from the Sentinel-2 satellite. Sentinel-2 satellite data has high accuracy and spectral sensitivity, which will make it possible to regularly update information on the state of land plots, monitor changes in ecosystems, monitor the state of agricultural crops, and monitor the state and dynamics of soil cover. Thus, as a result of adding new sources to the GIS database, it is planned to create a more complete and up-to-date view of the spatial characteristics of the territory, which will significantly increase the ability to analyze and monitor the environment in real time.

The totality of all data in the database serves as the basis for developing a methodology for selecting optimal locations for reserving meltwater and floodwaters. These data allow you to take into account the terrain, soil types, and other factors that affect catchment and storage efficiency.

In addition, the database includes information about the results of snow measurement observations, which help to estimate the amount of accumulated snow and predict the volume of meltwater. These data are used to analyze water resources, model flood situations, and plan water flow management measures.

Collecting data from snow surveys. To effectively monitor the snow cover, we need field measurements that record the thickness and density of snow. This data is collected during snow measurement and recorded on the tablet, separately from the GPS coordinates. Then the information is processed in the geographic information system: a text file with field data is used to create a point layer (shp), where each dimension corresponds to a geographical reference. This geo-linked data is necessary for further snow cover modeling, as well as for validation of remote monitoring methods. The developed technology makes it possible to supplement the data of remote

sensing of the Earth and use snow spectral indices-NDSII, DSI and RSI - to improve the accuracy of observations. Every year, field measurements are planned to be carried out at 200-2000 locations to monitor snow cover throughout the entire North Kazakhstan region. These data are necessary to obtain accurate information about the characteristics of the snow cover, such as its thickness and density, and serve as the basis for creating geo-linked layers in a geographic information system.

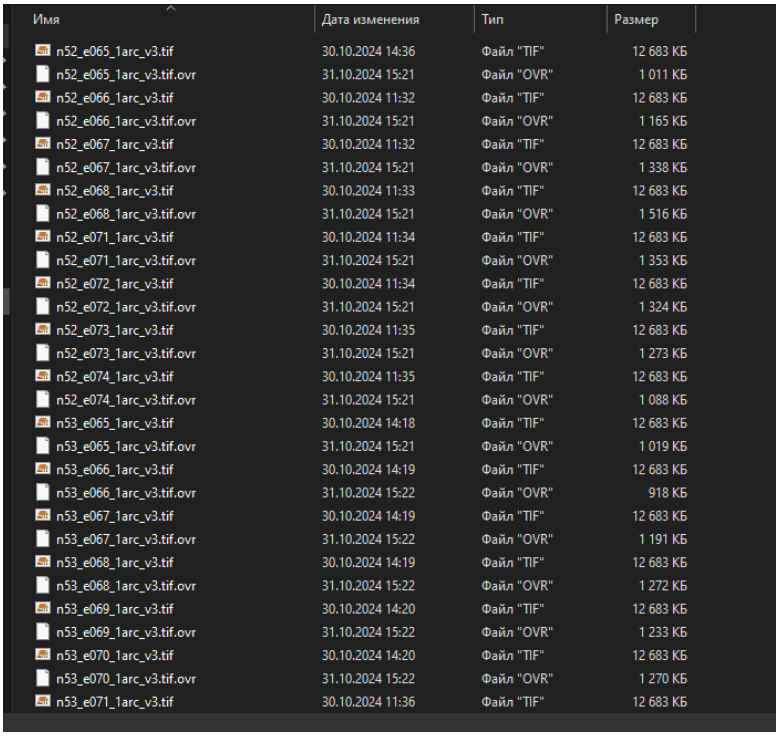
Collecting weather data for North Kazakhstan region. We selected data on average monthly air temperature and precipitation available in the ERA5-Land Monthly Aggregated - ECMWF Climate Reanalysis suite. The Google Earth Engine platform, which provides access to global climate data with high temporal and spatial resolution, was used to obtain information. The time period under study covers more than 10 years, starting in January 2014 and ending in September 2024. This time interval allows you to identify long-term climate trends and seasonal fluctuations.

The temperature_2m band temperature_2m represents data on air temperature at an altitude of 2 meters above the surface of land, sea, or inland bodies of water. The temperature value at this altitude is calculated by interpolating between the lower level of the model and the ground surface, taking into account current atmospheric conditions. This approach makes it possible to obtain data that reflect real temperatures near the earth's surface and are suitable for analyzing climate and weather conditions in the region under study. The temperature in this band is indicated in kelvins (K).

The total_precipitation_sum band total_precipitation_sumrepresents the total amount of accumulated liquid and frozen water, including rain and snow, that falls on the Earth's surface. This value includes two types of precipitation: large-scale precipitation (resulting from large weather systems such as fronts and troughs) and convective precipitation (resulting from convection when warmer and less dense air rises from the lower atmosphere). This parameter does not include fog, dew, or precipitation that evaporates in the atmosphere before reaching the earth's surface. Precipitation in this band is measured in meters, which corresponds to the depth of water that would form if it were evenly distributed over the model cell. These values represent accumulated precipitation from the beginning of the forecast period to the end of the model time step. It is important to keep in mind that model data reflect averaged values within the spatial cell and time step of the model, whereas observational data often relate to a specific point in space and time.

Data downloaded from the Google Earth Engine platform is converted and saved as bitmaps in GeoTIFF format, which makes it easy to work with them in GIS programs (Figure 16). Each band in the resulting raster represents a separate set of monthly data for the territory of the North Kazakhstan region. This allows you to store time series of data in a single file, where each

band corresponds to a specific month and includes information about either the average temperature at an altitude of 2 meters above the surface, or the total precipitation for the month. This approach makes it easy to analyze climate data, simplifies their processing and visualization, and allows for spatial and temporal comparisons to assess climate change in the region.



Имя	Дата изменения	Тип	Размер
n52_e065_1arc_v3.tif	30.10.2024 14:36	Файл "TIF"	12 683 КБ
n52_e065_1arc_v3.tif.ovr	31.10.2024 15:21	Файл "OVR"	1 011 КБ
n52_e066_1arc_v3.tif	30.10.2024 11:32	Файл "TIF"	12 683 КБ
n52_e066_1arc_v3.tif.ovr	31.10.2024 15:21	Файл "OVR"	1 165 КБ
n52_e067_1arc_v3.tif	30.10.2024 11:32	Файл "TIF"	12 683 КБ
n52_e067_1arc_v3.tif.ovr	31.10.2024 15:21	Файл "OVR"	1 338 КБ
n52_e068_1arc_v3.tif	30.10.2024 11:33	Файл "TIF"	12 683 КБ
n52_e068_1arc_v3.tif.ovr	31.10.2024 15:21	Файл "OVR"	1 516 КБ
n52_e071_1arc_v3.tif	30.10.2024 11:34	Файл "TIF"	12 683 КБ
n52_e071_1arc_v3.tif.ovr	31.10.2024 15:21	Файл "OVR"	1 353 КБ
n52_e072_1arc_v3.tif	30.10.2024 11:34	Файл "TIF"	12 683 КБ
n52_e072_1arc_v3.tif.ovr	31.10.2024 15:21	Файл "OVR"	1 324 КБ
n52_e073_1arc_v3.tif	30.10.2024 11:35	Файл "TIF"	12 683 КБ
n52_e073_1arc_v3.tif.ovr	31.10.2024 15:21	Файл "OVR"	1 273 КБ
n52_e074_1arc_v3.tif	30.10.2024 11:35	Файл "TIF"	12 683 КБ
n52_e074_1arc_v3.tif.ovr	31.10.2024 15:21	Файл "OVR"	1 088 КБ
n53_e065_1arc_v3.tif	30.10.2024 14:18	Файл "TIF"	12 683 КБ
n53_e065_1arc_v3.tif.ovr	31.10.2024 15:21	Файл "OVR"	1 019 КБ
n53_e066_1arc_v3.tif	30.10.2024 14:19	Файл "TIF"	12 683 КБ
n53_e066_1arc_v3.tif.ovr	31.10.2024 15:22	Файл "OVR"	918 КБ
n53_e067_1arc_v3.tif	30.10.2024 14:19	Файл "TIF"	12 683 КБ
n53_e067_1arc_v3.tif.ovr	31.10.2024 15:22	Файл "OVR"	1 191 КБ
n53_e068_1arc_v3.tif	30.10.2024 14:19	Файл "TIF"	12 683 КБ
n53_e068_1arc_v3.tif.ovr	31.10.2024 15:22	Файл "OVR"	1 272 КБ
n53_e069_1arc_v3.tif	30.10.2024 14:20	Файл "TIF"	12 683 КБ
n53_e069_1arc_v3.tif.ovr	31.10.2024 15:22	Файл "OVR"	1 233 КБ
n53_e070_1arc_v3.tif	30.10.2024 14:20	Файл "TIF"	12 683 КБ
n53_e070_1arc_v3.tif.ovr	31.10.2024 15:22	Файл "OVR"	1 270 КБ
n53_e071_1arc_v3.tif	30.10.2024 11:36	Файл "TIF"	12 683 КБ

Рисунок 16 – Данные ГИС для разработки методологии выбора оптимальных мест резервирования талых и паводковых вод

Thus, the developed GIS Database structure includes a combinationof various spatial data: digital terrain data (Shuttle Radar Topology Mission (SRTM) altitude model, with a resolution of 30 meters), detailed map of soil types, satellite snow index data (NDSII, DSI, RSI), climate spatial data on air temperature, etc. monthly precipitation over a multi-year period. In the future (2025-2026), the Database provides for the collection of ground-based point data that will be obtained as a result of snow route surveys (snow cover height and density, GPSsurvey points for geolocation), as well as weather data. The combination of all the database data will serve as a basis for developing a methodology for selecting optimal locations for reserving and storing meltwater and floodwaters in the region.

2. 5 Ecological state of the region's natural resources

The North Kazakhstan region is located in the very north of Kazakhstan, and in physical and geographical terms on the southern edge of the West Siberian Plain and partly on the territory of the Kazakh small-hill area (Saryarka). The region is located in the forest-steppe and steppe

zones, within the black earth belt and borders on the north with the Kurgan, Tyumen and Omsk regions of the Russian Federation, in the east with Pavlodar region, in the south with Akmola and in the west with Kostanay regions of the Republic of Kazakhstan. The distance in a straight line between the extreme points in the north-south direction is 375 km, west-east-602 km. Its administrative center is the city of Petropavlovsk. The North Kazakhstan region consists of 13 districts, 1 city of regional significance and 5 cities of district subordination, 186 rural (aul) districts and 634 rural localities.

The region is one of the leading agricultural regions of the country. The main industries are manufacturing and the production and distribution of electricity, gas and water.

Many types of minerals have been identified and studied to varying degrees in the region. 286 deposits were explored. Among them, 34 are metal, 2 are non – metals, 217 are construction and technological raw materials, and 33 are underground waters, of which 6 are mineral.

The territory of the region is part of the North Kazakhstan uranium-ore, diamond-bearing and tin-rare metal province. It revealed significant reserves of mineral raw materials, which are in the balance of the Republic of Kazakhstan: tin-65%, zirconium-36.6%, uranium-19%, titanium-5%, tungsten-1.1%. The prospects for expanding the mineral resource base are very significant, especially in the south-west of the region. There are a number of significant deposits and ore occurrences of gold, silver, technical and jewelry diamonds, tin, titanium, non-ferrous and rare metals, and brown coal [71].

Air pollution. Observations of the state of atmospheric air in Petropavlovsk are carried out by RSE Kazhydromet at 4 observation posts, including 2 manual sampling posts and 2 automatic stations.

In general, 12 indicators are defined for the city:

- suspended particles (dust).
- suspended particles PM-2,5;
- PM-10 suspended particles;
- sulfur dioxide;
- carbon monoxide;
- nitrogen dioxide;
- nitric oxide;
- ground-level ozone.
- hydrogen sulfide;
- phenol;
- formaldehyde;
- ammonia.

In general, there is no significant excess of the average daily concentration of pollutants in the city of Petropavlovsk. Table 27 shows the multiplicities of exceeding$_{\text{the MPC MP}}$ of the main pollutants in the atmosphere.

Table 27-Multiplicity of exceeding the MPC$_{\text{m.distribution of}}$ observed substances in Petropavlovsk

Pollutants by year:	2017	2018	2019	2020	2021	2022	2023
suspended particles (dust)	1,4	-	-	-	-	2,0	-
suspended PM particles-2,5	-	1,6	1,4	1,2	-	-	-
suspended PM particles-10	-	1,0	-	2,3	1,4	1,1	-
sulfur dioxide	4,0	1,0	-	-	-	-	-
carbon monoxide	1,4	1,2	-	2,2	2,8	1,4	1.4
nitrogen dioxide	1.1	2.1	1.1	2.8	2.7	2.7	3.4
nitric oxide	-	-	-	-	-	-	2,49
ozone	depletio n 2,9	3,1	1,2	1,1	1,2	9,9	-
hydrogen sulfide	27.7	5.6	6.4	6.6	15.2	21.5	9.7
phenol	1,3	2,1	1,7	-	2,0	2,0	1,0
formaldehyde	-	-	-	-	6,0	2,1	2,1
ammonia	1,6	-	1,2	1,2	4,1	5,0	-

"-" – no excess was observed

As can be seen from Table 27, the main contribution to atmospheric pollution by substance is made by hydrogen sulfide, ozone, ammonia and nitrogen dioxide.

The main source of excess of the maximum permissible concentration of hydrogen sulfide in atmospheric air is the waste water storage facility "Bioprud", which is on the balance sheet of" Kyzylzhar Su " LLP.

Air pollution is typical for the cold period of the year, which is accompanied by the impact of emissions from heat and power enterprises and heating in the private sector. Air pollution from nitrogen dioxide indicates a significant contribution to air pollution from motor vehicles at busy intersections of the city. "Kyzylzhar Su" LLP carries out continuous monitoring of hydrogen sulfide emissions with the involvement of an accredited laboratory of RSE "Kazhydromet". Measurements are carried out from the moment of opening the surface of the reservoir pond "Bioprud" from the ice cover in 4 points. To reduce hydrogen sulfide emissions, the company annually takes measures to reduce the water level in the storage tank by pumping accumulated wastewater to another storage pond-"Gorkoe", located at a considerable distance from Petropavlovsk. This made it possible to reduce putrefaction processes and the formation of bottom silt in the "Bioprud" storage pond. In winter, drilling of wells and ice holes is organized to aerate the pond and avoid salvo emissions when the ice melts in the spring. The dynamics of the air

pollution index (IIA) for Petropavlovsk for a long-term period is shown in Table 28. It shows that the IA has remained almost unchanged for many years and refers the atmosphere of Petropavlovsk to the category of "clean".

Table 28-Dynamics of the atmospheric pollution index (IA) in Petropavlovsk

Years	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
IZA	6,6	4,3	7,1	5,1	3,4	3,9	4,5	4,0	4,2	4,3	4,3	3,9
Years	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
IZA	4,0	4,0	4,0	4,0	4,5			4,0	7,0	3,0	4,0	3,0
Years	2022	2023										
IZA	4,0	3,7										

In the field of monitoring of air pollution, RSE Kazhydromet conducted observations in different years at 1-4 points: point No. 1. Tayynsha (Tayynshinsky district), point #2 of Saumalkol settlement (Ayyrtausky district), point # 3 of Bulaevo settlement (M. Zhumabayeva district), point # 4 of Beskol village (Kyzylzharsky district). The concentrations of suspended solids, sulfur dioxide, carbon monoxide, and nitrogen dioxide were measured, which during the observation period were within the permissible norm.

The main sources of air pollution in the North Kazakhstan region are energy facilities, industrial enterprises and motor transport.

The regional center of Petropavlovsk makes the greatest contribution to air pollution in the North Kazakhstan Region. SevKazEnergo JSC (CHPP – 2), which accounts for about 46.9% of the region's total pollutant emissions from stationary sources, is located here.

In 2022, the total number of stationary sources of pollutant emissions in the North Kazakhstan region was 13,695 units. The volume of gross emissions of pollutants for a long-term period from various sources and by ingredients on the territory of the North Kazakhstan region is given in Tables 3-4 [70].

Motor vehicles make a significant contribution to air pollution. According to the National Statistics Bureau of the Republic of Kazakhstan, as of 01.01.2023, 146,701 vehicles were registered in the North Kazakhstan region, including 123,520 passenger cars, 20,183 trucks and 2,998 buses [70].

The volume of gross emissions of pollutants for the multi-year period p0 of the North Kazakhstan region is given in tables 29-30.

Table 29-Volume of gross pollutant emissions from 1998 to 2022 (thousand tons) in the North Kazakhstan region

Air pollution emissions						
Years	2017	2018	2019	2020	2021	2022
Total in the region			138.1	137.9	126.0	117.7
From stationary sources	76.4	75.5	74.7	76.0	61.1	52.7
From mobile sources			63.4	61.9	64.9	65.0

Table 30-Volume of gross emissions of pollutants by ingredients (thousand tons) in North Kazakhstan region

Emissions of pollutants into the atmosphere for the main ingredients											
of the Years	1998	1999	2000	2009	2010	2011	2015	2016	2017	2018	2019
solids	64,9	for 59.9	59.9 per	64,9	for 59.9	59.9 per	19,1	19,0	25,7	25,6	23,2
sulfur dioxide	48,3	44,6	44,6	48,3	44,6	44,6	3,4	3,5	23,7	25,1	26,8
oxides of nitrogen	15	13,8	13,8	15	13,8	13,8	6,6	6,7	6,7	6,6	8,2
carbon monoxide	1,4	1,3	1,3	1,4	1,3	1,3	12,3	12,8	14,2	13,6	13,8
other	0,7	0,6	0,6	0,7	0,6	0,6					

Continuation oftable 30

Air pollutant emissions by main ingredients			
Years	2020	2021	2022
solids	23.8	21.8	19.4
sulfur dioxide	26.8	19.6	15.1
Nitrogen oxides	8.1	6.2	4.5
carbon monoxide	14.1	10.2	9.7
Other	0.7	0.6	0.6

Water resource pollution. Water resources of the region are represented by the Yesil River (with tributaries Akkanburluk and Imanburluk), Silety, Shagalaly, Kamysakty, Ashchisu, Karasu and numerous lakes. The most significant tributaries of the Yesil River in terms of water content and length are the Akan-Burluk and Iman-Burluk rivers.

The surface runoff of Yesil is used for water supply in Petropavlovsk and rural settlements of the region, irrigation of land plots, etc. In general, the river is low-water and belongs to rivers with high salinity of water, which is due to the arid climate and high salinity of underground waters.

The total number of lakes in the region is more than 2,328 lakes with a water mirror area of more$^{\text{than 4,525 km2}}$. There are fish resources in at least 1,328 reservoirs, mainly crucian carp. Of these, 395 reservoirs are included in the List of reservoirs of local significance [71]. Reservoirs differ in their hydrological and hydrochemical parameters, overgrowth, food supply, and

composition of ichthyofauna. Despite these differences, many of them are favorable habitats for fish and forage invertebrates.

Observations of surface water quality in the North Kazakhstan region are carried out by RSE Kazhydromet at 2 water bodies (Esil River, vdhr. Sergeyevskoe), in 6 gates. Based on their results, water pollution indices (WIS) were calculated for 6 main ingredients (Table 31). From the table, you can see that the water quality class has not changed in recent years and the water in these objects belongs to the "conditionally clean" water class.

Table 31 - Water quality class in water bodies of the North Kazakhstan region in 2017-2023

Item	2017	2018	2019	2020	2021	2022	2023
rubles	If 3	3	4	>3	4	4	>3
vdhr. Sergeyevskoe	3	3	4	>3	>3	3	>3

When studying surface waters, 47 physico-chemical quality indicators are determined in the water samples taken: temperature, suspended solids, color, transparency, hydrogen index (pH), dissolved oxygen, biochemical oxygen demand (BPC5), chemical oxygen consumption (COD), main salt ions, biogenic elements, organic substances (petroleum products, phenols), heavy metals, pesticides.

The main pollutants of water bodies of the North Kazakhstan region are magnesium, suspended solids and phenols. Exceeding the standards for these indicators is mainly typical for wastewater discharges in populated areas. The volumes of industrial, household, emergency and unauthorized discharges of water bodies in the North Kazakhstan region for a long-term period are shown in Table 32.

Soil cover contamination. In Petropavlovsk, the state of the soil cover was monitored by RSE Kazhydromet. In the soil samples taken in different regions, the content of copper was in the range of 0.82-15.30 mg / kg, lead-8.48-31.27 mg/kg, zinc-0.07-5.20 mg/kg, chromium-0.38-4.40 mg / kg and cadmium-0.11-0.55 mg/kg.

In the city, the excess of copper was observed in soil samples: in the area of school No. 4-4.84 MPC, in the area of the intersection of Mira and Mezhdunarodnaya streets-3.78 MPC, in the area of the park zone-3.78 MPC, in the area of CHPP-2-1.87 MPC, in the area of the Kirov plant-4.77 MPC. In the remaining soil samples taken in the fields, the content of all detected impurities was within the permissible norm [71].

Industrial and household waste. About 50 types of industrial and household waste are generated in the North Kazakhstan region.

Industrial waste**.**

The volumes of waste generation in 2016-2018 are presented in Table 33, the movement of hazardous and non-hazardous waste in tables 34-35 [72-73].

Table 32-Volumes of discharges in the North Kazakhstan region for the period 2014-2022

Information on actual discharge volumes		2014	2015	2016	2017	2018	2019	2020	2021	2022
Industrial discharges Water	disposal volume, thousand meters^3	13721,56	9531,403	8992,9	8 783,48	8624,92	8 398,5	8 357,3	8 303,2	901 0,863
	Volume of pollutants, thousand tons	15,129	10,484	8,9	8.6	8.23	7.9	7.4	7.06	2,714
Domestic wastewater	Disposal volume, thousand$^{tonsm\ 3}$	946	954,54	833,3	808,63	803,37	801,98	801,3	800,03	122 3,089
	Volume of pollutants, thousand tons	1.3	1.5	1.3	1.1	0.951	0.9	0.9	0.9	0.4339
Emergency and unauthorized discharges	Water disposal volume, thousand meters^3	-	-	-	42,0	5,327	153,9	347,3	180,7	2 7,384
	Volume of pollutants, thousand tons	-	-	-	0,01562	0,012 159	0,25	0,7	0.7	0.090
Total (all of the above resets)	Water disposal volume, thousand meters^3	14667,56	10485,94	9826,2	9 624,11	9433,62	9 354,4	9 505,9	9 283,9	1 026 1,321
	Volume of pollutants, thousand tons	16,429	11,984	10.3	9,7049	9,1932	9.07	8.9	8.6	0.097

Table 33-Volumes of waste generation in the North Kazakhstan region, thousand tons

Types of waste	2016	2017	2018
Red list waste	0.003	0.010	1.9
Amber list waste	27 448.7	30 315.0	16
454.6 Green list waste	1 909 097.4	2 019 992.928	2 097 651.1

Table 34-Movement of hazardous waste in the North Kazakhstan region, thousand tons

Type of operation	2020	2021	2022
Availability at the beginning of the year	38 317.9	1 243.8	1.5
Formed	2 108.4	949.4	9.9
Received from other persons	14.8	4.3	9.4
Recycled, reused, disposed	of 516.8	4.4	9.9
Neutralized	0.2	0.1	0.03
Buried	0	0	0
Transferred to third-party organizations, enterprises	338.2	2.5	4.6
Availability at the end of the year	39 586.05	2 188.1	5.6

Table 35-Movement of non-hazardous waste in the North Kazakhstan region, thousand tons

Type of operation	2020	2021	2022
Availability at the beginning of the year	148.5	798.2	1 428.2

Formed	19.4	3 996.7	3 232.5
Received from other persons	2.3	100.6	76.4
Recycled, reused, disposed	of 13.2	3 276.0	1 866.7
Buried	0	58.5	714.3
Transferred to third-party organizations, enterprises	7.0	65.5	164.8
Availability at the end of the year	149.9	1 495.3	1 992.5

Household waste. The volume of waste generated in 2022 in the North Kazakhstan region amounted to 81.92 thousand tons, of which 15.2 thousand tons were sorted and sent for processing. The share of recycling and recycling is 18.3%.

Collection and removal of municipal waste in the region is carried out by 21 enterprises, including 3 individual entrepreneurs. Coverage of the population by collection and removal of solid waste in 2022 is 65%.

In Petropavlovsk, there are 7 stationary recycling collection points and 1 mobile EcoCAR point for collecting dimensional electronic and electrical equipment. Processing of waste in the regional center is carried out by Raduga LLP, the enterprise has a waste sorting line.

In 6 regional centers of the region (Ayyrtau, Akkayyn, Esil, Kyzylzhar, Mamlyut, Tayynshinsky), entrepreneurs collect secondary raw materials from solid waste.

Solid waste landfills. On the territory of the region there are 453 solid waste disposal facilities, of which 11 landfills have all the necessary permits, 343-land certificates.

The current waste landfill of Petropavlovsk is located in the south-east in the direction of Shakhovskoye village. The landfill is intended for storage and isolation of solid domestic and non-hazardous industrial waste. According to the sanitary classification, it belongs to class 2. Hazard category-1. Design capacity-1,488,671 thousand tons. The daily volume of MSW intake is 150 tons. A low-capacity waste sorting line operates at the landfill, from where about 3% of raw materials are sent for further processing to third-party organizations. As of 01.01.2023, the occupancy rate is 87%, and the service life expires in 2024 [72].

Storage of waste on the working map of the MSW landfill is carried out by the method of colliding. Registration and recording of waste entering the landfill is carried out at the checkpoint in the MSW reception log.

In accordance with the plan of measures for environmental protection, the landfill is annually planted with green spaces – 20 seedlings per year. Industrial monitoring of the environment is carried out with sampling of water, air, soil and vegetation.

Unauthorized landfills, toxic waste. According to the results of space monitoring of JSC "NC "Kazakhstan Garysh Sapary", in 2022, 232 unauthorized landfills with waste were identified in the territory of the North Kazakhstan region, 224 of them were eliminated (97%). There are no

landfills for toxic waste disposal in the region. JSC SevKazEnergo uses ash dumps to dispose of ash and slag. On the territory of the region, 21 enterprises are engaged in collecting, sorting, processing and recycling waste, including MSW-13 enterprises and 8 enterprises for the disposal of industrial and medical waste. The enterprises process polymers and used automobile tires, produce products from recycled materials: plastic pipes, bags, basins, buckets, hangers and other plastic products, as well as injury-proof paving stones and paving slabs made of rubber.

Radiation situation. There are no sources of ionizing radiation in the North Kazakhstan region. Also, extraction of ores and waste containing radionuclides from the bowels of rocks is not carried out. However, there are 5 preserved and liquidated uranium deposits in the region: in the area of Musrepov – Shokpakskoye, Akkan-Burlukskoye; in the Ayyrtau district – Grachevskoye, Kosachinoye, Dergachevskoye [72].

The Shokpak field is preserved, located at a distance of 2 km from the village of Shokpak. The Akkan-Burlukskoye field has been liquidated and is located at a distance of 3 km from the village of Chistopolye. The Grachevskoye field is preserved, located at a distance of 10 km from the village of Saumalkol. The Kosachinoe deposit is preserved, located at a distance of 7 km from the village of Kutuzovka. The Dergachevskoye field has been liquidated and is located at a distance of 3 km from Sary-Tobek village. Observations of the level of gamma radiation on the ground were carried РГП Казгидромет out daily by RSE Kazhydromet at 3 meteorological stations (Vozmozhenka, Petropavlovsk, Sergeyevka). Monitoring of radioactive contamination of the surface layer of the atmosphere in the territory of the North Kazakhstan Region was carried out by RSE Kazhydromet at 2 meteorological stations (Petropavlovsk, Sergeevka) by five-day air sampling using horizontal plates (Table 36). On average, the radiation gamma background and the average precipitation density in the region were within acceptable limits [73-74].

Table 36-Radiation situation in North Kazakhstan region based on the data of Kazhydromet weather stations

Years	Radiation gamma background, mSv / h (norm 0.57 mSv/h)	Average precipitation density, Bq /m2 m2 (norm 150 Bq / m^2)
2015	0,11	1,2
2016	0,11	1,2
2017	0,11	1,2
2018	0,12	1,2
2019	0,12	1,4
2020	0,12	1,6
2021	0,11	1,9
2022	0,11	1,9

3 Socio-economic development indicators of the North Kazakhstan region

3.1 Theoretical foundations of sustainable development and multi-year data collection by socio-economic indicators of the region

The concept of sustainable development cannot be called a new idea, as this issue was dealt with at one time by outstanding scientists-economists, such as: F. Quesnay, T. Malthus, V. Pareto, who are the founders of the principle of balanced and balanced economic development. In his scientific works, J. R. R. Tolkien wrote: Hicks defines income, which is one of the main indicators of sustainable development.

The study of the theoretical basis of sustainable development allowed scientists to identify several approaches to the study of this issue: ecological-systemic, triune, cluster, and corporate approach.

Based on these studies, three interrelated policy programs on sustainable development were formed in 2015, which were supported by all UN Member States.

The first is the Addis Ababa Action Agenda for Financing Sustainable Development, which focuses on banking entities that play a key role in financing development, including in the areas of trade finance, infrastructure finance, sub-Government finance and other aspects.

The second global political program is the 2030 Agenda for Sustainable Development, which was also approved by the UN member States in September 2015. It sets out 17 Sustainable Development Goals (SDGs), economic, social development and environmental protection.

The third policy program is the Paris Agreement, which was approved by the member agencies of the UN Framework Convention on Climate Change in December 2015. The agreement aims to limit temperature increases to "well below 2 degrees Celsius and continue efforts to limit temperature increases even further to 1.5 degrees Celsius" (UN Climate Change Convention, 2015) [75].

Kazakhstan, as the first Central Asian country to join the UN Security Council, fulfills the tasks set in these Programs.

The development of the economy of any region (region in our case) is a multi-purpose and multi-criteria process. The goals ofsocial and economic development of the region may include: increasing income, improving education, nutrition and health, reducing poverty, improving the environment, equal opportunities, expanding personal freedom, and enriching cultural life. Some of them are identical, but under certain conditions they may have significant differences. Thus, limited funds can be directed either to the development of health care or to environmental protection. There is a conflict between development goals. At the same time, it is clear that the cleaner the environment, the healthier the population will be and the more the ultimate goal of population health will be achieved. Therefore, in this case, the conflict between goals is not absolutely insoluble. However, in other cases, the conflict of development goals requires special consideration and special methods of resolution.

One of the main indicators specified in the UN program is the Human Development Index. This indicator is ranked from 0 to 1. Three indicators of economic development are used for calculation:

- life expectancy;
- intellectual potential (adult literacy and average duration of education);
- the amount of per capita income, taking into account the purchasing power of the currency and the reduction in the marginal utility of income.

In addition to integral indicators, individual private indicators of sustainable development can also be used. Among them:

- national income per capita;
- the level of consumption of certain material goods;
- the degree of income differentiation;
- life span.
- level of physical health;
- level of education;
- the degree of happiness of the population.

In practice, strategic and tactical sustainable development goals are also distinguished. The strategic goal of any region is to improve the quality of life of the population and the entire management system is aimed at its implementation.

Tactical development goals (within the region and its districts) are:

- attracting new types of businesses;
- expansion of the existing business;
- small business development;
- development of the city center;
- industrial development;
- development of the service sector;
- increasing the level of employment of the region's population.

Purely economic indicators, such as GDP, per capita income, labor productivity and their growth rates, cannot fully characterize the socio-economic development of the region. Equally important are indicators of life expectancy, the level of health of the population, the degree of their education and qualifications, as well as indicators of structural changes in production and society.

At the level of the North Kazakhstan region under study, the following criteria and corresponding indicators of socio-economic development can be considered:

- GNP or GDP (absolute value per capita) and the growth rate of these indicators;
- the average level of income of the population and the degree of their differentiation;

- life expectancy, level of physical and mental health of people;

- level of education;

- the level of consumption of material goods and services (food, housing, telephone services), the provision of households with durable goods;

- the level of healthcare (availability of polyclinics, pharmacies, hospitals, diagnostic centers and ambulance services, the quality of medical services provided);

- the state of the environment.

- equal opportunities for people, development of small businesses;

- enriching people's cultural life.

When managing the economic development of a particular district of the region under consideration, it is advisable to identify all the above goals and monitor their achievement. In particular, along with monitoring the state of regional production and the dynamics of monetary incomes of the population, it is necessary to monitor other important parameters of economic development.For example, the availability and quality level of schools, kindergartens, and other educational institutions and their accessibility, as well as the level of education and qualifications of employees, etc. Food supply, quality control, and compliance with consumer rights in the market are also parameters for assessing the level of regional development. The level of physical and mental health of the population, life expectancy, the level of development of the health system and its accessibility, and the state of the environment are also important evaluation criteria for the socio-economic development of the region.

The positive dynamics of production growth does not yet indicate positive changes in the dynamics of socio-economic development in the modern sense, since the environmental component will slow down the progress of the area under study. Currently, many Kazakh cities are located near the storage of their own waste. A significant part of the land is irretrievably lost due to environmental problems and lack of financial resources. This is just one minor aspect of the complex problem of ecological well-being of people.Many cities are characterized by many times exceeding the permissible standards of water and air pollution. Significant areas of fertile land are irretrievably lost every year and permanently withdrawn from agricultural circulation. All negative environmental trends have an impact on the overall trend of the socio-economic state of Kazakhstan's regions.

A very fruitful concept that allows us to effectively analyze the problems of economic development of the region is the concept of main and auxiliary production. In any region, one can distinguish between the main industry, the products of which are mainly exported from the region, and auxiliary production, the products of which are consumed mainly within the region. For example, you can consider a machine-building plant as the main production facility and all the

infrastructure that serves it-post office, kindergartens, schools, clinics, banks, insurance institutions, forwarding and transport services, construction — as auxiliary. Usually, with the expansion of the main production, the entire infrastructure serving it also increases; the so-called multiplicative effectoccurs: the main production can be considered as a kind of accelerator of economic growth.

Primary production can be not only an accelerator, but also a deterrent to development, in particular in the case when the number of jobs in the main production is reduced in the process of structural adjustment. With fairly rapid structural changes due to scientific and technological progress, the main factor for the successful development of the field under study is not the main, but auxiliary production. The long-term prosperity of the region depends on how developed the infrastructure is and how ready it is to take on the burden of the new main production. The more developed the infrastructure (auxiliary production), the more flexible is the entire economy of the region, where its economic development and prosperity are based on a more solid foundation.

The purpose of this project (research) is to substantiate the approach to the formation of an effective mechanism for managing the process of ensuring sustainable development of the region in the context of the transition to an innovative economic model based on a new methodology for scientific and technological forecasting.

Achieving sustainable development of the regional socio-economic system in the context of transition to an innovative economic model is determined by the following factors (Table 37). The most important of them is the innovation and technological factor.

The innovation management mechanism in the region should not be identified with the management process, since it exists and functions in the management system as an independent subsystem, which at the macro level is designed to solve the following tasks:

- develop a state strategy for innovative development and support of entrepreneurship;
- create a regulatory framework in the field of scientific, technological and innovative development;
- ensure consistency and consistency of state programs; integrated use of measures and resources included in target programs at various levels;
- develop a system for evaluating the effectiveness of innovation process management and a system for monitoring scientific, technological and innovative development.

Table 37-Factors of sustainable development of the region in the context of transition to an innovative economic model

Name of the factor	Content of the factor and its role in ensuring the sustainable development of the region
Political and legal	Necessity of state regulation of socio-economic processes of regional development based on the development of normative legal acts

Educational	Availability of appropriate human resources, strengthening the degree of greening and innovatization of education, implementation of the "lifelong education" principle,
Environmental	Safety and reproduction natural resources.
Innovation and technology	The presence in the region of a developed market for high-tech products and an effectively functioning regional innovation system as a mechanism for implementing an innovative economy that allows for sustainable development.
Financial and economic	Support for the functioning in the region of an effective system of financial and economic instruments for regulating environmental and economic interaction and the innovation process (fiscal measures, subsidies, environmental and innovation funds, etc.).
Structural	Changes in the sectoral structure of the economy (expansion of the service sector and the high-tech and knowledge-intensive sector of the economy).
Informational	Provision of statistical observation and informative value of regional development indicators.
Communication	Raising consumer awareness about the importance of innovation achieving economic growth and increasing the responsibility of all economic entities in relation to the natural environment.
Social	. Strengthening the role of the main social groups of the population (economically active population, the younger generation) in the implementation of the transition of the economy to the path of sustainable and innovative development.
Reproduction	Optimization of the process of reproduction and renewal of fixed assets in the region to ensure innovation orientation and prevent the risk of man-made disasters.
The factor of globalization	Strengthening on the basis of informatization and computerization of the action of the educational factor affecting the ecological and economic behavior of people, the transfer of various technologies, etc.
Institutional	Creation of appropriate institutions for the implementation of the strategy for sustainable and innovative development in the region, designed to ensure the activation of all factors, as well as the creation of conditions for the use of effective organizational forms and mechanisms.
Note - Compiled by the authors based on the study of literature sources [76,77]	

Similar tasks are also solved at the meso-level, but they are focused on the specifics of a particular region.

A management object is a network of organizations that generate, create, and promote the creation and dissemination of innovations (elements of a regional innovation system).

The mechanism of innovation management in the region is, first, a set of management tools that cover three main interrelated components, with the help of which sound management decisions are made and their effective implementation is ensured, namely: principles, functions and management methods. Secondly, this method of purposeful change of organizational behavioral models of subjects of the regional innovation system, as well as the behavioral model of consumers of innovative products by creating an effective communication environment and using a set of tools for predictive and post-predictive management.

Predictive management implies the ability to anticipate the structure of future events using economic, mathematical and simulation models to predict the development of the region and determine long-term performance targets based on the results obtained [78].

Post-forecast management is a system of actions aimed at coordinating the development of future events and transferring knowledge about them.

The basic principles of management include objectively existing universal rules, such as: a balanced combination of centralization and decentralization, optimal interaction of individual management and collegiality, distribution of authority and responsibility, initiative and remuneration, hierarchy, subordination, and others.

The main system-wide management principles applied to the objectives of this study include:

1. The principle of purposefulness, according to which the basis of innovation management in the region is long-term goals, which are reflected in the strategy of socio-economic development of the region as a whole.

2. The principle of consistency means that in the process of developing, making and implementing management decisions, it is necessary to use a systematic approach, both to management objects (elements of the regional innovation system) and to management processes implemented through management mechanisms.

3. The principle of complexity. It is closely related to the previous ones. This principle implies a comprehensive coverage of the activities of all elements of the regional innovation system, taking into account all its aspects, directions and characteristics.

4. The optimality principle. It implies the need to choose the most effective development option from a variety of alternatives available in the existing conditions. At the same time, the main selection criteria are indicators of the economic, social and environmental effectiveness of the control actions carried out.

5. The principle of scientific character, which implies the use of the results of modern science in the theory and practice of management, objective laws of the development of nature and society. According to this principle, the entire mechanism of innovation management in the region should be based on modern knowledge and achievements in the field of economics, management, law, and ecology.

6. The principle of continuity implies that the innovation management process should be carried out continuously and continuously. Strategic management should be aligned with tactical and operational management.

7. The principle of adaptability. The essence of this principle is the necessity and perspective of adjusting control actions depending on changing factors and conditions of the external and internal innovation environment in the region.

Specific principles are based on general and system-wide ones and are filled with specific content that take into account the specifics of innovation management in the region. The main specific principles include:

1. Determination of scientific and technological goals and relevance of their significance for the development of relevant sectors of the economy. Here you can identify strategic goals that are important for the development of the economy as a whole, and specific tasks in the field of science, technology and innovation that follow from them.

2. Focus not only on technology development, but also on markets. The main guidelines are the interests of business, consumer preferences in the future and a strategic vision of the future state of the economic sector.

3. It should be noted that the creation of technologies is not limited to separate projects for the benefit of one or several participants. Innovation activity is positioned as a system of actions to bring entire sectors of the economy to a new technological level.

4. The ability to achieve goals without the coordination of a wide range of participants. This may be due to high research costs, or significant technological risks, etc.

5. Representation of key companies, both public and private. It is important for the state to have an entity in the regional innovation system that can act with a consolidated position on various issues of development of a particular sector of the economy.

6. Representation of key scientific and educational organizations working with this technology. This is necessary to study all possible scientific and technological alternatives and choose the most effective solutions.

7. Exclusion of the dominance of both technological and market monopolists. A regional innovation system should be open to new participants at all stages of its life cycle.

8. The importance of achieving positive results through innovation. Innovation should not only be in demand in a particular area, but also correspond to the specifics of this area and development goals. Innovation is necessary in cases where the coordination of the activities of subjects in the scientific and technical sphere is essential for development, and there is no other mechanism as an alternative.

9. Elaboration of priority actions within the regional innovation system. The first stage of creating a system requires organizational measures and negotiation skills on the part of all participants. This is usually hindered by competitive relationships.

The application of these management principles forms the basis for an innovative management function in the region.

Thus, the most important task of all states, in particular Kazakhstan, is to establish effective, harmonious relations between the three spheres of environmental, economic and social. To do this, it is necessary to develop a strategy for sustainable development in the region and take effective measures to balance them.

Before developing a strategic plan for the sustainable development of the region, it is necessary to analyze socio-economic indicators.

Socio-economic indicators are absolute or relative indicators that characterize the state of development of the economy (country, region, etc.) and its social sphere.

The development of the economy, in particular in the North Kazakhstan region, allows the population living in this territory to receive income and use it to meet current needs.

Development is expressed in qualitative changes in the economy that affect the well-being of the population.

Qualitative changes in the economy that affect the population's income include:

- economic growth of quantitative indicators;
- formation and functioning of an innovative economy;
- development of venture business;
- structural changes in the economy;
- increase of labor productivity.

K Economic indicators include:

- gross domestic product.
- investments in fixed assets;
- real disposable income;
- index of output of goods and services by basic types of economic activity;
- the volume of agricultural products produced;
- transport cargo turnover.
- Retail trade volume and turnover;
- data on the service sector.
- consumer price index.
- the number of unemployed;
- foreign trade turnover;
- nominal and real level of wages.

K Social indicators include:

- composition and dynamics of changes in the social structure, production and consumption of material and spiritual goods;

- structure бюджетов of time budgets.

- status, satisfaction условиями with living conditions and activities , т. etc.).

In accordance with the objectives of this project 2024, we have collected multi-year statistical data on socio-economic indicators of the development of the North Kazakhstan region in the context of districts for 2004-2023, in the following areas:

- socio-demographic data.

- standard of living.

- labor market and remuneration;

- gross regional product.

- the real sector of the economy;

- trade;

- prices, etc.

All the collected multi-year data on the socio-economic development of the region was initially collected in the form of tables in Excel format. For example, the appendix of the report E, J, I, K shows the collected socio-economic indicators for the whole region. The database on socio-economic development for a multi-year period for 13 districts and Petropavlovsk for all the above indicators is available on electronic media and is available here:

https://drive.google.com/drive/folders/10Dk9lGr_MvGftHxcQs_DBlPajFtzspH?usp=drive_link

These materials are structural components of the geographic information database, which includes extensive thematic information for further comprehensive spatial analysis and assessments within the framework of the tasks of this project.

The collected data and their analysis characterize certain socio-economic trends and processes that are currently observed in the region. As of October 1, 2024, 524.0 thousand people live in the North Kazakhstan region, of which 258.0 thousand people or 49.2% live in the city, 266.0 thousand people or 50.8% live in rural areas, respectively. In 2023, 20,322 people left this region for other countries and regions, and 16,666 people came for permanent residence in the North Kazakhstan region. Thus, the balance of population migration in all flows was – (-3656 people), which indicates that more people leave this region than come.

The migration process is caused by social problems, including poor roads, lack of centralized water supply, and in addition, in some villages there is a question of closing hospitals. Among the determining reasons for the younger population are economic reasons, in particular

low wages. According to the latest data, the level of wages in North Kazakhstan region is second only to Turkestan and Zhambyl regions.

It should be noted that in the region as a whole, the number of hospital organizations has remained virtually unchanged over the past 5 years. There are 25 hospitals in the region. The number of hospital beds in 2023 decreased by 6.0% compared to the previous year.

The number of pre-school organizations, schools, and colleges has almost remained at the same level. There is a tendency to increase the number of students in schools and colleges. There are 2 universities in the region, with a population of 6.2 thousand people.

In the region, the active population decreased by 1.7%. The unemployment rate was 4.6% of the labor force, which is 4.9 thousand people.

The average monthly nominal salary accrued to employees (excluding small businesses engaged in entrepreneurial activities) in 2023 amounted to 262,248 tenge, an increase of 15.5% by 2022. The real wage index was 99.9%. The cost of living is 47,845 tenge.

The volume of gross regional product in 2023 amounted to 2.4 trillion tenge, or 4.5 million tenge of products were produced per person.

The volume of production of industrial products (goods, services) in 2023 amounted to 674.9 billion tenge, of which the share of the manufacturing industry accounts for almost 85.0%.

In the structure of the manufacturing industry, 47% is accounted for by food production. This indicates that the region has developed agriculture.

For the analyzed year, the value of gross agricultural output in the region amounted to 757.5 billion tenge, including 577.6 billion tenge in crop production and 179.1 billion tenge in animal husbandry. In this region, mainly engaged in the cultivation of cereals, oilseeds, as well as potatoes and vegetables. Cattle breeding, sheep breeding, pig breeding, and horse breeding are also developed here.

The volume of investments in fixed assets for the analyzed year amounted to 443.7 billion tenge, an increase of 20.4% compared to the previous year.

The volume of cargo turnover in 2023 amounted to 9.9 billion rubles. tcm (taking into account the estimation of the volume of cargo turnover of individual entrepreneurs engaged in commercial transportation). This indicator is lower by 11.0% compared to the previous year.

Passenger turnover is 615.6 million pkm, which is also 10% lower compared to the previous year.

The volume of construction works (services) amounted to 163.4 billion tenge, 31% higher than in 2022. In 2023, the total area of commissioned housing increased slightly by about 2.0%.

The number of registered legal entities in 2023 amounted to 37,977 units, which increased by 4.6% compared to 2022. The output of all small and medium-sized businesses for the analyzed year amounted to 1.1 trillion tenge.

The volume of retail trade in 2023 amounted to 398.9 billion tenge, or 11.1% more than in 2022.

The consumer price index in September 2024, compared to December 2023, was 106.1%.

Prices for food products increased by 10.5%, non – food products-by 9.8%, paid services for the population-by 13.8%.

Prices of industrial production enterprises increased by 3.7% in 2023 compared to 2022.

The North Kazakhstan region, being an agricultural, trade and transit region of Kazakhstan, has great potential for economic development.

The region is rich in mineral resources. Mineral reserves in this region in the balance of the Republic of Kazakhstan: tin-65%, zirconium-36.6%, uranium-19%, titanium-5%, tungsten-1.1%. There are a number of large deposits and ore occurrences of gold, silver, technical and jewelry diamonds, tin, titanium, non-ferrous and rare metals, brown coal.

The main specialization of the region is the production of grain, in particular durum wheat varieties, which are in great demand in the global agricultural market. Animal husbandry is represented by meat-and-wool sheep breeding, meat and meat-and-dairy cattle breeding.

The North Kazakhstan region is one of the most lake-filled in Kazakhstan: there are about 3.1 thousand mostly small drainless lakes. The total area of the water mirror of the lakes reaches 340 thousand hectares, the volume of water is about 4.5 billion^{m3}.

Large industrial enterprises of various types of activity are also located in the region. For example, LLP "Plant of Small engines", JSC "ZIKSTO", JSC "Munaimash", JSC "Plant named after S. M. Kirov", JSC "Petropavlovsk Heavy Engineering Plant", JSC "Petropavlovsk Repair and Mechanical Plant", LLP "Diesel", LLP "Rotor", which produce spare parts for agricultural machinery and equipment, engines, pumps, mobile power plants, food processing equipment, gas and electricity meters.

Light industry is developed, and the building materials industry is developing.

The favorable geographical location of the region allows you to conduct foreign trade. Mainly exported are food products, livestock products, agricultural raw materials, mining raw materials, mechanical engineering and metalworking products (cranes, valves, pipeline valves, transmission shafts, bearings, gearboxes and other similar products).

However, the region has a low birth rate, the balance of migration processes is negative; the number of villages where no more than 50 people live is 140 (over the past 5 years, 13 auls have ceased to exist here). The adopted program of voluntary resettlement of Kazakhstanis from

the south to the north "did not give the expected result." Among the factors that prevented the successful implementation of the program, analysts consider difficulties with housing, employment and underdeveloped infrastructure.

Therefore, it is necessary to develop a regional economic and industrial policy that would allow us to focus joint efforts on solving priority tasks that ensure the development of the region.

According to the project objectives, in 2025, the project researchers intend to conduct a more detailed analysis of socio-economic indicators and develop effective mechanisms for sustainable development of the region.

3.2 Information database and methodological bases for assessing the labor resources of the North Kazakhstan region

Labor resources and demographic changes play a key role in the development of the territory, ensuring its socio-economic development and contributing to the creation of infrastructure necessary to improve the quality of life of the population. In the context of modern demographic and economic changes, regions with efficient labor resources and balanced demographics have significant advantages in sustainable development. Thus, the integration of labor force analysis and forecasting with demographic hypotheses makes it possible not only to ensure an adequate level of employment, but also to optimize the distribution of social and engineering resources in the long term.

The effectiveness of the use of labor resources is directly related to their skill level, health status and motivation. Studies show that labor resources and their qualitative characteristics, such as the level of education and professional skills, have a direct impact on the economic potential of the territory. Becker G.'s work "Human capital" emphasizes that investments in education and vocational training lead to increased productivity and strengthen the sustainability of the regional economy [78-2].

Smith and Mill also note that labor productivity depends on the level of training of employees and their adaptation to changes in the labor market [79, 80]. This is especially true in rural and developing regions, where the population has limited opportunities for professional development.

Human resources provide the creation and maintenance of infrastructure, which is the basis for improving the standard of living. The World Bank emphasizes that high-quality infrastructure helps attract and retain skilled workers, thereby improving the labor potential of the Territory [81].

Demographic development is an integral element in managing the development of labor resources and sustainable socio-economic growth of the territory as a whole. Demographic changes determine the quantity and quality of the labor force, affecting its reproduction and

structure, while labor resources form the economic basis that contributes to the improvement of the demographic situation. Integrated management of these aspects allows the region to adapt to demographic and economic challenges, strengthening its sustainability and competitiveness.

A study by G. Borjas devoted to immigration and its impact on the economy demonstrates that migration flows can fill the shortage of labor resources in economically developed regions, contributing to their growth [82]. However, the outflow of population from rural regions leads to their demographic degradation and deterioration of socio-economic indicators.

Maintaining a stable birth rate is a necessary condition for long-term preservation of labor potential. M. Wade and A. Holland note that the decline in the birth rate is especially noticeable in developed countries, and this affects the structure of the labor force, requiring the development of measures to support families and stimulate the birth rate [83]. The problems of the shortage of qualified personnel that arise due to the decline in the birth rate and the aging of the population are considered in the works of such scientists as A. Boucher, A. Constant, D.Crown, M.. Wade [84-87].

General theoretical positions of the labor market and socio-economic problems are also considered in the works of M. Piore, M. Nazarzadeh Zare, Thi Tuyet Tran and others [88-90].

It should also be noted that human resource management today remains insufficiently studied, which is reflected in the works of foreign scientists S.Binggeli, Ch. Guo, A.. Hajro [91-93].

Scientists of Kazakhstan also conduct research in the field of assessing the socio-demographic situation, problems of personnel shortage, unemployment and labor resources.

During the 1990s and most of the 2000s, the problems and issues of the labor market of the Republic of Kazakhstan were considered in the context of poverty, unemployment, and social protection of the population [94-95].

In recent years, the current agenda in the field of labor and employment has shifted towards increasing the economic activity of the population and efficient use of labor resources. There is a need for significant changes in the state policy in this area, the transition from a policy of low unemployment to a policy of effective employment and reaching a fundamentally new level of labor productivity.

Thus, labor resources and demographic factors have a key impact on the development of the territory, determining its socio-economic development and sustainability. Effective management of labor and demographic resources allows creating favorable conditions for economic growth, improving living standards and sustainable use of natural resources. Further research in this area will contribute to the development of adaptive management models that can respond to the challenges associated with changing demographics and labor market requirements.

Methodological approaches and information database. Assessing the demographic and labor potential of a region for the purposes of territory development requires the use of various methods that allow us to take into account the peculiarities of the distribution and development of the population and labor resources in a spatial context. These methods help to optimize the use of labor potential, improve planning and ensure sustainable development of the territory.

When determining the demographic potential of a region, the following methods are used:

Determination of the working-age population. Demographic analysis allows you to determine the current and projected number of working-age population, which is the basis for assessing the available labor resources. This includes birth rates, mortality rates, age structure, and migration. This data helps to understand the size of the labor force in the coming years.

Study of the age structure of the population. The age structure of the population directly affects the labor potential of the region. A large proportion of the young population speaks about the future growth of the labor force, while the predominance of older age groups indicates the need to compensate for a possible shortage of employees. Age characteristics help to predict the availability of updated labor resources and the need for professional training.

Analysis of the demographic load factor. The demographic load factor (the ratio of the able-bodied and disabled population) shows how much the able-bodied population is able to meet the social needs of disabled groups (children and pensioners). A high load factor can limit the development of the economy and create an additional burden on employed workers. Evaluating this indicator helps to balance economic and social measures in human resource management.

Forecast of labor resources based on demographic changes. Demographic data allow us to make predictions about the size and structure of the working-age population. For example, a lower birth rate and longer life expectancy may lead to an aging workforce and the need to rethink labor strategies. This helps to plan the long-term development of labor potential, taking into account future needs.

Assessment of migration processes. Migration of the population significantly affects the labor potential of the region, as it can either strengthen or weaken it. The influx of migrants can compensate for the lack of workers in certain sectors, and the outflow, on the contrary, can worsen the shortage of labor resources. The assessment of migration processes allows us to take into account the possibilities of attracting labor from other regions and countries, if our own demographic potential does not cover the needs.

Methods of labor potential analysis include:

Assessment of the economically active population, employment and unemployment. The level of employment of the population in various industries is analyzed, which is important for understanding the possibilities of using labor potential in territorial development [96].

The analysis of the qualification and educational level helps toassess what qualified personnel are available in the region, as well as to identify the need for professional training for the development of certain industries.

To assess the demographic and labor potential of the region, in addition to fundamental methods, applied, interdisciplinary methods are used:

Mapping of demographic and labor indicators is based on the use of GIS to visualize key indicators that can influence the planning of territories [97].

Analysis of the spatial distribution of labor resources allows you to identify the most and least provided with labor resources of the territory, which helps to determine priorities in the development.

SWOT analysis of labor potential is used to identify strengths, weaknesses, opportunities and threats in the development of the region's labor resources, which helps in strategic planning of development.

The next methodological approach involves obtaining index scores. It consists in the fact that diverse indicators focused on the assessment of population parameters are brought to a uniform basis and integrated according to certain principles into a single value. The complexity of the index method lies in the choice of particular indicators and ways of matching them.

The most famous example of the index method is the Human Development Index (HDI), developed in 1989 by economists A. Sen and M. ul-Haq at the request of the United Nations Development Programme for analysis at the national and regional levels. The index approach allows you to compare parameters that differ in dimension and direction of action, and calculating the integral index makes it easier to evaluate the final result, allows you to make cross-country and interregional comparisons, and track the dynamics.

The labor balance method is a method that evaluates the ratio of available labor resources and their needs in different sectors of the economy. This method helps you understand which industries lack employees and where there is an excess of them. This method helps to create a balanced employment system that takes into account the needs of the economy and the capabilities of the region's labor resources.

Based on the considered methods and analysis of the system of regional statistical indicators presented in the database of the Bureau of National Statistics, a system of data indicators for assessing the labor resources of the region is formed (Scheme 4). This system covers key indicators that characterize the size, gender and age structure of the entire population, as well as the dynamics of migration processes. Indicators of the region's labor resources make it possible to identify socio-economic trends, assess the sustainability of the economy, identify problem areas and plan measures to eliminate them.

The size of the labor force makes it possible to assess the economic potential of the region and identify the level of involvement of the working-age population in economic activities, which is critical for sustainable economic growth. The level of employment helps to understand how well the region provides employment for the population and prevents social problems such as poverty and social inequality. Index The number of employees indicator allows you to analyze the dependencies of certain sectors and organizations, as well as assess the level of social protection through labor guarantees and the availability of social packages.

The unemployment rate is one of the key indicators of economic sustainability and social well-being. A high level of unemployment leads to a decrease in the standard of living and social stability. Keeping the unemployment rate low contributes to sustainable development and poverty reduction. Data on the number of employees by age and type of activity are important for identifying imbalances, such as a shortage of jobs for certain age groups or a concentration of workers in one sector, which can make the economy less resilient.

Demographic potential	Labor resources
1. Population size (city / village) 2. Population by ethnic 3. group Population by gender (city / village) 4. Population size by major age groups (city / village) 5. Birth rate (city / village) 6. Mortality rate (city / village) 7. Natural population growth (urban/rural) 8. Infant mortality 9. Maternal mortality 10. Population life expectancy 11. Demographic load 12. factors Population ageing index 13. Total fertility rates (urban / rural) 14. Total birth rate (city / village) 15. Total mortality rates (city / village) 16. Total natural population growth rates (city/village) 17. International population migration by level of education 18. International population migration by ethnic 19. groups International population migration by individual age groups and ages 20. International population migration with CIS countries 21. International population migration with other countries 22. Interregional population migration by individual age groups and ages 23. Intra-regional migration by individual age groups and ages	1. Labor force size (city / village) 2. Employed population (city / village) 3. Employment rate (city / village) 4. Number of employees (city / village) 5. Number of self-employed workers (city / village) 6. Number of unemployed population (city / village) 7. Unemployment 8. rate Youth unemployment 9. rate Number of employees by type of economic activity 10. Average monthly salary per employee 11. Average monthly salary by type of economic activity (city / village)

Scheme 4-Developed system of indicators for assessing the labor resources of the North Kazakhstan region

The average monthly salary is an important indicator of the standard of living of the population and reflects purchasing power. Comparing salaries by type of economic activity reveals income inequality, stimulating efforts to support a fair distribution of income.

Together, these indicators will make it possible to comprehensively assess the state and prospects of the labor market, as well as identify measures that will contribute to the sustainable development of the region [98].

Based on the developed system of indicators, a statistical database was compiled for the North Kazakhstan region in the context of districts in dynamics for 2000-2022. The collected statistical database that characterizes the demographic potential of the North Kazakhstan region is given in Appendix L and is also available at the following address: (https://drive.google.com/drive/folders/10Dk9lGr_MvG-ftHxcQs_DBlPajFtzspH?usp=drive_link).

To date, there is no detailed regional causal analysis of the main demographic indicators and labor resources of the North Kazakhstan region. For effective management of labor resources in the future, this project will assess and forecast demographic indicators and labor resources, which will help identify and solve emerging problems in the territorial planning of the region.

The study of demographic processes in the North Kazakhstan region remains very relevant today. Over the past 20 years, there have been negative or very low indicators of natural population growth in the North Kazakhstan region (-0.67% in 2023). Out of 13 districts with positive natural growth in 2023, only three (Petropavlovsk Петропавл0.17%, Akzhar 4.88%, Ualikhanov 7.59 %). With a high natural growth rate, the population increases, which in the long run leads to an increase in the number of young people who enter the labor market. This can help replenish the labor force and improve the demographic structure of the region. Low or negative natural growth, on the contrary, leads to a reduction in the number of able-bodied people. This situation can lead to a shortage of labor, which, in turn, negatively affects the economic development and sustainability of the region.

Forecasting changes in the demographic structure and labor market will allow planning measures to provide labor resources and reduce migration outflows. To maintain the demographic and labor potential of the Territory, programs are needed to stimulate employment, support the birth rate and attract migrants. Family support programs, housing subsidies for young professionals, and improved social infrastructure help retain and attract labor in the region.

3.3 Characteristics of transport and communications in the region

During the implementation of the scientific project "Building a decision support system for the natural and economic development of the territory of the North Kazakhstan region in the context of sustainable development" in November 2024, a business trip was conducted to Petropavlovsk to collect statistical data on the North Kazakhstan region. Data were obtained from the "Department of Passenger Transport and Highways of the Akimat of the North Kazakhstan region"as of October 1, 2024. According to the data obtained, there are 8 bus stations, 1 bus station

and 1 passenger service point in the region. The availability of official taxi services in cities is 100%. Passenger traffic covers 371 localities out of 443, which is 83.8% of the total area covered. As of August 1, 2024, there are 126 bus routes operating in the region, including:

- city - 18,
- prigorodnye-9,
- intercity intra-regional services - 55,
- international - 4,
- inter-regional-6,
- intra-district - 21,
- intra-rural settlements - 13.

On the territory of the North Kazakhstan region there are railways of the Petropavlovsk branch of the South Ural Railway-a branch of JSC " Russian Railways "and the railway of JSC NC"Kazakhstan Temir Zholy".

Currently, there are 3 railway stations in the North Kazakhstan region (Petropavlovsk, Bulaevo, Mamlyutka), including 23 railway stations in the territory (Azat, Baumanskaya, Belogradovka, Volodarskaya, Gankino, Daut, Zhanazhol, Zhanaturmys, Kara-Guga, Kaudandy, Kyzyl, Tu, Kiyaly, Kondratovka-Sibirskaya, Novoishimskaya, Pervaya Tselinnaya, Prirechnaya, Saumalkol, Smirnovo, Suly, Tayynsha, Talshchik, Teniz, Tokushi).

Petropavlovsk Airport accepts regular flights to Astana, Almaty and Shymkent. The standard capacity of the airport terminal is 200 passengers per hour. The artificial runway corresponds to Class B and is designed to provide take-off and landing of all types of aircraft.

The international corridor "Almaty-Karaganda-Astana-Petropavlovsk" passes through the territory of the North Kazakhstan region. The length of the railway of JSC NC "Kazakhstan Temir Zholy" is 615 km. The operational length of the Southern Railway is 182.2 km, including 182.2 km of double – track lines, 587.34 km of extended road separation, 368.3 km of access roads, and 505.552 km of electrified lines. The road network of the North Kazakhstan region is 8,416. 2 km, including 1,970 km of national and 6,446. 2 km of local significance.

Highways. The network of national and regional highways provides the region's access to the bordering states and regions. Andsecond-mobile roads of local significance are a branch of roads of national significance that provide connections between individual localities and district centers.

The length of the public road network in the North Kazakhstan region is 8,996 km, of which 1,970 km are roads of national significance, 1,983 km are roads of regional significance, and 5,043 km are roads of district significance.

The Mamlyutka stationary transport control post, located on 496 km of the Chelyabinsk – Novosibirsk highway, which previously operated in the region, has been mothballed since June 2018, in agreement with the Transport Committee, in connection with the reconstruction of the road section from Petropavlovsk to the Zhana Zhol checkpoint.

NorthKazakhstan region is a border area (in the west, north and east it borders with the Kurgan, Tyumen and Omsk regions of the Russian Federation), 4 international automobile checkpoints operate on its territory (three for multilateral communication-Zhana-Zhol, Kyzyl Zhar, Kara Koga and one for bilateral communication with the Russian Federation – Bidaik). In this regard, special attention is paid to the protection of domestic carriers by conducting constant monitoring of compliance by foreign carriers with the requirements of the licensing system for road transport in international traffic [100].

Road repairs (data from the Akimat of North Kazakhstan region). Work on medium repairs is carried out selectively on the M-51 national highway "Border of the Russian Federation (to Chelyabinsk) - border of the Russian Federation (to Novosibirsk) via Petropavlovsk, Omsk"). The plot with a total length of 14 km is located on the territory of Magzhan Zhumabayev district. Here, work will be carried out on the construction of a leveling layer, asphalt concrete pavement and roadsides, and the application of road markings. Road signs were replaced, as well as asphalt pavement was installed at the exits. Commissioning is scheduled for the current year 2024. Also in the Magzhan Zhumabayev area, the KT-14 Karakoga - Gorka highway(0-10 km) is undergoing an average repair. In addition, the section of the republican highway R-58 "Bulaevo - Vozmozhenka - Molodogvardeyskoe - Kirovo - Kiyaly - Roshchinskoe" with a total length of 38.4 km is undergoing an average repair on the asphalt pavement.

In Ayyrtau district, a bridge for 55 km of the regional highway "Elenovka - Arykbalyk - Chistopolye - Yesil" (17-209 km) is undergoing major repairs.

Medium repairs were also started on the section of the Zhezkazgan-Petropavlovsk highway, which passes through four districts of the North Kazakhstan region. Work will be carried out on 40 km (836-876 km). In Akzharsky district large-scale works on average repair of roads between the villages of Alkaterek and Leningradskoye with a length of 24.7 km are being completed. In the Mamlyutsky district, from the town of Mamlyutki to the village of Novodubrovnoye, work has begun on the average repair of the section of the A-21 "Mamlyutka-Kostanay" highway with the arrangement of a recreation area and the installation of lighting poles with a total length of 28.5 km.

In total, 10 projects are being implemented this year on roads of national significance passing through the territory of North Kazakhstan region (the total length of repairs is 281 km). One object (30 km) is under reconstruction, two objects (57.7 km) are undergoing major repairs,

and seven objects with a total length of 193 km will undergo medium repairs. The share of local roads that are in good and satisfactory condition, according to the results in 2022, was 72%, in 2023 it was reached 84%.

Basic requirements for the quality assurance system:

- performing all construction control services to the extent and within the time limits stipulated in the terms of reference to the contract;

- assessment of construction quality compliance with design requirements and technical documentation, including control measurements and tests of finished structures, as well as materials and products used;

- supervision of compliance with the production technology of works, including instrumental control, monitoring of compliance with technological maps, schemes and regulations;

- conducting interim acceptance of completed works, as well as participating in the acceptance of completed construction projects into operation;

- preparation of reports on the results of construction control at objects for the construction, reconstruction and repair of highways [100].

Transportation of passengers and luggage by road. Regular passenger services are provided by 10 carriers, including 4 LLP companies and 6 individual entrepreneurs. To meet the needs of the population in passenger transportation in the region, there are 126 bus routes, including urban – 18, suburban - 9, intercity intra-regional-55, international-4, inter-regional-6, intra-district-21, intra-village-13. About 185 buses and minibuses are involved on regular routes. There are 8 bus stations and 1 bus station and 1 passenger service point in the region for passenger and carrier services. Data for Petropavlovsk Bus Station LLP are shown in Table 38.

Regular passenger car service covers 371 localities out of 443 (localities with more than 100 inhabitants), covering 83.8% of them [101].

Table 38 - Data on Petropavlovsk Bus Station LLP

Location: Director	of North Kazakhstan Region, 1 Yu. Medvedeva str . Sysoeva Alexandra Alexandrovna
Year of creation Bus station building: Plot size:	1998 1 200 sq. m. 4, 5 ha
Main activity:	terminal services for passenger transportation, provision of passenger and baggage
transportation services Brief information:	number of seats on the platform for passengers boarding – 9, number of routes served: international - 4, inter - regional – 6, intercity intra - regional-54, suburban-9
Number of operating routes: Average monthly salary:	32 people 110,000 tenge

Since 2017, the Department has been working to subsidize socially significant intra-regional routes and include them in the List of socially significant messages of the North Kazakhstan region. To date, there are 47 socially significant routes in the region:

Molodogvardeyskoye-Petropavlovsk
Aksuat-Petropavlovsk
Smirnovo-Petropavlovsk
Ivanovka-Petropavlovsk
Novorossiysk-Petropavlovsk
Grigoryevka-Petropavlovsk
Kairankol–Petropavlovsk
Petropavlovsk-Kishkenekol
Petropavlovsk-Dubrovnoye
Dolmatovo-Petropavlovsk
Petropavlovsk-Saumalkol-Imantau
Pacific-Petropavlovsk
Kazanka-Petropavlovsk
.Petropavlovsk-Ilinka
.Amangeldinskoe-Petropavlovsk
Lomonosovka-Petropavlovsk
Maybalyk-Petropavlovsk
Novogeorgievka - Petropavlovsk
Presnovka-Petropavlovsk
Uzynkol-Petropavlovsk
Uzynzhar-Petropavlovsk
Krasnoyarsk-Petropavlovsk
Katanay-Petropavlovsk
Mektep-Petropavlovsk
Novoukrainka-Petropavlovsk
Kamyshlovo-Petropavlovsk
Tayynsha-Petropavlovsk
.Bolshoy Izyum-Petropavlovsk
Kiyaly-Petropavlovsk
Dvinsk-Petropavlovsk
Berlik-Petropavlovsk
Iskaka Ibraeva-Petropavlovsk
Karakoga-Petropavlovsk
Gankino-Petropavlovsk
Svetloye-Petropavlovsk
Aituar-Petropavlovsk
Voloshinka-Petropavlovsk
Takhtabrod-Petropavlovsk
Ploskoe-Petropavlovsk
Petropavlovsk-Neezhka
Petropavlovsk-Novopokrovka
Tonkoshurovka-Petropavlovsk
Novonikolskoye-Petropavlovsk
Karagandinskoye-Petropavlovsk
Sovetskoye-Petropavlovsk
Andreevka-Petropavlovsk
Druzhba- Petropavlovsk

In January-September 2024, the volume of cargo transportation amounted to 16,869. 8 thousand tons, or 92.4% compared to January-September 2023. The volume of cargo turnover was 7,431. 3 million tons, or 87.5%. 12,454 thousand people were transported by passenger transport, or 90.1% by January-August 2023. Passenger turnover (taking into account the estimate) was 499,158. 5 thousand pkm, or 89.1% [102].

As of August 1, 2024, 172 bus routes operate to meet the needs of the population in passenger transportation in the region, including urban-19, suburban-11, intercity intra-regional-72,

international-8, inter-regional - 29, intra-district-20, intra-village-13. Availability of official taxi services in cities is 100%. Passenger traffic covers 371 localities out of 443, which is 83.8% of the total area covered. The composition and address of bus stations and bus stations in the North Kazakhstan region are given in Table 39.

Railway transport. In the North Kazakhstan region there are branches - "Petropavlovsk branch" of the South Ural Railway-a branch of JSC "Russian Railways", a branch of JSC "KTZ-Cargo Transportation" - "Akmola branch of the State Enterprise". Characteristics-Passport of the Petropavlovsk branch of the South Ural Railway are shown in Table 3. There are 32 railway stations, of which 25 stations belong to the "Akmola branch of the State Enterprise" and 7 stations belong to the "Petropavlovsk branch of the South Ural Railway", as well as 223 access roads, of which 94 belong to the Petropavlovsk branch of the South Ural Railway and 129 - to the Akmola branch to the SOE department.

Length of main roads in the North KazakhstanRegion:

- 822.6 km of the branch of JSC "NC KTZ-Akmola branch of the backbone network";

- 368 kmSOUTH.

The length of the station tracks is 142.5 km of the Akmola branch and 184.1 km of the Petropavlovsk branch of the Southern Railway. The number of railway stations is 32, of which -7 stations belong to the Petropavlovsk branch of the Southern branch of JSC" Russian Railways", 25 stations - to the branch of JSC" KTZ-Cargo Transportation " - "Akmola branch of the State Enterprise". The number of industrial buildings and railway stations is 23,including:

- 4 belong to RussianRailways (Petropavlovsk station, Bulaevo station, Mamlyutka station, Kara-Gugastation);

- 19-to the branch of JSC NC KTZ" Akmola branch of the trunk network " (Baumanskaya stationКайранкуль, Kairankul station, Aksuat station, Sulystation, Novoishimskaya station, Volodarovskayastation, Smirnovo station, KiyalyStation, Tayynsha station, Oktyabr station, Chkalovo stationАщиголь, Ashchigol station, Dautstation, Talshchik stationТальщик, Oktyabr station). Kyzyl-Tu, Yanko station, Ugolki station, Zolotorunnaya station, Belogradovka stationБелоградовка).

There are 12 pairs of passenger trains running in the region:

- 4-interstate communication,

- 8 – intra-republican message [103].

Table 39. Composition and address of bus stations and bus station of the North Kazakhstan regi

No	Object name	Address	Year of construction	2012-2016	2017-2020	2021-2024
North Kazakhstan region						
1	Petropavlovsk bus	station Petropavlovsk, Medvedeva str. 1	1969	valid	valid	valid
2	bus station S. Smirnovo	S. Smirnovo, Tselinnуный 25	1983	valid	valid	valid
3	bus station S. Saumalkol	Ayyrtau district, S. Saumalkol, Internatsionalnaya K.	2009	valid	valid	closed
4	bus station S. Korneevka	EUandYessilsky district,Korneevka village, 13	2007	valid	valid	closed
5	bus c. Yavlenka village bus station	station Yavlenka village Yesilsky district,Yavlenka village, Kovalenko str . 15	1970	valid	valid	valid
6	bus station s.Presnovka	Zhambyl district, S.presnovkaSt., Moscow 1	1964	valid	valid	valid
7	bus S. blahovischenka	Zhambyl district, S. Blagoveschenka, St. MMusrepova 52	2003	acts	acts	acts
8	Bus S. Bulaevo	District to them.M.Zhumabayev, St. Bulaevo 46 B	2010	acts	acts	acts
9	bus S. Chistopole	District G MMusrepova, S.chystopillia, St Aatecall of 33	2009	acts	acts	acts
10	bus S. Novoishimskiy	District to them. G.MMusrepova, S.Novoishimskiy, ABsLai xEN 41 B	2004	acts	acts	closed
11	bus S. Ruzayevka	District to them. G.MMusrepova, S.Ruzaevka, ABAth 87	1990	valid	valid	closed
12	Bus S. ì	Malatinsky district, p. ì, Winsand74	1964	valid	valid	closed
13	bus S. Kellerovka	Malatinsky Orion, S.Kellerovka, Paper 3	1975	valid	valid	closed
14	bus S. Taiynsha	Tiensinski district, S.tayynsha, Train	2008	acts	acts	acts
15	bus S. Timiryazevo	Timiryazevskiy district, S.Timiryazevo, virgin 9	2007	acts	acts	acts
16	bus S. ToIscenic:l	Havealimanowski district,.Toof escenica, ABsLai xEN 15	2003	acts	closed	closed
17	bus Sergeevka village	Shalom andK.Eunsky district, village of Sergeevka, the World 99	1974	operates	operates	operates
18	bus S. BECKal	-italianski district, S.BEscol, Road 6	2010	acts	closed	closed
19	S. Chkalovo village	ChkalovoTayynshansky district, c.Chkalovo village	-	operates	closed	closed
for 20	seconds. Imantau	Ayyrtau district, c.Imantau village	-	valid	closed	closed

Table 40-Characteristics-Passport of the Petropavlovsk branch of the South Ural Railway

Head	Popov Valery Yuryevich
Full name	Petropavlovsk branch of the South Ural Railway-a branch of Open Joint Stock Company "Russian Railways"
Founder	Open Joint Stock Company " Russian Railways "(Moscow)
Year of creation	1946, (the first train arrived at Petropavlovsk station in 1894)
Main activity:	Activities of railway transport, provision of non-public railway track services, provision of locomotive traction services, transportation of passengers, cargo, loading and unloading of cargo, delivery and cleaning of wagons.
Brief information:	The operational length of the Petropavlovsk branch of the road is 182.3 km (including double-track lines-182.3 km (100%), the deployed length of the road branch - 587.5 km, electrified lines – 505.552 km (86%), load capacity - 118 million tons/km gross per 1 km of track per year. The railway's locomotive fleet consists of 82 locomotives, including 52 electric locomotives and 30 diesel locomotives.
Infrastructure investment volume to the infrastructure in 2023 1-9 months: Number of employees: Average monthly salary:	4,991 billion tenge. 3,820 people 315,000 thousand tenge.

Length of main roads in the North KazakhstanRegion:

- 822.6 km of the branch of JSC "NC KTZ-Akmola branch of the backbone network";

- 368 km SOUTH.

The length of the station tracks is 142.5 km of the Akmola branch and 184.1 km of the Petropavlovsk branch of the Southern Railway.

The number of railway stations is 32, of which -7 stations belong to the Petropavlovsk branch of the Southern branch of JSC" Russian Railways", 25 stations - to the branch of JSC" KTZ-Cargo Transportation " - "Akmola branch of the State Enterprise".

Number of industrial buildings and railway stations – 23:

- 4 belong to Russian Railways (Petropavlovsk station, Bulaevo station, Mamlyutka station, Kara-Guga station);

- 19-to the branch of JSC NC KTZ" Akmola branch of the trunk network " (Baumanskaya station, Kairankul station, Aksuat station, Suly station, Novoishimskaya station, Volodarovskaya station, Smirnovo station, Kiyaly Station, Tayynsha station, Oktyabr station, Chkalovo station, Ashchigol station, Daut station, Talshchik station, Oktyabr station). Kyzyl-Tu, Yanko station, Ugolki station, Zolotorunnaya station, Belogradovka station).

There are 12 pairs of passenger trains running in the region:

- 4-interstate communication,

- 8 – intra-republic message.

As of August 1, 2024, the region has a subsidiary enterprise "Petropavlovsk branch" of the Federal State Unitary Enterprise "South Ural Railway" of the Ministry of Railways of the Russian Federation, with a length of 184.96 km.

Kazakhstan Temir Zholy NC JSC railway passes through the territory of the North Kazakhstan region, with a length of 615 km.

Structural divisions of" Petropavlovsk branch "of Federal State Unitary Enterprise "YUGUD":

- Locomotive Depot
- Car depot
- Track distance #18
- Distance communication alarm
- Power supply distance
- Distance of civil structures, water supply and sanitation
- Track machine station No. 175
- Distance of loading and unloading operations
- Construction and installation train No. 705
- Road separation
- Petropavlovsk Station
- NODH (Department of Logistics)

The railway station departs 16 pairs of trains, in summer -32 pairs of them from the cities of the Republic of Kazakhstan-19 trains. Transit trains :No. 83 Karaganda — Moscow. commuter trains — 4 pairs, no international trains.

To carry out passenger transportation by rail, a train station with a capacity of 1,300 passengers/hour is required by the estimated deadline. Due to the increase in freight traffic in the Republic of Kazakhstan as a whole, the Master Plan recommends for the future the construction of second tracks on the Astana – Petropavlovsk station section with electrification of the section. This will increase the capacity and carrying capacity of the railway in this direction and will have a positive impact on the environment.

The map of highways and railways of the North Kazakhstan region is shown in Figure 17.

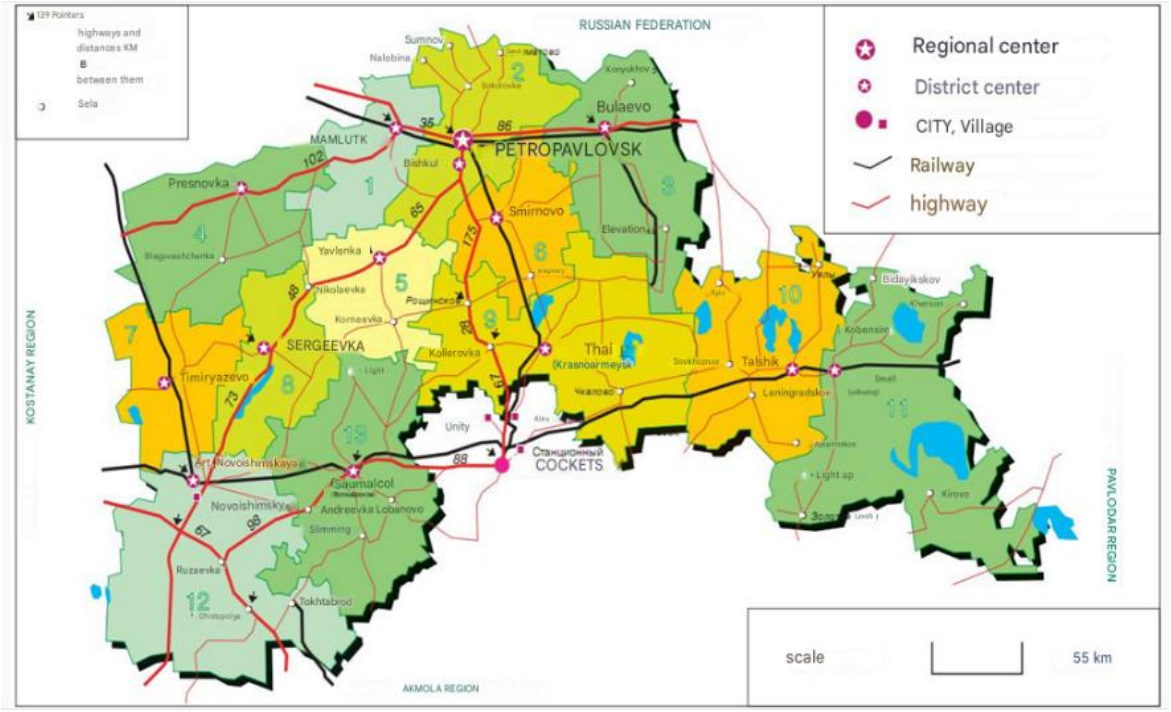


Figure 17-Map of highways and railways of the North Kazakhstan region [102]

Air transport of North Kazakhstan region. Passport data for "Kyzyl –Zhar International Airport" LLP are given in Table 41.

Reference data for the airport. The property of the airport (runway, taxiway, aircraft parking, passenger terminal and all specialized equipment, laboratory and fuel and lubricants warehouse are in the municipal property of the region.

Through an open tender on the GosReestr portal, the property complex was transferred to trust management, with the right of subsequent redemption to MAK LLP.

The new operator received a certificate of airworthiness of the airfield valid until October 2024. Currently, there are flights to Astana 7 times a week, Almaty 5 times a week and Shymkent 2 times a week.

Flights are operated to the following destinations:

- Astana - Petropavlovsk
- Petropavlovsk - Astana
- Almaty - Petropavlovsk
- Petropavlovsk - Almaty
- Shymkent-Petropavlovsk
- Petropavlovsk-Shymkent

Table 41-Passport data of "Kyzyl-Zhar International Airport"LLP

Date of establishment	1974
Director	Dzhilisbayev Valikhan Aueskhanovich
Performs flights:	Almaty – Petropavlovsk-Almaty Astana-Petropavlovsk – Astana Shymkent-Petropavlovsk-Shymkent
Terminal building Total area of the airport territory	Area[of 2,400] m2 Area of 224 ha
Standard capacity of the terminal	200 passengers per hour
Airport status	International, airport class "4D", airfield class " B "
Artificial runway (IVPP)	two steering tracks RD-A corresponds to class " B " designed to provide take-off and landing of aircraft up to 99 tons of type AN-24, CRJ-200, Foker-50, Boeing 757
Number of employees	103 people
Average monthly salary	130,000 tenge

Communication and communication. The Internet and digital information and communication technologies are increasingly integrated into all spheres of the economy and society: science, culture, medicine, education, business, politics, technology and production. These changes are driving social and economic development and innovation around the world.

Current situation in the field of communications according to the Akimat of the North Kazakhstan region. Digitalization Department. According to the International Telecommunication Union (ITU), the number of people using the Internet worldwide exceeded 4.9 billion in 2021, compared with 4.1 billion in 2019.

The growth in the number of Internet users, respectively, leads to an increase in the amount of information transmitted by them through the network. So, the total Internet traffic over the past 2 years has grown 1.5 times. The acceleration of digitalization processes was influenced along with technological trends by the COVID-19 pandemic. The transition to remote work and online training has given a new impetus to the active use by citizens and businesses of the capabilities of social networks, various digital platforms in the video conferencing mode. In turn, the digital transformation with contactless interaction with citizens and businesses has put a strain on the existing information and telecommunications infrastructure. In this regard, most Governments have approved plans to establish connections with a bandwidth of 50 to 100 Mbit/s. In general, the COVID-19 pandemic has highlighted the need to develop a reliable, accessible and secure telecommunications infrastructure using new technologies [99].

According to experts ' forecasts, in 10 years up to 70 % of products and services in the world will be based on digital platform models, which also raises the issue of modernizing the IT infrastructure.

Today, Kazakhstan is in the top 30 of the United Nations ranking of the most digitized states. At the same time, Kazakhstan ranks 65th in the Telecommunications Infrastructure sub-index. At the same time, the rate of Internet traffic usage is currently growing significantly due to the growth of the digital economy, entertainment content, and business entering virtual communication, i.e. the transition of economic activity to a platform model. In the face of rapid daily growth and an increase in the duration of Internet sessions, the volume of traffic consumed increases from year to year. The growth of users of social networks and video services is growing not only in our country, but also around the world. So, traffic to social networks and instant messengers increased by 16% (2022 to 2021), Youtube by 13% and a record 101% on TikTok. At the same time, it is important to note that the content itself is becoming more and more traffic-intensive, as the quality of the video produced is constantly increasing (since the pandemic, this figure has reached 1000 petabytes).

According to the National Statistics Bureau of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan (hereinafter – BNS), in 2022, the share of Internet users (including mobile) aged 6 to 74 years is 94 %, the share of households with Internet access is 96.2 %. There are 6,290 rural settlements in Kazakhstan (hereinafter-SNP), of which 4858 (76 %) are provided with mobile broadband Internet access, including 2,813 SNPs using 4G technology, and 2,045 SNPs using 3G technology.

Fiber-optic communication lines (hereinafter referred to as FOCL) have been completed in 2601 of the 6290 SNPs. According to a study conducted in April - June 2022 by the international company IDC, the current market distribution among broadband access technologies is as follows: fiber – optic home communication in rural areas is 18 %, in small towns – 28 %; the share of fiber-optic communication in large cities is 44 % [102].

In rural areas, small towns and suburbs, ADSL technology (via copper wires) is mainly used, the share of which exceeds 35 %. In large cities, 25% of subscribers use ADSL. ADSL technology allows simultaneous transmission of voice and data at speeds up to 10 Mbit / s over conventional "copper" telephone channels, which does not meet the growing needs of the population and businesses.

Statistical data in the field of digitalization of North Kazakhstan region. There are 458 secondary schools in the region, all of them have 100% access to the Internet (100% or 458 schools are connected to broadband access). All schools and pre-school organizations have automated public services: "Putting children of preschool age (up to 7 years) on the waiting list" and "Issuing

a referral for admission to the first class". On the basis of the Palace of Schoolchildren, the North Kazakhstan University named after M. Kozybayev and the Petropavlovsk Humanitarian College named after M. Zhumabayev, there are IT centers. Smart-school projects (30 schools), Electronic Kindergarten (26 DDO) have been implemented, and the activities of colleges have been automated. 100% of schools are connected to the Bilimland educational platform, 98% of schools in the region work in the Unified Information System "Kundelik KZ". In addition, 17 IT classes were opened, as well as a Robotics course was introduced in 80 schools (there are 463 sets of Robotics).

In the healthcare sector, 100% of workplaces of healthcare facilities are computerized, 88.9% of facilities (467 out of 525 facilities) are provided with Medical Information Systems. The SKOMED and DamuMed mobile apps are used. Using telemedicine, 1,646 consultations were provided in 2023. On the basis of the regional emergency medical care center, the KOMEK automated emergency medical care system is used (in 2023, more than 160 thousand requests were registered. of which 72.1% are located in Petropavlovsk) [102].

In the housing and utilities sector, there is a Single settlement center that provides services through the portal sk_energo.kz utilities in electronic format, the ERC mobile application has been launched. The SKADA system has been implemented to monitor the health of utility networks. In addition, work was carried out to introduce a system for automating the services of natural monopolies. Petropavlovsk Akimat launched a single portal Sqoqyzmet.kz, a total of 37 services have been implemented, and there is also functionality for launching the provision of services in a proactive format. This project is aimed at creating a "Single Window" for interaction of the population with public utilities. In Petropavlovsk, about 8.7 thousand units of energy-saving street lamps (or 49%) were installed, including 4.7 thousand units with dimming (intelligent control, saving up to 40% of electricity). 48.2 thousand metering devices for heat, water and electricity with automatic data transmission were installed (33.4 thousand electrical appliances; 1.3 thousand heat devices; 13.5 thousand water devices).

The sphere of construction and land relations. A geoportal has been developed (100% ready). The module "Cartographic service", "Geomonitoring", open map was launched, and public services were launched. The geoportal consists of an Open and Active Map. The open map serves to raise public awareness. Everyone can get acquainted with the general plan of the city's development, with detailed planning projects. Information is placed in the form of layer groups, which makes it easier to find the right objects by switching the layer of interest [102].

Transport sector. The city of Petropavlovsk has a public transport dispatching system. Starting in 2021, an electronic fare payment system with a differential fare will be introduced on all public transport in the city. It is possible to pay for travel using bank cards with NFC module,

SMSBUS Passenger applications, phone with NFC function, QR code, mobile application from Beeline and Kcell. Today, more than 29 million people have used the electronic payment system.

Security sphere. In order to ensure security, work is underway to expand the video surveillance network. Today, there are 40 thousand video surveillance cameras in the region, including 20 thousand in Petropavlovsk. In addition, there are 35 Hardware and software complexes for recording traffic violations (28 of them were installed in 2022). Since November 16, 2022, 118 thousand violations have been recorded by the data of the agroindustrial complex. Also, there are no road accidents and a decrease in traffic violations in these areas. The mobile application "Police 102"is actively used in the work. In order to digitalize the law enforcement system, the project "Unified Register of Administrative Proceedings" is being implemented. Currently, 757 tablets and 573 mobile printers operate in the region.

Smart city management sphere. On the basis of the akimat in Petropavlovsk and regional centers of the region, the "Open Akimat" system operates. It is a division of the working process of the city akimat into a front office and a back office (separation of the visitor area and the place of service provision). There is also an electronic queue and Reception, for receiving advisory information. A single contact center of Petropavlovsk-iKomek 109 has been opened, which unites call centers of state bodies and municipal enterprises and is a single point of contact with residents of the city working 24/7. Since the launch of the service, more than 260 thousand requests have been received.

iKomek has launched the Aikey program, which transparently reflects the number of requests, consultations, complaints and incidents. A "Digital analytical Map of Petropavlovsk" has also been introduced, which marks houses, streets, playgrounds, asphalt paving, sports facilities, hospitals, and areas where emergencies most often occur. Using a Digital map, it became possible to close requests from the first call, thereby speeding up the process of interaction with the population [102].

Social and labor sphere. Starting from January 1, 2023, the Digital Family Card information system was introduced to proactively assign state support measures. This system includes information on 203.9 thousand families (533 thousand people). A Social services Portal is functioning for individuals with disabilities to independently purchase funds and rehabilitation services. In 2023, 11,520 applications were submitted to AIS "E-sobes", 10,826 applications were completed, including 10,599 applications via the Social Services Portal.

In addition, an Electronic labor Exchange is used. The share of employed citizens by employment centers through the portal is 51%. As of today, 2,810 employers have placed 6,939 vacancies.

The sphere of agriculture. GPS navigation is used, also thanks to automated systems for monitoring energy resources, measuring soil moisture, monitoring crop seedlings, etc. there is an opportunity to increase the yield, as well as the efficiency of enterprises. 4.9 million hectares of arable land (100%) were digitized. There are 198 agricultural enterprises using digitalization in agriculture (23 digital, 84 advanced and 91 basic farms). Elements of digitalization are used in 64 livestock farms (30-dairy farms, 27-meat processing, 1-pig farm, 6-poultry farms). With the use of herd control, it became possible to conduct individual productivity monitoring, keep records of zootechnical events and selection and breeding work (calving, insemination, launching, etc.), and normalize feeding [100,102]. All the collected information will be used in the future to solve the project tasks related to the development of the North Kazakhstan region.

4 Development of the project geographic information database structure

To conduct geospatial analysis and create a decision support system (DSS) for the North Kazakhstan region, modern technologies and software are used to effectively collect, process, analyze and visualize data. The main technologies used include the use of a Geographic Information System (GIS), which is the main technology for processing and analyzing spatial data. GIS is used to create, manage, and analyze maps and data linked to geographical coordinates. Software: ArcGIS, QGIS, and other GIS platforms are used to create map layers, process spatial data, analyze relationships between natural and anthropogenic objects, and visualize results. Application: GIS helps to integrate various data sets, such as maps of the distribution of natural resource characteristics, ecological status, arable land area, location of weather stations, etc., allowing for a comprehensive spatial analysis.

To implement the project objectives, it is necessary to collect, store and analyze various types of necessary information. For this purpose, the geographic information database structure for the project was developed (Figure 18), which includes several groups of different types of thematic information and multi-year data. The project's geographic information database structure is designed to integrate spatial and tabular data, which allows solving problems of sustainable development and spatial analysis.

It is based on a database in ArcGIS Prothat includes data from various sources organized for analysis, modeling, and mapping.

One of the key components is an extensive collection of long-term data on natural and climatic data (soil and climate, environmental, water resources), as well as long-term data on socio-economic development of the territory (labor resources, economic indicators, infrastructure development). Satellite image databases provide the basis for monitoring the Earth's surface, spatial analysis of vegetation, water resources, agroclimatic conditions, economic activity, infrastructure status, socio-economic development, and other important aspects of the study area.

Remote sensing data of the Earth (RS) includes the use of multi-time images of satellite systems of different spatial resolution. Satellite data are key information for the project implementation, as they allow collecting, analyzing and spatially evaluating key parameters in all areas related to economic activity, territorial development, and natural resources at high intervals.

Thus, we have a foundation for research, on which we will develop algorithms for solving the tasks of this project in the future. The project also provides for route surveys of agricultural land, local UAV surveys of individual water and infrastructure facilities.

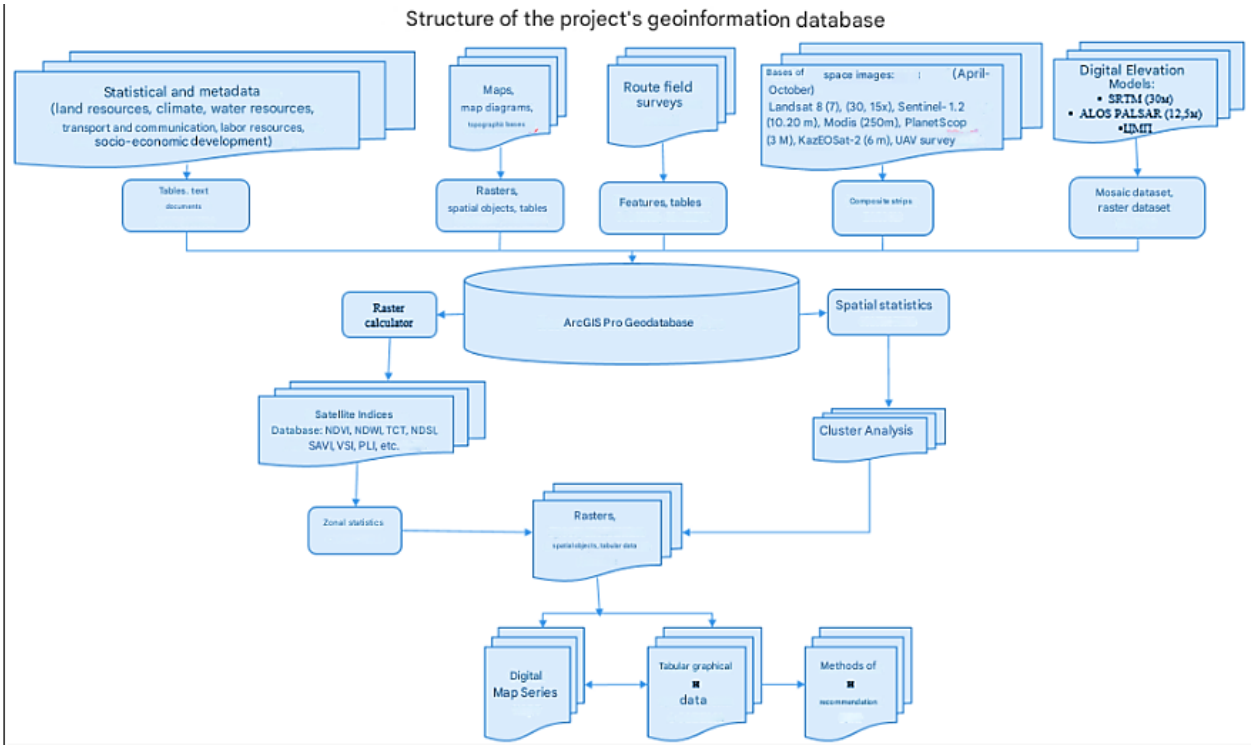


Figure1-8 - Structure of the project's geographic information databaseпроекта

Databases of satellite images. Sentinel-1/2 images with a resolution of 10 and 20 m are a key source of data for detailed analysis of the earth's surface, due to their high spatial, temporal and spectral resolution. (Figure1-9). The satellite system includes two identical satellites-Sentinel-2A and Sentinel-2B, which were launched using a VEGA launch vehicle. Each satellite has a time resolution of **10** days, and their combined re-visit provides data every **5** days. The satellites are equipped with an MSI optical instrument capable of collecting data in 13 spectral bands: four bands with a spatial resolution of 10 m, six with 20 m, and three with 60 m. The capture band is 290 km wide, which makes it possible to effectively monitor changes on the Earth's surface [103]. Sentinel-1 radar data provides reliable surveillance regardless of weather conditions and light conditions at night. This is especially important for monitoring during cloudy seasons, when in Northern Kazakhstan, during the growing season, cloudy weather is often observed and precipitation peaks in summer.

Sentinel-2 multispectral data provides valuable information about the spectral characteristics of vegetation, water bodies, soil moisture and salinity, and other information, allowing you to effectively assess the state of crops, identify stressful areas of vegetation, analyze the dynamics of crop vegetation and field work, etc.. The scheme of covering the territory of the region with Sentinel-2 scenes is shown in Figure 16.

Снимки Sentinel-2 images are widely used for calculating vegetation indices (NDVI, SAVI, etc.), which help to assess biomass, crop productivityь, degree of contamination, and

boundaries of land use types. In addition, they are used to analyze water resources, including determining soil moisture and monitoring water bodies, forests, and natural objects. Together, the Sentinel-1/2 data provides high accuracy and detail in agricultural monitoring and natural resource management tasks, making it a central element in the processing of remote sensing data**.**

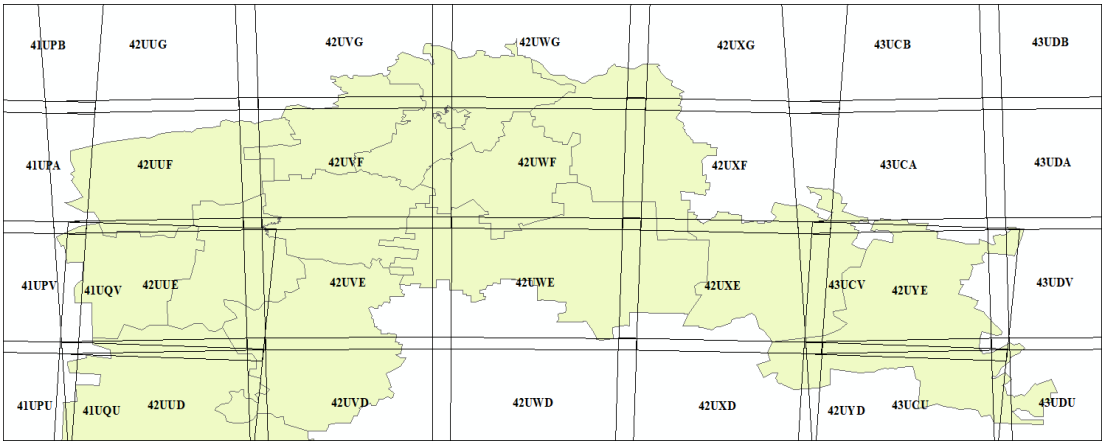


Figure1-9-Diagram of coverage of the study area with Sentinel-2 scenes

Landsat 5/7/8 satellite images with a resolution of 30 m (15 m for the panchromatic channel) are used for long-term monitoring of changes in the Earth's surface. The scheme of covering the territory of the North Kazakhstan region with Landsat 8 scenes (30 m)and visualization of covering the territory of the North Kazakhstan region with images in the geoinformation database is shown in Figures 20-21-21.

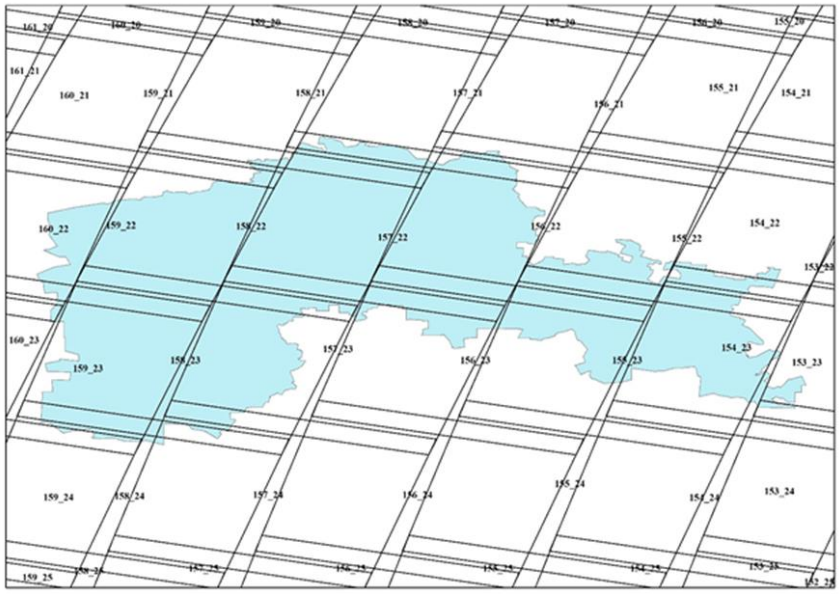


Figure 20 - Scheme of covering the territory of the North Kazakhstan region Landsat 8 scenes (30 m)

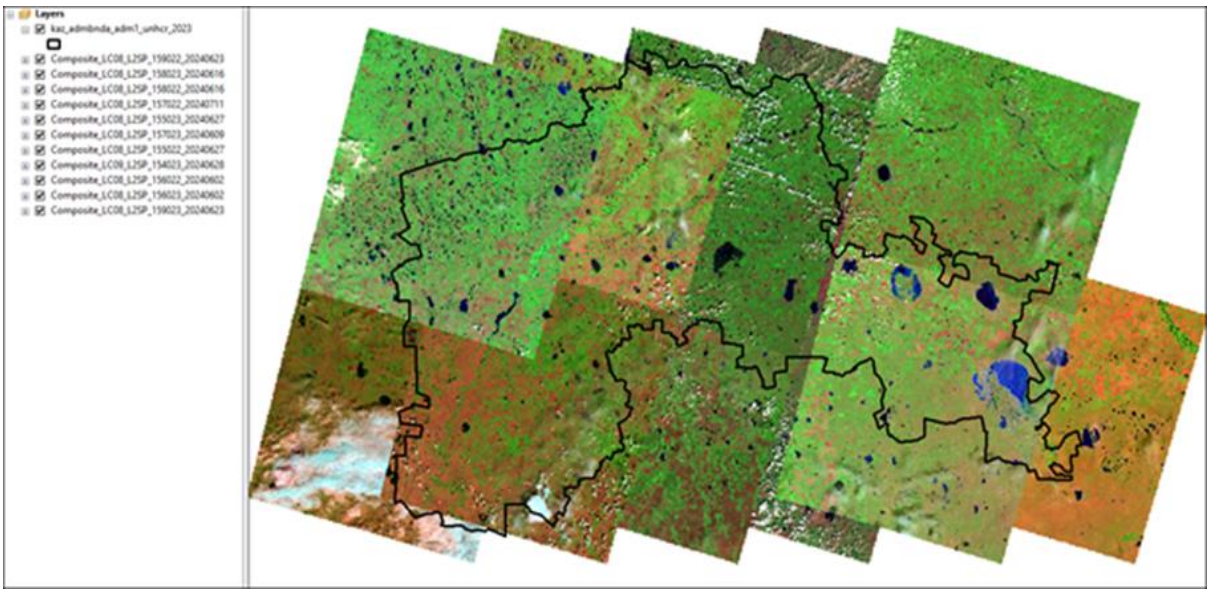


Figure 21-Visualization of the coverage of the territory of the North Kazakhstan region with Landsat 8 images in the geographic information base

Landsat 8 satellite data is used to assess vegetation cover, calculate vegetation and water indices (NDVI, NDWI, SAVI, etc.), and accurately determine the boundaries of agricultural land types**.** Landsat-8 is designed for Earth observation, including mapping, monitoring of natural resources, and environmental management for scientific and commercial purposes. The satellite provides images with a resolution **of 30** meters for multispectral data and **15** meters for panchromatic data, covering the visible, infrared and thermal ranges. Its features include high sensitivity to changes on the Earth's surface, the possibility of continuous global monitoring and data collection for research. The re-coverage period is 16 days, which allows for regular data updates [104].

Summary data on Landsat satellite images for the North Kazakhstan region (2004-2024) for the geographic information database are given in table 42. Landsat images for analysis were downloaded from the public NASA Earth Observing System Data and Information System (EOSDIS) database using USGS Earth Explorer tools. The data can be accessed via the USGS Earth Explorer website. "[5105].

Table 42-Summary of Landsat satellite images for the North Kazakhstan region (2004-2024) for the geographic information database

Year	of Sputnik	Coating scenes	, the company snapshots	Channels	notes
2004	Landsat 7	154_22, 154_23, 155_22, 155_23,156_22, 156_23, 157_22,157_23, 158_22, 158_23, 159_22, 159_23, 160_23	1 may – 31 October	Channels 1-8	the presence of the scene with the bands due to a failure SLC
2005	Landsat 7	154_22, 154_23, 155_22, 155_23,156_22, 156_23, 157_22,157_23, 158_22, 158_23, 159_22, 159_23, 160_23	1 may – 31 October	Channels 1-8	the presence of the scene with the bands due to a failure SLC
2006	Landsat 4-5	154_22, 154_23, 155_22, 155_23,156_22, 156_23, 157_22,157_23, 158_22, 158_23, 159_22, 159_23, 160_23	1 may – 31 October	Channels 1-7	Full coverage
2007	Landsat 4-5	154_22, 154_23, 155_22, 155_23,156_22, 156_23, 157_22,157_23, 158_22, 158_23, 159_22, 159_23, 160_23	1 may – 31 October	Channels 1-7	Full coverage
2008	Landsat 4-5	154_22, 154_23, 155_22, 155_23,156_22, 156_23, 157_22,157_23, 158_22, 158_23, 159_22, 159_23, 160_23	1 may – 31 October	Channels 1-7	Complete coverage
of the 2009	Landsat 4-5	154_22, 154_23, 155_22, 155_23,156_22, 156_23, 157_22,157_23, 158_22, 158_23, 159_22, 159_23, 160_23	1 may – 31 October	Channels 1-7	Complete coverage
of the 2010	Landsat 4-5	154_22, 154_23, 155_22, 155_23,156_22, 156_23, 157_22,157_23, 158_22, 158_23, 159_22, 159_23, 160_23	1 may – 31 October	Channels 1-7	Complete coverage
of the 2011	Landsat 4-5	154_22, 154_23, 155_22, 155_23,156_22, 156_23, 157_22,157_23, 158_22, 158_23, 159_22, 159_23, 160_23	1 may – 31 October	Channels 1-7	Full coverage
2012	Landsat 7	154_22, 154_23, 155_22, 155_23,156_22, 156_23, 157_22,157_23, 158_22, 158_23, 159_22, 159_23, 160_23	1 may – 31 October	Channels 1-8	the presence of the scene with the bands due to a failure SLC
2013	Landsat 8	154_22, 154_23, 155_22, 155_23,156_22, 156_23, 157_22,157_23, 158_22, 158_23, 159_22, 159_23, 160_23	1 may – 31 October	Channels 1-11	High resolution
2014	Landsat 8	154_22, 154_23, 155_22, 155_23,156_22, 156_23, 157_22,157_23, 158_22, 158_23, 159_22, 159_23, 160_23	1 may – 31 October	Channels 1-11	High resolution
2015	Landsat 8	154_22, 154_23, 155_22, 155_23,156_22, 156_23, 157_22,157_23, 158_22, 158_23, 159_22, 159_23, 160_23	1 may – 31 October	Channels 1-11	High resolution
2016	Landsat 8	154_22, 154_23, 155_22, 155_23,156_22, 156_23, 157_22,157_23, 158_22, 158_23, 159_22, 159_23, 160_23	May 1 – October 31,	1-11 Channels	High-resolution
2017	Landsat 8	154_22, 154_23, 155_22, 155_23,156_22, 156_23, 157_22,157_23, 158_22, 158_23, 159_22, 159_23, 160_23	1 may – 31 October	Channels 1-11	High resolution
2018	Landsat 8	154_22, 154_23, 155_22, 155_23,156_22, 156_23, 157_22,157_23, 158_22, 158_23, 159_22, 159_23, 160_23	1 may – 31 October	Channels 1-11	High resolution
2019	Landsat 8	154_22, 154_23, 155_22, 155_23,156_22, 156_23, 157_22,157_23, 158_22, 158_23, 159_22, 159_23, 160_23	1 may – 31 October	Channels 1-11	High resolution
2020	Landsat 8	154_22, 154_23, 155_22, 155_23,156_22, 156_23, 157_22,157_23, 158_22, 158_23, 159_22, 159_23, 160_23	1 may – 31 October	Channels 1-11	High resolution
2021	Landsat 8	154_22, 154_23, 155_22, 155_23,156_22, 156_23, 157_22,157_23, 158_22, 158_23, 159_22, 159_23, 160_23	1 may – 31 October	Channels 1-11	High resolution
2022	Landsat 8	154_22, 154_23, 155_22, 155_23,156_22, 156_23, 157_22,157_23, 158_22, 158_23, 159_22, 159_23, 160_23	1 may – 31 October	Channels 1-11	High resolution
2023	Landsat 8	154_22, 154_23, 155_22, 155_23,156_22, 156_23, 157_22,157_23, 158_22, 158_23, 159_22, 159_23, 160_23	1 may – 31 October	Channels 1-11	High resolution
2024	Landsat 8	154_22, 154_23, 155_22, 155_23,156_22, 156_23, 157_22,157_23, 158_22, 158_23, 159_22, 159_23, 160_23	1 may – 31 October	Channels 1-11	High resolution

As an example, Figure 22 shows a fragment of Landsat satellite images placed in the geodata database.

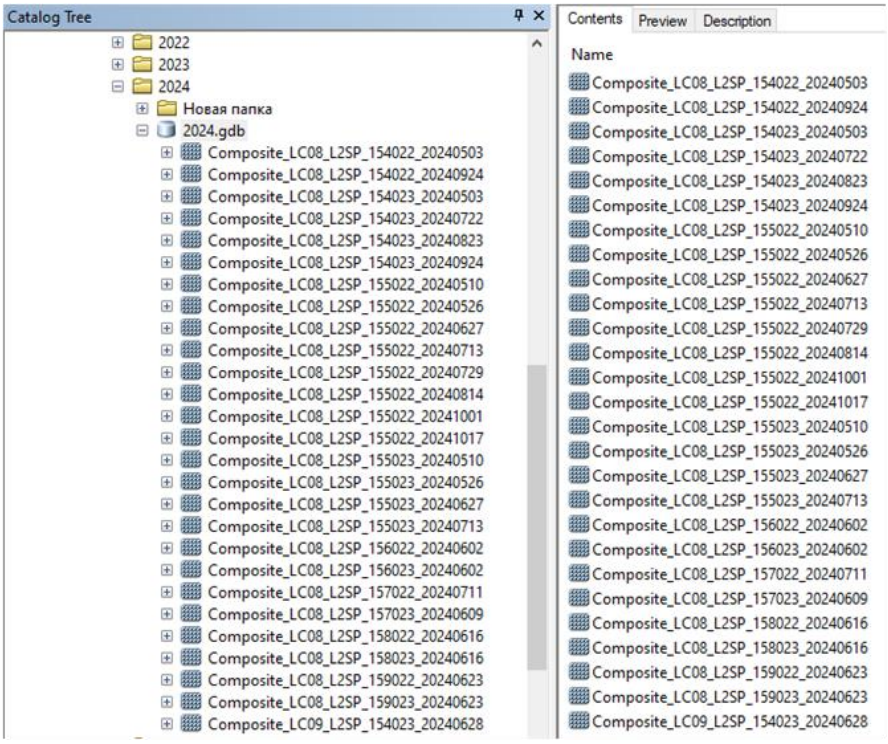


Figure 22-Example of filling a geodata database with Landsat satellite images

MODISimages, which are characterized by a low spatial resolution (250 m), are used for regional and global studies that require data on large areas. They are particularly useful for monitoring the seasonal dynamics of vegetation, allowing you to detect changes in biomass, productivity and growth phases of vegetation cover over large areas, assess agrometeorological conditions and climate changes. The MODIS (Moderate Resolution Imaging Spectroradiometer), installed on the Terra and Aqua satellites of the EOS series, is equipped with 36 spectral channels with a radiometric resolution of 12 bits, covering the visible, near, medium and thermal infrared ranges. The spatial resolution of MODIS is 250 m for channels 1-2, 500 m for channels 3-7, and 1,000 m for channels 8-36, and the shooting frequency varies from one to two times a day, depending on the latitude of the area [106]. The scheme ofcovering the North Kazakhstan region with MODIS scenes and visualization of the territory coverage with images is shown in Figures 23-24.

Thanks to frequent surveys, MODIS data provides the ability to track time changes, which makes it a valuable tool for analyzing global climate processes, such as changes in temperature, precipitation, assessing the degree of climate aridity, comparing weather conditions for individual years, and their impact on ecosystems. These data are an important source of information for macro-level management of natural and agricultural resources.

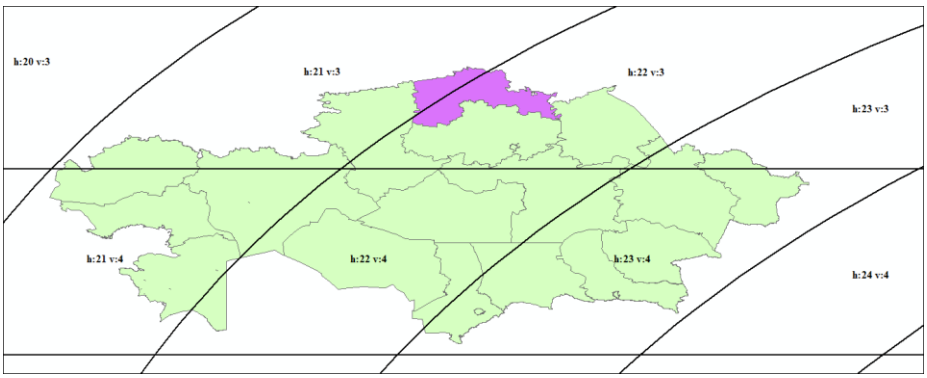


Figure 23-Scheme ofcovering the North Kazakhstan region with MODIS scenes

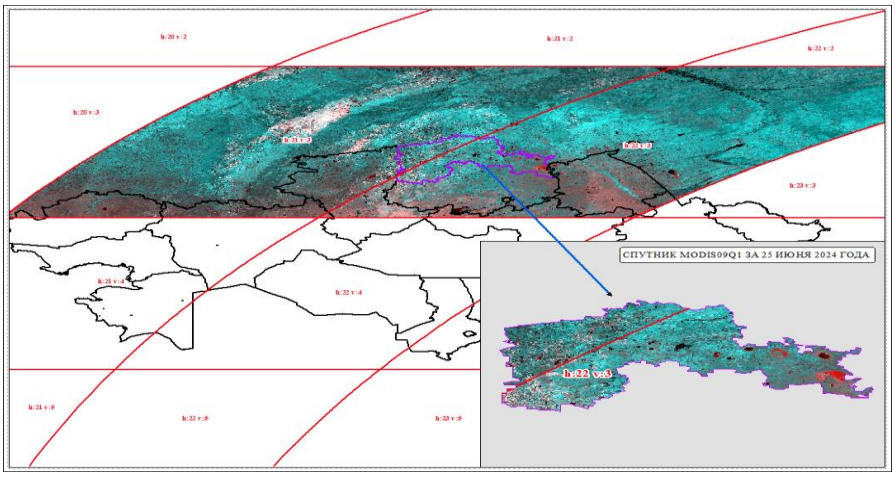


Figure 24-Visualization of the coverage of the territory of the North Kazakhstan region снимками with MODIS snapshots

The satellite index database includes a wide range of indicators that are used to quantify the state of objects based on remote sensing data. Key indexes:

Normalized Difference Vegetation Index (NDVI) - used to assess the condition and productivity of crops, identify areas of active vegetation and determine changes in the vegetation cover.

Normalized Difference Water Index (NDWI) - it is used for analyzing soil moisture and determining the degree of vegetation cover moisture, which is especially important for monitoring water resources.

Soil Adjusted Vegetation Index (SAVI) - adapted for use in conditions where the vegetation cover is sparse, reducing the influence of the soil background on the analysis results.

Tasseled Cap Transformation (TCT) is a method for transforming spectral data to highlight key characteristics of the Earth's surface, such as brightness, greenness, and humidity.

Vegetation Stress Index (VSI) - designed to identify zones of vegetation stress and assess climate aridity.

Plowed Land Index (PLI) - used to identify cultivated land and analyze its condition, including active farming zones. The Plow Index (PLI) is derived from the brightness index of the

Tasseled Cap transform. The formula for the plowing index is an original linear combination of values from six spectral channels Blue, Green, Red, NIR, SWIR1, SWIR2. Andthe analysis of changes in surface brightness using the ploughed area index PLI makes it possible to accurately identify ploughed areas of fields and their borders [107].

Normalized Difference Salinity Index (NDSIS) - is one of the key indexes included in the database structure, used to assess the degree of soil salinity based on the analysis of spectral characteristics. This index is calculated from remote sensing data, mainly using the near-infrared (NIR) and short-wave infrared (SWIR) bands, which makes it possible to identify areas with high salt concentrations in the soil. The inclusion of NDSI in the database structure makes it possible to monitor the spatial distribution of saline areas, assess the dynamics of these changes over time, and identify areas that require agricultural measures. The index data is used to make decisions about land reclamation and land use optimization, especially in areas with an increased risk of soil degradation.

Normalized Differencenow Source Index (NDSI) - The Normalized Difference Snow Index (NDSI) is included in the database structure for snow cover analysis. This index is calculated basedon the reflectivity inthe greenand short-wave infrared (SWIR) spectral bands, which makes it possible to effectively highlight snow surfaces in satellite images. As part of the database structure, NDSI is used to determine the area of snow cover, monitor its seasonal dynamics, and estimate the timing of snow establishment and removal. These data are of key importance for water resource analysis, agricultural planning, and flood forecasting. Snow cover distribution information is also integrated with other database parameters, such as climate and hydrology, to build comprehensive spatial analysis models.

Для населенных пунктов могутThe following indexes can be used for localities:

Building Density Index (IPZ) - to determine the intensity of use of the territory; IPZ= Built-up area/Total land area

Infrastructure Accessibility Index (IAI) - for analyzing the accessibility of infrastructure facilities (schools, hospitals, shops, etc.)

Land Development Index (IOZ) - to determine the share of developed territory.

IOZ=Developed area /Total area

The Transportation Accessibility Index (TAI), can be used to assess the availability of transport routes in a particular area. This index helps to understand how easy it is to move around the region using various modes of transport, and assesses the degree of development of transport infrastructure.

TAI = Length of the transport network / Area of the territory,

where the length of the transport network is the total number of kilometers of all types of transport routes, including roads, railways, metro lines, and other transport routes that pass through the territory.

Area of the territory — the total area of the territory under study, where the availability of transport routes is analyzed.This index is used to assess logistics opportunities, infrastructure development and determine how effectively the transport network functions in connection with the needs of the North Kazakhstan region.

Unmanned aerial vehicles (UAVs) provide ultra-high spatial resolution data that is used for detailed research of the structure of fields, water bodies, infrastructure, buildings and features of their use. The use of such devices will allow obtaining high-resolution images, including multispectral images, which will be used for modeling. This will significantly improve the accuracy and detail of the data obtained, as well as provide a reliable basis for further analytical and practical tasks of the project. The data can be used to accurately analyze the condition of crops, identify problem areas in crops caused by adverse weather conditions (drought, clogging, diseases), such as areas with excessive humidity or soil erosion, the state of water bodies, floods, etc. In addition, the UAV survey will be used to create digital terrain models (DEM) along the Yessil River in the North Kazakhstan region, providing a detailed view of the topography of the surrounding areas. This data is also used to develop terrain models within localities for border refinement and spatial analysis.

An orthomosaic is a photographic plan of the area that shows the earth's surface and objects on it with precise reference to a given coordinate system. It is created on the basis of images obtained from UAVs during aerial photography with the subsequent transformation of images from the central projection to the orthogonal projection using the orthorectification method, and is the basis for the creation of topographic plans and maps of various content (Figure 25).

A digital surface model (DTM) allows you to analyze the vertical profile of plots, taking into account microrelief and altitudinal features, which contributes to accurate spatial modeling and adaptation of agricultural technologies to terrain conditions, identification of possible flood zones as a result of melting snow cover in spring or river flooding.



Figure 25 - Satellite image (left) and detailed orthomosaic (right)

Digital elevation models (DEMs) are used for topographic analysis and spatial modelling, including elevation assessment in the context of drainage, erosion and land-use planning. SRTM data with a resolution of 30 m and ALOS PALSAR with a resolution of 12.5 m provide information on large and medium terrain features, which is relevant for the assessment of the drological network and the identification of erosion zones (Figure 26).

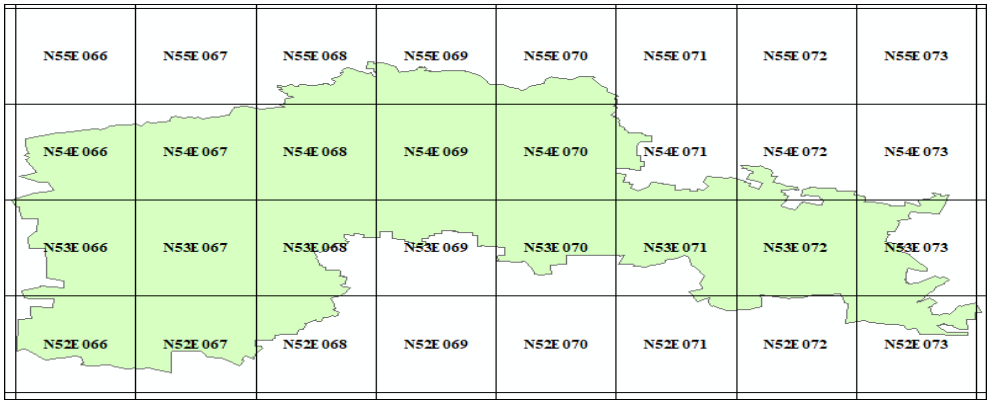


Figure2-6-Coverage of the North Kazakhstan region with SRTM scenes (30m)

Tabular and graphical data on natural resources, socio-economic development, and infrastructure. The data set includes multi-year statistical data (2004-2023) and metadata related to key thematic areas that characterize the development of the territory of the North Kazakhstan region:

- Land resources: the area of land categories (arable land, fallow land, pastures, etc.), data on land degradation, soil types, fertility, moisture content, water properties, etc.
- Climate: precipitation, temperature, total hydrothermal resources during the growing season, aridity indices, agroclimatic zoning of the territory, snow cover, wind direction and speed, etc.
- Water resources: surface and underground water volumes, pollution indicators, chemical composition, etc.
- Transport and communications: road length, availability of transport, communications, Internet, infrastructure parameters, etc.
- Labor resources: population, life expectancy, employment by industry, migration, etc.
- Socio-economic development: GDP, industrial data, wages, agricultural yields, etc.

These data serve as the basis for analyzing the current situation, forecasting and modeling. For example, climate metadata and soil maps are used to build agroclimatic maps, while labor statistics are used to assess demographic processes and trends.

Composite strips. Data is images created by combining spectral channels of satellite data to enhance analytical value and visual quality. This method allows you to get new indexes and visualizations that focus on key characteristics of the earth's surface. For example, composites made up of SWIR2 (short-wave infrared), NIR (near-infrared), and GREEN (green spectrum) channels are used to analyze soil moisture, identify reservoir boundaries, and assess the state of vegetation, including its productivity and the presence of stress factors (Figure2-7). Composite images not only provide visibility, but also serve as the basis for complex calculations, such as zonal statistics, which allow you to estimate the average values or distribution of indicators, such as vegetation indices, within the specified territorial zones. This approach ensures accuracy in the interpretation of remote sensing data and promotes informed decision-making in land and natural resource management.

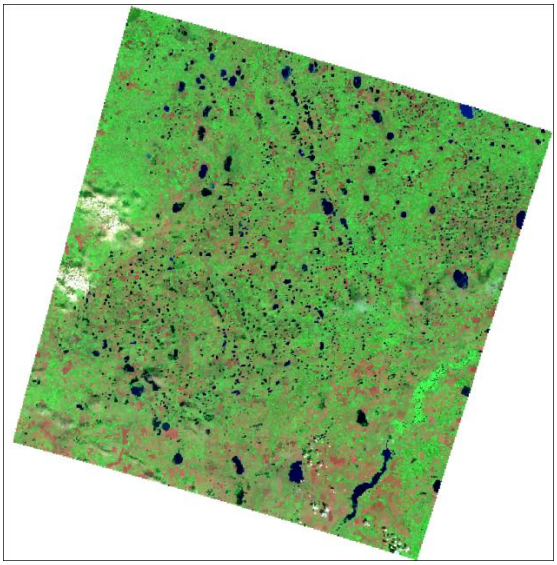


Figure 27-Landsat 8 visualization using a combination of SWIR2 (Short-Wave Infrared 2), NIR (Near Infrared), and GREEN channels

Types of agricultural land**.** In the course of further research , an up-to-date map of agricultural land will be created, which will become part of the database structure and will provide an accurate definition of the boundaries and areas of arable land, pastures, deposits, and other natural land uses (Figure2-8).

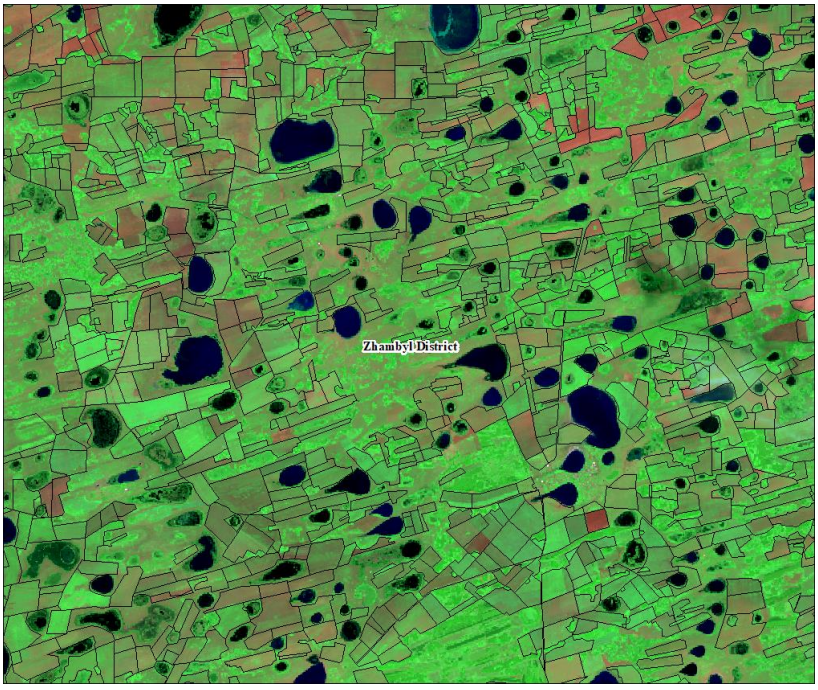


Figure 28-Example of creating an agricultural field mask (Landsat image 8)

The mask of different types of land use is formed on the basis of processing data from cloudless Sentinel-2 and Landsat images, using various satellite indexes, automatic classification methods, and manual digitization. The results of the NDVI, SAVI and other indices analysis are taken into account in the process of work, which allows us to identify the nature of land use and

its current state. For example, an updated field mask forms the basis for solving thematic agricultural tasks, such as crop recognition, determining acreage, steam treatment, monitoring crop rotations, timing and area of sowing and harvesting operations, monitoring the state of fields, optimizing acreage, and planning measures to improve the quality of agricultural land.

Spatial objects. Spatial features form the basis of the database structure and include key classes of vector and raster data, such as fields, reservoirs, roads, and localities. They are formed on the basis of satellite image processing and include sets of mosaics and rasters that create a continuous coverage of the study area. This allows you to perform a detailed analysis of the characteristics of different zones, for example, calculate the average soil moisture, NDVI values, or other vegetation indicators. Spatial features are used as a basic element for building thematic maps and cartos, as well as for conducting zonal statistics that are necessary for monitoring, planning, and making decisions within the framework of resource and territory management.

Cluster analysis. Cluster analysis methods will be used to process spatial and attribute data in order to identify homogeneous territories, such as zones with the same soil types, vegetation conditions, or moisture levels. Using clustering algorithms, the database allows you to group sites by similar characteristics, which is especially important for analyzing large data sets. These clusters are used to optimize the use of resources, including the allocation of the most promising land for irrigation, arable land or other types of economic activity. The results of cluster analysis simplify data interpretation, helping to identify key areas for land improvement activities, planning agricultural work, and developing territory management strategies.

Maps, cartos, and topo bases. The result of processing all the data in the geographic information database is thematic maps, cartograms, and topographic bases that provide visualization and analysis of key parameters and aspects of the territory. Thematic maps include information on land use, climate assessment, hydrological resources, infrastructure, socio-economic indicators, labor resources, and other natural objects, reflecting the spatial distribution and dynamics of estimated characteristics at various administrative levels (region, district, rural district, individual farms, or locality) for modern and historical periods and for the future. Cartograms are used to illustrate relationships, for example, between the state of water resources, climate, and farmland, which is important for making informed management decisions. Topographic frameworks provide an accurate representation of terrain and infrastructure, creating a basic context for further analysis of key parameters of the main types of information. These products are an integral part of multi-factor analysis, assessment, and statistical reporting for making recommendations related to planning and developing a sustainable growth strategy and managing development in the study area.

Results of route surveys. In subsequent years, the project provides for conducting route surveys of agricultural land to obtain factual information for developing methods for processing and verifying mapped data, based on the project objectives in the region under study.

As a result, the structure of the geodata database includes the formation and storage of satellite data results, ground surveys, calculations of indexes and models of actual information, agrometeorological, climate information, statistical data at the district and regional levels in the form of raster, vector, and tabular data.

As satellite images, ground-based data, and index results, база геоданныхbecome available, the project's geodata database provides for the possibility of updating with new data, which will be accumulated and used for further research in the North Kazakhstan region within the framework of the tasks provided for in this project.

5 Project Website development

Within the framework of this project, the goal of this year was to develop a website designed to present information about the scientific and educational platform related to research and initiatives in the North Kazakhstan region. The main tasks included creating a user-friendly interface, an attractive design, and integrating important project information.

The site menu is located on the left side of the window and consists of the following sections:

- News (project news is covered)
- Topicality (the project's topicality is shown)
- Goals and objectives (specified goals and objectives, project calendar plan)
- Expected results (describe the expected results of the project)
- Results achieved (project results achieved will be reflected)
- Project (project information)
- Team (project team members with photos and their data)
- Publications (list of publications)
- Patents (list of patents)
- Information for potential customers

Below the main menu there are buttons for switching to the Kazakh, Russian and English site mode. The website operates in three languages: Kazakh, Russian and English.

При разработке сайта были использованы Visual Studio (VS) Integrated Development Environment (IDE), HTML 5, Tailwind CSS, and JavaScript were used to develop the site и JavaScript. Visual Studio is an integrated development environment (IDE) created by Microsoft, which has been one of the leaders in software development for many years. This environment is designed for developing software in various programming languages, such as C#, C++, Python, JavaScript, and many others. Visual Studio has many features that make the development process more efficient and convenient [109, 110].

The appearance of the website of the Agritech Hub scientific and educational platform of the North Kazakhstan region is shown in Figure 29.

Design of the structure and navigation.

First of all, the site structure was developed taking into account the user's convenience. The navigation menu on the left has been fixed so that it stays in place when scrolling through the page, providing quick access to the main sections, such as:

- News
- Relevance
- Goals and objectives
- Expected results
- Results achieved
- Project

- Team
- Publications
- Patents
- Information for potential customers

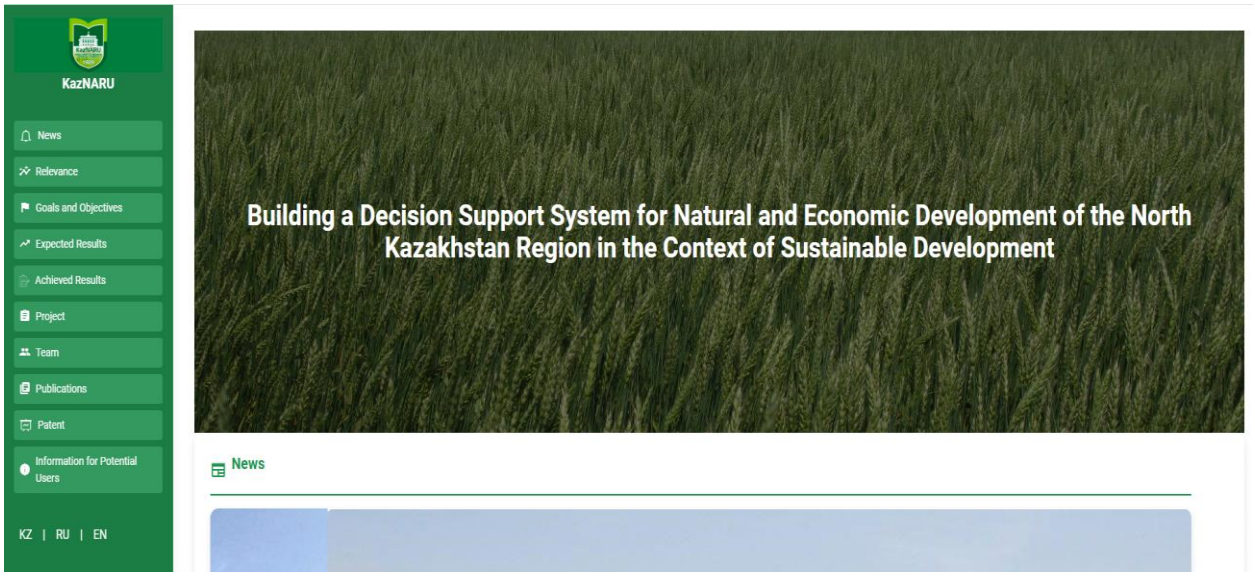


Figure 29 - Scientific and educational platform of the project website

The design of the structure and navigation took into account the user's convenience and quick access to the main sections of information. The navigation menu on the left has been locked in place so that it stays in place as you scroll through the page, providing quick access to key sections such as Relevance, Goals, Deliverables, Project, Team, and Publications (Figure 30).

Particular attention was paid to the visual design of the right side of the page, where information cards describing key aspects are located. For each card, styles were used with rounded corners, shadows, and hover animations to make the site more dynamic and pleasant to see.

Integration of backgrounds and images. At the beginning of the right side of the site, a background image (a background with a green field image) was added, covering the entire width of the available area. At the top of the background in the center, the name of the project was added ("Construction of a decision support system for the natural and economic development of the territory of the North Kazakhstan region in the context of sustainable development"), which added attractiveness to the site and improved perception (Figure 31).

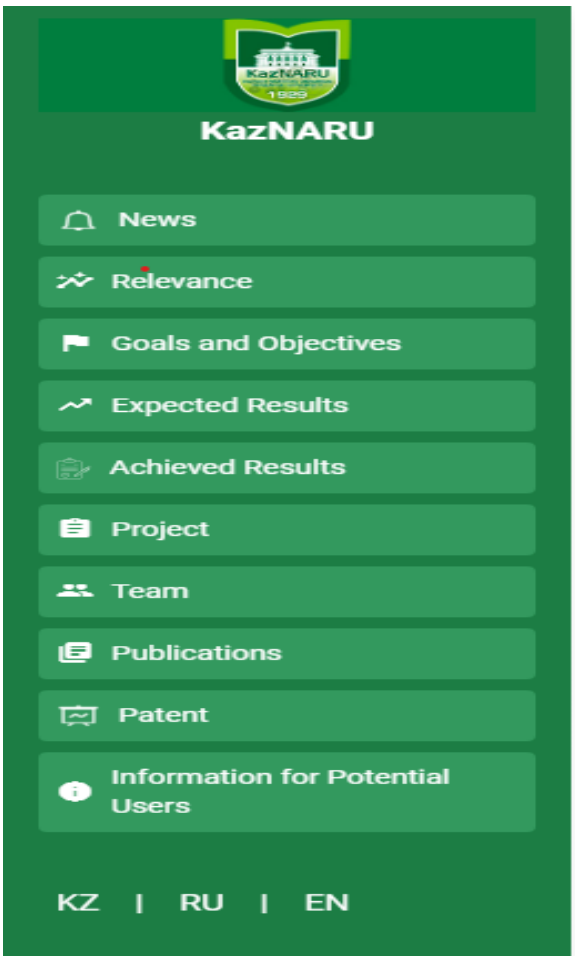
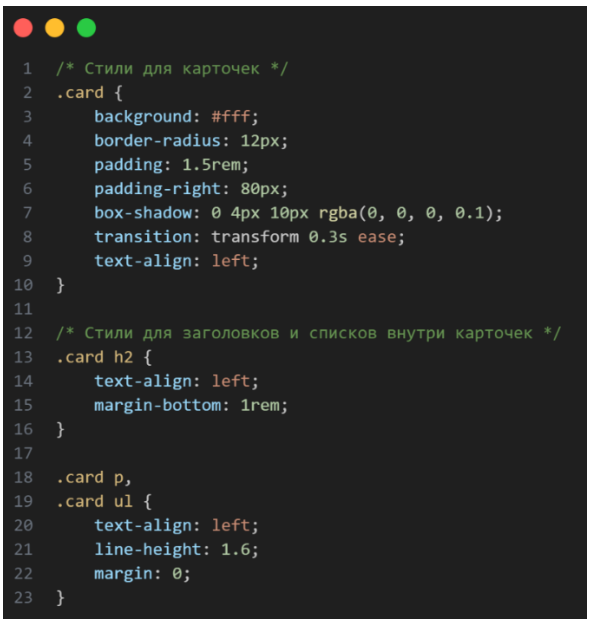


Figure 30 - Structure of the website navigation fixed menu on the left



Figure 31 - Design of the right side of the site

Layout and stylization. Tailwind CSS was used for styling, which made it possible to set styles quickly and efficiently. The "Roboto" font was used to make the text look modern and readable (Figure 32). Padding, padding, and alignment have been adjusted so that text and images have sufficient spacing and are arranged harmoniously on the page [110, 111].



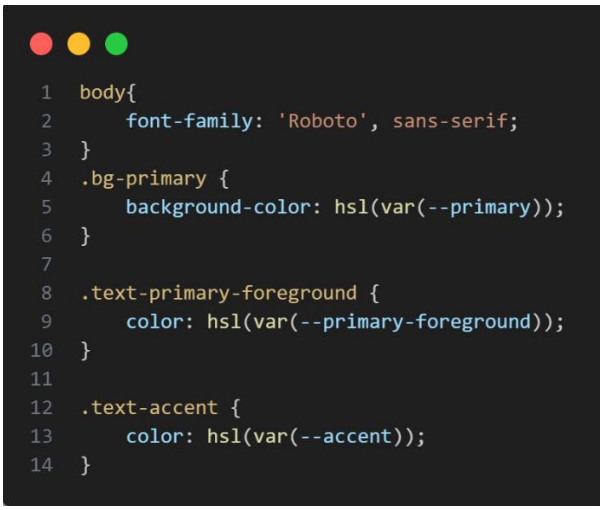
```css
/* Стили для карточек */
.card {
    background: #fff;
    border-radius: 12px;
    padding: 1.5rem;
    padding-right: 80px;
    box-shadow: 0 4px 10px rgba(0, 0, 0, 0.1);
    transition: transform 0.3s ease;
    text-align: left;
}

/* Стили для заголовков и списков внутри карточек */
.card h2 {
    text-align: left;
    margin-bottom: 1rem;
}

.card p,
.card ul {
    text-align: left;
    line-height: 1.6;
    margin: 0;
}
```

Figure 32 - Layout and styling using Tailwind CSS

Text block customization and alignment. In the information cards, the text has been left-aligned for better readability. Padding was set on the left and right to prevent content from adjoining the edges of the card, creating a cleaner and neater look (Figure 33).



```css
body{
    font-family: 'Roboto', sans-serif;
}
.bg-primary {
    background-color: hsl(var(--primary));
}

.text-primary-foreground {
    color: hsl(var(--primary-foreground));
}

.text-accent {
    color: hsl(var(--accent));
}
```

Figure 33 - Setting up and aligning text blocks for information cards

The main changes and improvements included work to remove unnecessary elements, as a result, decorative stripes and lines that interfered with the perception of content were removed. This made the site more minimalistic and improved the overall look.

CSS variables were used to simplify color scheme control, making it easy to change the color palette of the site (Figure 34).

```css
:root {
    --background: 0 0% 100%;
    --foreground: 240 10% 3.9%;
    --card: 0 0% 100%;
    --card-foreground: 240 10% 3.9%;
    --popover: 0 0% 100%;
    --popover-foreground: 240 10% 3.9%;
    --primary: 145 63% 30%; /* темно-зеленый цвет */
    --primary-foreground: 0 0% 100%; /* белый цвет текста */
    --secondary: 145 50% 40%; /* чуть светлее зеленый для фоновых элементов */
    --secondary-foreground: 0 0% 100%;
    --accent: 145 70% 35%; /* яркий зеленый для акцентов */
    --accent-foreground: 0 0% 100%;
    --muted: 145 60% 25%; /* приглушенный зеленый */
    --muted-foreground: 0 0% 80%;
}
```

Figure 34- Using the Color Palette Using CSS Variables

Add animation and interactivity. The information cards have been configured to rise slightly on hover, which adds interactivity and makes interacting with the site more enjoyable (Figure 35).

```css
.card {
    background: #fff;
    border-radius: 12px;
    padding: 1.5rem;
    padding-right: 80px;
    box-shadow: 0 4px 10px rgba(0, 0, 0, 0.1);
    transition: transform 0.3s ease;
    text-align: left;
}
```

Figure 35 - Setting up interactivity and animation on the site

Thus, the site already has functionality and modern styling, which allows you to use it as a demo version. In the future, it is necessary to supplement it with the remaining information and conduct testing to finally check the operation of all elements. The project website operates at the address: https://northkazdss.kaznaru.edu.kz .

CONCLUSION

As a result of the completedworks on theproject "Building a decision support system for the natural and economic development of the territory of the North Kazakhstan region in the context of sustainable growth" in 2024, according to the calendar plan, the following results were obtained:

The review of the best world practices and conceptual foundations of territorial planning in the countries of far and near abroad (Germany, France, Spain, Canada, Great Britain, Korea, China, Russia, etc.), based on the principles of sustainable growth, is carried out.

The collection of long - term information on the main natural and climatic parameters (air temperature, precipitation, snow cover, reserves of productive moisture in the soil, etc.) was carried out. The list of meteorological parameters will be expanded in the future. An held assessment of climatic conditions,trendsin climate change over the past 20 years, zoning of the territory according to hydrothermal conditions will be carried out, as well as an assessment of climate aridity in the studied region.

Information was collected on the landand resource potentiall of the region over the past 20 years for 7 categories of land: agricultural purposes, settlements, industrial territories, specially protected lands, forest and water resources, reserve lands. CData on the long-term dynamics of agricultural areasand lands: arable land, fallow land, perennial plantings, pastures, hayfields, vegetable gardens and service allotments were collected.

The total area of the land fund (as of January 1, 2023) in the North Kazakhstan region is 9804.3 thousand hectares, of which 74% is occupied by agricultural land, 11% by settlements and 6% by reserve land. The area under agricultural land in 2023 compared to 2004 increased by 1310.7 thousand hectares, or almost 23.0%. In the structure of agricultural land, 71.2% is arable land, 28% is pastureland, and 0.2% is hayfields, which indicates that agriculture is developed in this region. The dynamics of land use in settlements of the North Kazakhstan region shows that over the 20 years from 2004 to 2023, they expanded by 124.7 thousand hectares or increased by 13.5 % and amounted to 98 thousand hectares.

Data on the main characteristics of soil types, mechanical composition, fertility, state of water resources (including provision of the territory with underground and aboveground waters), biodiversity and ecological state of natural objects are collected.

The study of the theoretical basis of sustainable development allowed scientists to identify several approaches to the study of this issue: ecological-systemic, triune, cluster, and corporate approach. The following indicators are taken as the goals of social and economic development of the region: increasing income, improving education, nutrition and health, reducing poverty,

improving the environment, equal opportunities, expanding personal freedom, enriching cultural life.

The development of territorial planning is expressed in qualitative changes in the economy that affect the well-being of the population. Qualitative changes in the economy that affect household incomes include the following indicators:

- economic growth of quantitative indicators;
- formation and functioning of an innovative economy;
- development of venture business;
- structural changes in the economy;
- increase of labor productivity.

To fulfill the tasks set in the project, the researchers collected long-term statistical data on socio-economic indicators of the development of the North Kazakhstan region in the context of districts for 2004-2023, in the following areas:

- socio-demographic data.
- standard of living.
- labor market and remuneration;
- gross regional product.
- the real sector of the economy;
- trade;
- prices, etc.

Adatabase of data on socio-economic development for a multi-year period was formed for 13 districts and for Petropavlovsk in all the above areas, which willebe included in the structure of the Geoinformation Database.

According tasks to the project objectives, in 2025, researchers will conduct a more detailed, in-depth analysis of socio-economic indicators and develop effective mechanisms for the sustainable development of this region.

To determine the demographic potential of the region, various methods were studied, such as: determining the number of able-bodied population, studying the age structure of the population, analyzing the demographic load factor, forecasting labor resources based on demographic changes, assessing migration processes, assessing the economically active population, employment and unemployment, analyzing the qualification and educational level, mapping demographic and labor indicators, analysis of the spatial distribution of labor resources, SWOT analysis of labor potential, labor balance, which made it possible to form a system of indicators for evaluating labor resources. As a result, astatistical database on the labor resources of the region in the context of districts in

dynamics for 2000-2022 was compiled. The database characterizes the demographic potential and labor resources of the North Kazakhstan region.

For effective management of labor resources in the future, this project will assess and forecast demographic indicators and labor resources, which will identify and solve the problems of providing labor resources and reduce the migration outflow of the population from this area.

To maintain the demographic and labor potential of the Territory, it is necessary to develop programs to stimulate employment, support the birth rate and attract migrants. The developed programs to support families, subsidies for housing for young professionals and improvement of social infrastructure in the future will provide the region with labor resources.

All collected data in the form of tabular material is placed on an electronic medium:https://drive.google.com/drive/folders/10Dk9lGr_MvGftHxcQs_DBlPajFtzspH?usp=drive_link

The project's geodata database structure has been developed in ArcGIS Pro. The database provides for the concentrationю and placement of data from various sources, organized for analysis, modeling, and mapping. The structure of the database provides for the placement of collected thematic data on natural and climatic, land, water resources, socio-economic development, labor resources, transport and infrastructure, a set of which will create spatiale datae for the preparation of thematic maps describing the development of the territory of the North Kazakhstan region.путниковыеSatellite data is the key information in the developed project's geodata database, as it allows you to quickly collect, analyze and spatially evaluate key parameters in all areas related to economic activity, territorial development, and natural resources. Collected space-basede-imagesand multi-time satellite systems: Landsat 8 (7,4-5) (30 m), and placed in the database for the last 20 years. In the farшnorth, it is also planned to place and use satellite data Sentinel - 1/2 (10m) (20m), MODIS (250m), etc., a set of calculated indices, data from local route surveys and UAV surveys.

Data was collected to develop a methodology for selecting optimal locations for reserving and storing meltwater and flood waters in the region: spatial digital terrain data, a 30-meter altitude model of the Shuttle Radar TopologyMission(SRTM), climate spatial data on air temperature and monthly precipitation over a long period of time, digitization of a detailed map types of soils. In the future, it is planned to collect ground-based point data that will be obtained as a result of snow-measuring route surveys, as well as weather data. The combination of all these data will serve as a basis for developing a methodology for selecting optimal locations for reserving and storing meltwater and floodwaters in the region.

A website has been developed that provides brief information about the program: relevance, purpose, results, first and last names of the research team members, their respective

profiles, publications, patents, etc. https://northkazdss.kaznaru.edu.kz://northkazdss.kaznaru.edu.kz .

The work carried out and the data collected will later be used in the analysis, development of multi-factor evaluation criteria, on the basis of which a series of thematic maps will be prepared, generalized data for solving various tasks of this project.

REFERENCES

1. https://ru.wikipedia.org/wiki (in Russian).

2. Garkushina V. V. Real estate management and territory planning: a textbook. Nur-Sultan: Kazakh Agrotechnical University named after S. Seifullin, 2020. - 80c (Гаркушина В.В. Управление недвижимостью и планирование территорий: учебное пособие.- Нур-Султан: Казахский агротехнический университет им. С. Сейфуллина, 2020.- 80с) (in Russian).

3. On the administrative-territorial structure of the Republic of Kazakhstan Law of the Republic of Kazakhstan dated December 8, 1993 No. 2572-XII. (Об административно-территориальном устройстве Республики Казахстан Закон Республики Казахстан от 8 декабря 1993 года № 2572-XII.) (in Russian).

4. https://stat.gov.kz/ru (in Russian).

5. On approval of the Rules of development and approval of the General Scheme of organization of the territory of the Republic of Kazakhstan Resolution of the Government of the Republic of Kazakhstan dated March 4, 2011 No. 222 (Об утверждении Правил разработки и согласования Генеральной схемы организации территории Республики Казахстан Постановление Правительства Республики Казахстан от 4 марта 2011 года № 222) (in Russian).

6. https://aisggk.kz/ (in Russian).

7. Tarakanov O. V. T19 Territorial planning as a basis for managing the development of territories: textbook. manual / O. V. Tarakanov, N. A. Kiseleva, M. S. Akimova; under the general editorship of Doctor of Technical Sciences, prof. Penza: PGUAS Publ., 2014, 124 p. (Тараканов О.В. Т19 Территориальное планирование как основа управления раз- витием территорий: учеб. пособие / О.В. Тараканов, Н.А. Ки- селева, М.С. Акимова; под общ. ред. д-ра техн. наук, проф. Ю.П. Скачкова. – Пенза: ПГУАС, 2014. – 124 с.) (in Russian).

8. Journal of Foreign Legislation and Comparative Law 2•2014 M. Burinskine, O. S. Petrakovskaya. Legal regulation of the fundamentals of territorial planning in Lithuania and Ukraine. (Журнал зарубежного законодательства и сравнительного правоведения 2•2014 М. Буринскине, О.С. Петраковская. Правовое регулирование основ территориального планирования в Литве и Украине.) (in Russian).

9. Territorial and spatial planning. United Nations New York and Geneva, 2008 (Территориально-пространственное планирование. организация объединенных наций Нью-Йорк и Женева, 2008 год) (in Russian).

10. Adair, A. and others (2006). Spatial Strategies on the Island of Ireland. Development of a Framework for Collaborative Action. InterTradeIreland, Newry (in English).

11. Alterman, R. (ed.) (2001). National-Level Planning in Democratic Countries: An International Comparison of City and Regional Policy-making, Liverpool University Press, Liverpool. (in English).

12. Cullingworth, B. and Nadin, V. (2006). Town and Country Planning in the UK. Fourteenth edition. Routledge, London. (in English).

13. DECREE OF THE PRESIDENT OF THE REPUBLIC OF KAZAKHSTAN. On approval of the Territorial Development Plan of the Republic of Kazakhstan until 2025 (УКАЗ ПРЕЗИДЕНТА РЕСПУБЛИКИ КАЗАХСТАН. Об утверждении Плана территориального развития Республики Казахстан до 2025 года) (in Russian).

14.https://cyberleninka.ru/article/n/istoriya-razvitiya-landshaftnogo-planirovaniya (in Russian).

15. https://tech.wikireading.ru/hWYswkXm9T. (in English).

16. Landscape planning: principles, methods, European and Russian experience. Antipov A. N., Drozdov A.V. (eds.), 2002. ISBN 5-94797-006-6. Publishing House of the Institute of Geography SB RAS. Irkutsk. 2002 monograph (Ландшафтное планирование: принципы, методы, европейский и российский опыт. Антипов А.Н., Дроздов А.В. (ред.). 2002. ISBN 5-94797-006-6. Изд-во Института географии СО РАН. Иркутск. 2002 монография) (in Russian).

17. Management networks and the complexity of spatial planning. González, OL (Ledesma Gonzalez, Oswaldo) [1] DOI 10.30827/cuadgeo.v60i2.15619 (in English).

18. Integration of the concept of ecosystem services in territorial planning. Avendaño-Leadem, DF (Avendano-Leadem, Daniel Francisco) [1] ; Cedeño-Montoya, BC (Cedeno-Montoya, Bepsy Cristina) [1] ; Arroyo-Zeledón, MS (Arroyo-Zeledon, Michael Steven) [2]. REVISTA GEOGRAFICA DE AMERICA CENTRALarrow_drop_down Issue 65 Page 63-90. DOI 10.15359/rgac.65-2.3 (in English).

19. Integration of territorial planning principles into road infrastructure plans in Spain. López-Escolano, K(López-Escolano, Carlos);Navarro, M. L. X(Hernandez Navarro, Maria Luz). REVISTA GEOGRAFICA VENEZOLANAarrow_drop_down. Volume 60 Issue 1 Page 184-199 (in English).

20 Wang Linyu. Systemic changes in the territorial and spatial planning of the PRC in the XXI century. Architecture and Modern Information Technologies. 2023. No. 1 (62). pp. 297-312 (in English).

21 Evaluation of spatial planning from the perspective of the Sustainable Development Goals. Author: Qiqi Hu, Yanan Zhang, Jiabin Wang, Ran Ho, and Zhe Feng. 2024 Sustainable Development, 16(7), 2965;https://doi.org/10.3390/su16072965. (in English).

22 Sakharov A. G. Andronova I. V. (2020) Sustainable development of Arctic territories Canada: Goals and results // Bulletin of International Organizations, vol. 15, no. 4 p. (in Russian). DOI:10.17323/1996-7845-2020-04-07 (Сахаров А.Г. Андронова И.В. (2020) Устойчивое развитие арктических территорий Канады: цели и результаты // Вестник международных организаций. Т. 15 № 4 С. (на русском языке). DOI:10.17323/1996-7845-2020-04-07) (in Russian).

23. https://forbes.kz/articles/kak_yujnaya_koreya_svershila_svoe_ekonomicheskoe_chudo.(in Russian).

24. LANDSCAPE PLANNING AS AN ASSET OF REGIONAL DEVELOPMENT IN LATVIA Volosina, M;Zarina, A; (...);Vinogradovs, I.ECONOMIC SCIENCE FOR RURAL DEVELOPMENT 2018 Issue 48 Page 276-283. DOI 10.22616/ESRD.2018.095 (in English).

25. Assessment of the regulation of legal relations in territorial planning: a case study in Lithuania. Jukneliene, D (Jukneliene, Daiva) [1] ; Valciukiene, J (Valciukiene, Jolanta) [1] ; Atkocevicene, V (Atkocevicene, Virginija) [1] LAND USE POLICYarrow_drop_down. Volume 67 Page 65-72. DOI 10.1016/j.landusepol.2017.05.019 (in English).

26. Territorial planning: a tool for implementing sustainable regional development. Salne, E.,Apanaviciene, R.. KAUNAS UNIV TECHNOLOGY PRESS. View Web of Science ResearcherID and ORCID(in English).

27. Republic of Kazakhstan. Environment and Ecology, vol. 3, ed. Medeu, A. R. 2nd ed. Almaty, 2010, pp. 366-367. (Республика Казахстан. Окружающая среда и экология. Т.3. Под. ред. Медеу. А.Р. 2-е изд. Алматы, 2010. - С. 366-367.) (in Russian).

28. Agroclimatic handbook of the North Kazakhstan region, - L.: Gidrometeoizdat, 1958, 128 p..(Агроклиматический справочник по Северо-Казахстанской области. - Л.: Гидрометеоиздат, 1958. - 128 с.) (in Russian).

29. National Atlas of the Republic of Kazakhstan. Natural conditions and resources. // Institute of Geography. - Almaty: - 2010. - Vol. 1. - 150 p. (Национальный Атлас Республики Казахстан. Природные условия и ресурсы. //Институт географии. – Алматы: – 2010. – Т.1. – 150 с.) (in Russian).

30. Atlas of the Kazakh SSR, Moscow: GUGK, 1982, vol. 1, 300 p. (Атлас Казахской ССР. – М.: ГУГК, 1982. Т. 1. – 300 с.) (in Russian).

31.Drozdov, O. A. Klimatology. [Text] /O. A. Drozdov, V. A. Vasiliev, N. V. Kobysheva et al. - L.: Gidrometeoizdat, 1989. - 568 p.(Дроздов, О.А. Климатология. [Текст] /О.А. Дроздов, В.А. Васильев, Н.В. Кобышева и др. – Л.: Гидрометеоиздат, 1989. - 568 с.) (in Russian).

32. Handbook on the climate of Kazakhstan. //Multi-year data. Air temperature. North Kazakhstan region. Issue 1-Almaty: Kazhydromet Publ., 2004.(Справочник по климату Казахстана. //Многолетние данные. Температура воздуха. Северо-Казахстанская область. Вып.1 - Алматы: Казгидромет, 2004.) (in Russian).

33. Handbook on the climate of Kazakhstan. //Multi-year data. Atmospheric precipitation. North Kazakhstan region. Issue No.1. Section 2. Almaty: Kazhydromet, 2004. (Справочник по климату Казахстана. //Многолетние данные. Атмосферные осадки. Северо-Казахстанская область. Вып.1. Раздел 2. - Алматы: Казгидромет, 2004.) (in Russian).

34. Scientific and applied handbook on the climate of the USSR. //Multi-year data. Kazakh SSR. Series 3. Book 1. - L.: Gidrometeoizdat, 1989. - Issue 18. - Ch. 1-6 – - 515 s (Научно-прикладной справочник по климату СССР. //Многолетние данные. Казахская ССР. Серия 3. Книга 1.- Л.: Гидрометеоиздат, 1989. - Вып.18. - Ч. 1-6. – 515 с) (in Russian).

35. Prushchak O. V. Methodological approaches to the integrated assessment of the resource potential of the agro-industrial complex of the region // Bulletin of the Saratov State Socio-Economic University. 2017. № 5 (69). URL: https://cyberleninka.ru/article/n/metodicheskie-podhody-k-kompleksnoy-otsenke-resursnogo-potentsiala-apk-regiona (Accessed on 11.03.2021).(Прущак О. В. Методические подходы к комплексной оценке ресурсного потенциала АПК региона // Вестник Саратовского государственного социально-экономического университета. 2017. № 5 (69). URL: https://cyberleninka.ru/article/n/metodicheskie-podhody-k-kompleksnoy-otsenke-resursnogo-potentsiala-apk-regiona (дата обращения: 11.03.2021).) (in Russian).

36. Eminova E. M., Kardashova M. A., Dalgatova I. D. Resource potential of innovative development of the agro-industrial complex. 2017. № 3 (77). URL: https://cyberleninka.ru/article/n/resursnyy-potentsial-innovatsionnogo-razvitiya-apk (Accessed on 11.03.2021). (Эминова Э. М., Кардашова М. А., Далгатова И. Д. Ресурсный потенциал инновационного развития АПК // РППЭ. 2017. № 3 (77). URL: https://cyberleninka.ru/article/n/resursnyy-potentsial-innovatsionnogo-razvitiya-apk (дата обращения: 11.03.2021).) (in Russian).

37. Potapov A. P. Resource potential of the agro-industrial complex in the system of foreign economic relations of Russia. 2011. № 16. URL: https://cyberlemnka.ru/artide/n/resursnyy-potentsial-apk-v-sisteme-vneshneekonomicheskih-svyazey-rossii (Accessed on 11.03.2021).(Потапов А. П. Ресурсный потенциал АПК в системе внешнеэкономических связей России // Никоновские чтения. 2011. № 16. URL: https://cyberlemnka.ru/artide/n/resursnyy-potentsial-apk-v-sisteme-vneshneekonomicheskih-svyazey-rossii (дата обращения: 11.03.2021).) (in Russian).

38. Popova A. L. Teoreticheskie podkhody k ponyatiyu resursnogo potentsiala innovatsionnykh protsessov v APK [Theoretical approaches to the concept of resource potential of innovative processes in the agricultural sector]. 2015. № 8. URL: https://cyberlemnka.ru/artide/n/teoreticheskie-podhody-k-ponyatiyu-resursnogo-potentsiala-innovatsionnyh-protsessov-v-apk (Accessed on 11.03.2021). (Попова А. Л. Теоретические подходы к понятию ресурсного потенциала инновационных процессов в АПК // Символ науки. 2015. № 8. URL: https://cyberlemnka.ru/artide/n/teoreticheskie-podhody-k-ponyatiyu-resursnogo-potentsiala-innovatsionnyh-protsessov-v-apk (дата обращения: 11.03.2021).) (in Russian).

39. Ovchinnikova N. G., Shmakova V. V. Analysis of the land fund of rural settlements in the Martynovsky district of the Rostov region // Economics and ecology of territorial entities. 2018. № 2. URL: https://cyberleninka.ru/article/n7analiz-zemelnogo-fonda-selskih-poseleniy-v-sostave-martynovskogo-rayona-rostovskoy-oblasti (Accessed on 11.03.2021).(Овчинникова Н. Г., Шмакова В. В. Анализ земельного фонда сельских поселений в составе Мартыновского района Ростовской области // Экономика и экология территориальных образований. 2018. № 2. URL: https://cyberleninka.ru/article/n7analiz-zemelnogo-fonda-selskih-poseleniy-v-sostave-martynovskogo-rayona-rostovskoy-oblasti (дата обращения: 11.03.2021).) (in Russian).

40. Podurets O. I. Sovremennoe sostoyanie zemel'nykh resursov Kemerovo oblasti i ikh ispol'zovanie [Current state of land resources in the Kemerovo region and their use]. 2018. № 10 (96). URL: https://cyberleninka.ru/article/n/sovremennoe-sostoyanie-zemelnyh-resursov-kemerovskoy-oblasti-i-ih-ispolzovanie (Accessed on 11.03.2021).(Подурец О. И. Современное состояние земельных ресурсов Кемеровской области и их использование // РППЭ. 2018. № 10 (96). URL: https://cyberleninka.ru/article/n/sovremennoe-sostoyanie-zemelnyh-resursov-kemerovskoy-oblasti-i-ih-ispolzovanie (дата обращения: 11.03.2021).) (in Russian).

41. Merkulov E. Yu., elm, G. B. Methods of assessment of efficiency of use of land resources in the region // Bulletin of TSU, 2015, No. 2 (142). URL: https://cyberleninka.ru/article/n/metodika-otsenki-effektivnosti-ispolzovaniya-zemelnyh-resursov-regiona (Accessed on 11.03.2021).(Меркулова Е. Ю., Вязов Г. Б. Методика оценки

эффективности использования земельных ресурсов региона // Вестник ТГУ. 2015. № 2 (142). URL: https://cyberleninka.ru/article/n/metodika-otsenki-effektivnosti-ispolzovaniya-zemelnyh-resursov-regiona (дата обращения: 11.03.2021).) (in Russian).

42. Haripova Z. R. Use of land and resource potential in the system of urban environmental management // Economics and ecology of territorial entities. 2015. № 1. URL: https://cyberleninka.ru/article/n/ ispolzovanie-zemelno-resursnogo-potentsiala-v-sisteme-gorodskogo-prirodopolzovaniya (Accessed on 11.03.2021).(Харипова З. Р. Использование земельно-ресурсного потенциала в системе городского природопользования // Экономика и экология территориальных образований. 2015. № 1. URL: https://cyberleninka.ru/article/n/ ispolzovanie-zemelno-resursnogo-potentsiala-v-sisteme-gorodskogo-prirodopolzovaniya (дата обращения: 14.03.2021).) (in Russian).

43. Artamonova I. A., Baturina I. N., Mikhailyuk O. N., Poverinova E. M. Improving Methodologies of Assessing the Efficiency of Agricultural Land Use // Advances in Social Science, Education and Humanities Research. Kurgan State University, Institute of Economics of the Ural Branch of the Russian Academy of Sciences, Tyumen Industrial University, Eurasian Institute of Social and Economic Research. 2019. pp.121-124. DOI: 10.2991 / assehr. k. 200113. 025. (in Russian).

44. Garazha Y., WORLD EXPERIENCE IN LAND RESOURCES MANAGEMENT.//INTERNATIONAL JOURNAL OF NEW ECONOMICS AND SOCIAL SCIENCES (IJONESS) ISSN: 2450-2146 ,Year 2016, Volume 3, No. 1, page 162-170. (in English).

45. Consolidated analytical report on the state and use of land in the Republic of Kazakhstan (2004-2023).(Сводный аналитический отчет о состоянии и использовании земель Республики Казахстан (2004-2023 гг.).) (in Russian).

46. Agroclimatic handbook of the North Kazakhstan region, L. Gidrometeoizdat, 1958, pp. 111-120.(Агроклиматический справочник по Северо-Казахстанской области.-Л. Гидрометеоиздат,1958.-с. 111-120.) (in Russian).

47. Republic of Kazakhstan. Volume 3: Environment and Ecology. Under. ed. Medeu, A. R. 2nd ed. Almaty, 2010, pp. 134-147. 124 (Республика Казахстан. Том 3: Окружающая среда и экология. Под. ред. Медеу. А.Р. 2-е изд. -Алматы, 2010. - С. 134-147. 124) (in Russian).

48. Soils of the Kazakh SSR, Alma-Ata: Nauka Publishing House, 1983, 238 p.(Почвы Казахской ССР. - Алма-Ата: Изд-во «Наука», 1983. - 238 с.) (in Russian).

49. Soil map of the Kazakh SSR. Edited by U. U. Uspanov. M-ba 1: 2500000. - Moscow: GUGK Publishing House, 1976. - 2 p. (Почвенная карта Казахской ССР. Под редакцией У.У. Успанова. М -ба 1:2500000. - М.: Изд-во «ГУГК», 1976. - 2 с.) (in Russian).

50. Erokhina O. G., Kusainova M. M., Sokolov A. A., Pachikin K. M. Soil map / / National Atlas of the Republic of Kazakhstan. Volume 1: Natural conditions and Resources. Almaty, 2006, pp. 96-97. (Ерохина О.Г., Кусаинова М.М., Соколов А.А., Пачикин К.М. Почвенная карта // Национальный атлас Республики Казахстан. Том 1: Природные условия и ресурсы. - Алматы, 2006. - С. 96-97.) (in Russian).

51. Soil fertility / / National Atlas of the Republic of Kazakhstan. Volume 3: Environment and Ecology. Almaty, 2006, 85 p. (in Russian) (Плодородие почв // Национальный атлас Республики Казахстан. Том 3: Окружающая среда и экология. -Алматы, 2006. - 85 с.) (in Russian).

52. Erokhina O. G., Kusainova M. M., Sokolov A. A., Pachikin K. M. Soils of Kazakhstan // Republic of Kazakhstan. Volume 1: Natural conditions and Resources. Almaty, 2006, p. 316-361. (Ерохина О.Г., Кусаинова М.М., Соколов А.А., Пачикин К.М. Почвы Казахстана // Республика Казахстан. Том 1: Природные условия и ресурсы. -Алматы, 2006. - С. 316 361.) (in Russian).

53. Sokolov A. A. Prirodnye zony Kazakhstana [Natural zones of Kazakhstan]. Kazakhstan and the Chelyabinsk Region, Moscow: Nauka Publishing House, 1968, pp. 9-24. (Соколов А.А. Природные зоны Казахстана // Агрохимическая характеристика почв СССР. Казахстан и Челябинская область. - М.: Изд-во «Наука», 1968. - С. 9-24.) (in Russian).

54. National reports on the state of the environment and use of natural resources of the Republic of Kazakhstan for 1998-2022.(Национальные доклады о состоянии окружающей среды и использовании природных ресурсов Республики Казахстан за 1998-2022 г.г) (in Russian).

55. https://www.oopt.kz/ (in Russian).

56.https://www.gov.kz/memleket/entities/skotabigat/press/article/details/34064?lang=ruhttps://ecokarta.kz/ (in Russian).

57. Activity Report for 2023 Esil Basin Inspectorate for Regulating the Use and Protection of Water Resources. (Отчет о деятельности за 2023 г. Есильской бассейновой инспекции по регулированию использования и охраны водных ресурсов.) (in Russian).

58. https://drive.google.com/drive/folders/1i2ex3P7RpNX-gJaMtM1mSOsGMde3M4Zu / (in Russian).

59. Scheme of integrated use and protection of water resources in the river basin. Yesil (Ishim) on the territory of the Republic of Kazakhstan. Summary note.- Almaty; PC "Institute of Kazgiprovodkhoz", 2006. -133 p. (Схема комплексного использования и охраны водных

ресурсов бассейна р. Есиль (Ишим) на территории Республики Казахстан. Сводная записка.- Алматы; ПК «Институт Казгипроводхоз», 2006.-133 с.) (in Russian).

60. https://drive.google.com/drive/folders/10Dk9lGr_MvG-ftHxcQs_DBlPajFtzspH?usp=drive_linkc (in Russian).

61.Rekonstruktsiya: filialy RSE na PHV "Kazvodkhoz" [Reconstruction: branches of the RSE on the PHV "Kazvodkhoz"].- RSE on the right of economic management "Kazvodkhoz" of the Committee on Water Resources of the Ministry of Ecology, Geology and Natural Resources of the Republic of Kazakhstan. -2021. - URL:http://qazsu.kz/ru/activity/rekonstruktsiya.php (Реконструкция: филиалы РГП на ПХВ «Казводхоз» [Электронный ресурс].- РГП на праве хозяйственного ведения «Казводхоз» Комитета по водным ресурсам Министерства экологии, геологии и природных ресурсов РК.–2021.- URL:http://qazsu.kz/ru/activity/rekonstruktsiya.php) (in Russian).

62. Restoration of hydrotechnical systems of land irrigation [Electronic resource]. - RSE on the right of economic management "Kazvodkhoz" of the Committee on Water Resources of the Ministry of Ecology, Geology and Natural Resources of the Republic of Kazakhstan.- 2021.- URL:http://qazsu.kz/ru/activity/vosstanovlenie-gidrotekhnicheskikh-sistem-oroshenie-zemli.php (дата обращения 08.09.2021).(Восстановление гидротехнических систем орошение земли [Электронный ресурс]. –РГП на праве хозяйственного ведения «Казводхоз» Комитета по водным ресурсам Министерства экологии, геологии и природных ресурсов РК.- 2021.- URL:http://qazsu.kz/ru/activity/vosstanovlenie-gidrotekhnicheskikh-sistem-oroshenie-zemli.php (дата обращения 08.09.2021).) (in Russian).

63. Scheme of integrated use and protection of water resources of the river basin. Yesil (Ishim) on the territory of the Republic of Kazakhstan. Summary note.- Almaty; PC "Institute of Kazgiprovodkhoz", 2006. -133 p.(Схема комплексного использования и охраны водных ресурсов бассейна р. Есиль (Ишим) на территории Республики Казахстан. Сводная записка.- Алматы; ПК «Институт Казгипроводхоз», 2006.-133 с.) (in Russian).

64. General scheme of integrated use and protection of water resources of the Republic of Kazakhstan. The concept. (Main provisions) / Production cooperative "Institute of Kazgiprovodkhoz". Almaty, 2008, 126 p. (in Russian) (Генеральная схема комплексного использования и охраны водных ресурсов Республики Казахстан. Концепция. (Основные положения) / Производственный кооператив «Институт Казгипроводхоз». – Алматы, 2008.- 126 с.) (in Russian).

65. Lakes of Northern Kazakhstan collection of articles. Publishing House of the Academy of Sciences of the Kazakh SSR, 1960.(Озера Северного Казахстана сборник статей. Изд-во Академии наук Казахской ССР. 1960 г. Н. Н Пальгов.) (in Russian).

66. https://xn--80aeaj2aesddcjte.kz/po-obespechennosti-vodosnabzheniem-severo-kazakhstanskaya-oblast-okazalas-v-chisle-autsajjderov/

67. National Report on the State of the Environment and the Use of Natural Resources of the Republic of Kazakhstan for 2016.(Национальный доклад о состоянии окружающей среды и об использовании природных ресурсов Республики Казахстан за 2016 год.) (in Russian).

68. Tyumenev S. D. Vodnye resursy i vodoobespechennost ' territorii Kazakhstana: Uchebnik [Water resources and water supply in the territory of Kazakhstan]. Almaty: KazNTU Publ., 2008, 267 p.(Тюменев С.Д. Водные ресурсы и водообеспеченность территории Казахстана: Учебник. – Алматы: КазНТУ, 2008. – 267 с) (in Russian).

69. National Atlas of the Republic of Kazakhstan. Volume 1: Natural Conditions and Resources. Bas editor, G. G. D. prof. Medeu A.R., Almaty, 2010-150b. (Қазақстан Республикасының ұлттық Атласы. 1-том: Табиғи жағдайлары мен ресурстары. Бас редактор, г.ғ.д. проф. Медеу А.Р. Алматы, 2010-150б.) (in Russian).

70. National reports on the state of the environment and use of natural resources of the Republic of Kazakhstan for 1998-2022.(Национальные доклады о состоянии окружающей среды и использовании природных ресурсов Республики Казахстан за 1998-2022 г.г.) (in Russian).

71 Information bulletins on the state of the environment of the Republic of Kazakhstan for 2016-2023 (Информационные бюллетени о состоянии окружающей среды Республики Казахстан за 2016-2023 г.г.) (in Russian).

72. Information reviews on the results of maintaining the State Cadastre of Production and Consumption Waste for 2016-2018 . https://taldau.stat.gov.kz/ru/Search/SearchByKeyWord

73. http://ecokadastr.kz/ru/MyAccount/Login / (in Russian).

74. https://ecoportal.kz/Category// (in Russian).

75. Sustainable development: theoretical and practical aspects of the concept//. https://na-obr.ru/ (Устойчивое развитие: теоретические и практические аспекты концепции // https://na-obr.ru/) (in Russian).

76. T. V. Uskova. Managing the region's sustainable development

https://core.ac.uk/download/pdf/197428651.pdf (Т.В. Ускова. Управление устойчивым развитием региона https://core.ac.uk/download/pdf/197428651.pdf) (in English).

77. Improvement of the management mechanism for innovative development of the territory. Monograph. Saint Petersburg University of Management and Economics. A team of authors. Scientific editorship of H. S. Pak. https://eec.eaeunion.org/upload/clcr/6.2.4.pdf . (in English).

78. Methods of forecasting economic development, including taking into account the cross-border consequences of decisions taken in the field of macroeconomic policy. Report. The year 2024

https://eec.eaeunion.org/upload/clcr/doklad_8.1.3_2.pdf (Методы прогнозирования развития экономики, в том числе с учетом трансграничных последствий принимаемых решений в области макроэкономической политики. Доклад. 2024 год

https://eec.eaeunion.org/upload/clcr/doklad_8.1.3_2.pdf) (in Russian).

78-2. Becker, G. S. (1993). Human Capital: A Theoretical and Empirical Analysis with Special Reference to Education (3rd ed.). Chicago: University of Chicago Press. (in English).

79. Smith, A. an inquiry into the nature and causes of the wealth of Nations. [Text] / ed. ред. by A..I.. Abalkin. - M, Moscow: Nauka Publ., 1980, p. 490 (Смит, А. Исследование о природе и причинах богатства народов. [Текст] / отв. ред. А.И. Абалкин. - М. : Наука, 1980, с. 490). (in English).

80.Mill, J. Principles of Political Economy [Text] / J. Mill. - L., 1920., c. 47 (in English).

81. World Bank (2018). The Changing Nature of Work. Washington, DC: World Bank. https://doi.org/10.1596/978-1-4648-1328-3. (in English).

82.Borjas, G. J. (2016). We Wanted Workers: Unraveling the Immigration Narrative. New York: W. W. Norton & Company. (in English).

83.Wade, M., & Holland, A. (2023). "The planet's population will get to 10.4 billion – then drop. Here's when we reach peak human." Sydney Morning Herald. (in English).

84.Boucher, Anna. "Gender, migration and the global race for talent." (2016): 1-256.

85.Constant, Amelie F. Return, circular, and onward migration decisions in a knowledge society. Springer International Publishing, 2021. (in English).

86. Daniel Crown, Alessandra Faggian, Jonathan Corcoran Foreign-Born graduates and innovation: Evidence from an Australian skilled visa program Research Policy, 49 (9) (2020), Article 103945, (in English).

87. Wade, M., and A. Holland. 2023. "The planet's population will get to 10.4 billion – then drop. Here's when we reach peak human." Sydney Morning Herald Nine Entertainment Co., accessed 20 December 2023. (in English).

88. Piore M. Birds of passage. Migrant labour and industrial societies. New York: Cambridge University Press. 1979. (in English).

89. Nazarzadeh Zare, M. and Parvin, E. (2024), "The reasons for the gap between academic education and the required skills of the labor market in Iran", Journal of Applied Research in Higher Education, Vol. 16 No. 3, pp. 831-842. https://doi.org/10.1108/JARHE-02-2023-0052 . (in English).

90. Thi Tuyet Tran, Nuttawuth Muenjohn, Alan Montague (2024), Negotiating entry to the professional labour market among Vietnamese skilled migrants in Australia: The impact of cultural distance, International Journal of Intercultural Relations, Volume 100, May 2024, 1019776, https://doi.org/10.1016/j.ijintrel.2024.101977. (in English).

91. Steve Binggeli, Joerg Dietz and Franciska Krings, Immigrants: A Forgotten Minority Published online by Cambridge University Press: 07 January 2015. (in English).

92. Chun Guo, Akram Al Ariss Human resource management of international migrants: Current theories and future research The International Journal of Human Resource Management, 26 (10) (2015), pp. 1287-1297, (in English).

93. Aida Hajro, G.ünter K. Stahl, Callen C. Clegg, Mila B. Lazarova Acculturation, coping, and integration success of international skilled migrants: An integrative review and multilevel framework Human Resource Management Journal, 29 (3) (2019), pp. 328-352. (in English).

94. Sadovskaya, E. Y. Trudovye migratsii v Respublike Kazakstan kak osnova transbordernykh migratsii [Labor migrations in the Republic of Kazakhstan as the basis of cross-border migrations]. Rossiya – Kazakhstan: frontiersky migrations: Sb. nauch. trudov [Russia – Kazakhstan: Frontier migrations: Collection of scientific works], Moscow: Uralsk, 2002, pp. 201-234. (Садовская, Е. Ю. Трудовые миграции в Республике Казахстан как основа трансграничных миграций // Россия – Казахстан: фронтьерские миграции: Сб. науч. трудов/ под общ. ред. Ж. А. Зайончковской и М. Н. Сдыкова. – М.: Уральск, 2002. – С. 201–234.) (in Russian).

95. Tereshchenko T. A. Geography of the population of the West Kazakhstan region: a textbook. Uralsk: RIC WKSU named after M. Utemisov, 2016. 158 p. (Терещенко Т.А. География населения Западно-Казахстанской области: учебное пособие. – Уральск: РИЦ ЗКГУ им.М.Утемисова, 2016. – 158 с.) (in Russian).

96. Kovalev V. A., Kapustina L. S. "Assessment of labor potential for sustainable development of territories" Saint Petersburg, 2020 (Ковалёв В.А., Капустина Л.С. "Оценка трудового потенциала для устойчивого развития территорий" Санкт-Петербург, 2020) (in Russian).

97. Dyshlyuk S. S., Sukhorukova S. A. Using GIS technologies in the process of territorial planning // Interexpo Geo-Siberia. 2010. №2. (Дышлюк С. С., Сухорукова С. А. Использование

ГИС-технологий в процессе территориального планирования // Интерэкспо Гео-Сибирь. 2010. №2.) (in Russian).

98. Labor market development concept of the Republic of Kazakhstan for 2024-2029. Approved by Resolution of the Government of the Republic of Kazakhstan No. 1050 dated November 29, 2023 (Концепция развития рынка труда Республики Казахстан на 2024-2029 годы. Утверждена постановлением Правительства Республики Казахстан от 29 ноября 2023 года № 1050) (in Russian).

99.https://adilet.zan.kz/rus/docs/P2200001116/(in Russian).

100.https://legalacts.egov.kz/npa/view?id=14291348/ (in Russian).

101.https://www.gov.kz/memleket/entities/sko/activities/380?lang=kk./ (in Russian).

102. Source: statistical data of the Department of Statistics for the North Kazakhstan region http://stat.gov.kz (Источник: статистические данные Департамента статистики по Северо-Казахстанской области http://stat.gov.kz) (in Russian).

103. https://sentiwiki.copernicus.eu/web/s2-mission./ (in English).

104. https://innoter.com/sputniki/landsat-8/. /(in English).

105. https://earthexplorer.usgs.gov/. (in English).

106. https://www.scanex.ru/data/satellites/terra-aqua-modis/.(in English).

107. Arystanov, A., Karabkina, N., Sagin, J., Nurguzhin, M., King, R., & Bekseitova, R. (2024). Use of Indices Applied to Remote Sensing for Establishing Winter–Spring Cropping Areas in the Republic of Kazakhstan. Sustainability, 16(17), 7548. https://doi.org/10.3390/su16177548. (in English).

108. https://v2.tailwindcss.com/docs /(in English).

109. https://tailwindcss.ru/docs/installation/framework-guides/ (in English).

110. https://developers.google.com/fonts/docs/getting_started?hl=ru (in English).

111. https://toimi.pro/ru/blog/podborka-poleznykh-resursov-dlya-veb-dizaynerov/(in Russian).

APPENDIX A

The average air temperature (ºC) according to the meteorological stations of the North Kazakhstan region

MS Blagoveshchenka	1	2	3	4	5	6	7	8	9	10	11	12	Average fortheyear
2003	-15,1	-16,9	-10,4	1,2	15	16,9	18,7	22,1	12,7	3,2	-9,1	-8,2	2,5
2004	-16	-12,7	-8,1	2,1	16,2	19,1	21,5	17,7	12,5	4,6	-3,1	-15,5	3,2
2005	-16,5	-21,4	-6,4	3,7	14,6	19,6	19,3	16,8	11,4	5,1	-3,1	-10,9	2,7
2006	-24,5	-15,3	-3,2	3,4	13	20,8	18,4	15,9	12,6	3,6	-6,6	-7,2	2,6
2007	-8,2	-15,1	-9,2	4,9	13,7	16,8	20,5	18,8	13	5,3	-6,3	-14,5	3,3
2008	-21,9	-13,6	-2,3	4,9	12,6	17,9	22,3	18,5	8,6	5,5	0,1	-11	3,5
2009	-16,2	-17,6	-5,8	3,9	12,2	18,4	18,6	17,1	12	4,7	-4,7	-17,2	2,1
2010	-24,1	-22,2	-9	5,2	14,1	20,3	19,9	21,1	12,5	3,4	-1,4	-15,3	2,0
2011	-20,7	-17,6	-9,4	5,5	12,7	17,4	18,8	15	14,1	5,4	-10,3	-16,5	1,2
2012	-20,4	-20,9	-7,6	9,7	13,8	20,1	22,4	18,5	11,6	5,6	-5	-21,3	2,2
2013	-17,5	-13,3	-7,9	5	11,4	18,2	19	17,4	10,9	3	1	-10	3,1
2014	-16,6	-19,1	-3,9	3,4	14,5	19	15,2	18,9	9,1	0,3	-7,2	-11,5	1,8
2015	-15,4	-13,2	-8	3,6	14,3	20,5	18	15,1	11	2,1	-8,3	-8	2,6
2016	-20,1	-8,5	-5	8	12,9	17,3	19,4	20,4	12,3	0,5	-10,6	-16,3	2,5
2017	-15	-16	-6,9	4,4	12,8	18,1	18,5	18,8	10,7	1,4	-2,2	-12,1	2,7
2018	-19,9	-15,5	-10,3	2,8	9,6	15,6	20,3	16,3	11,9	4,7	-5,6	-16,4	1,1
2019	-15,5	-16,1	-4,6	3,8	13,6	16	20,6	17,2	10,1	5,9	-7,7	-10,7	2,7
2020	-9,8	-7,4	-2,5	8	16,5	16,4	21,8	19,3	11	4,8	-6,6	-14,1	4,8
2021	-19,6	-17,2	-9,1	4,2	18,5	18,2	20	20	9,6	4	-6,9	-11,3	2,5
2022	-14,8	-11,5	-9,6	7,9	13,4	17,5	20,4	18,4	12,6	3,8	-8,2	-15	2,9
2023	-14,1	-13,5	-3,3	5,8	14,7	18,4	23	18,1	12,7	5,5	-1,3	-13,1	4,4

MS Blagoveshchenka	1	2	3	4	5	6	7	8	9	10	11	12	Averagefortheyear
2003	-15,1	-17	-11,2	0,7	15	17,4	17,9	20	12,2	3,3	-10,5	-9,2	2,0
2004	-17,6	-12,5	-10	1,8	16,1	18,9	20,6	16,8	11,1	4,8	-2,9	-16,6	2,5
2005	-16,6	-21,6	-6,7	3,5	13,5	19,6	19,3	16,4	11,3	4,8	-2,7	-13,4	2,3
2006	-25,9	-17,2	-5,2	2,1	12	20,4	18,1	15,4	11,6	2,9	-7,7	-6,8	1,6
2007	-8,9	-15,1	-9,8	5	13,1	16,2	20,3	17,5	12	5	-6,7	-13,4	2,9
2008	-21,4	-13,6	-2,8	4,7	12,6	17,7	21,6	17,9	8,1	4,7	0	-11,7	3,2
2009	-17,1	-18,9	-6,9	3,7	11,9	17,6	18,6	16,4	10,9	3,7	-5,5	-16,6	1,5
2010	-26	-22,2	-9,6	4,8	12,8	19,4	18,8	19,8	11,5	3,2	-2	-17,2	1,1
2011	-22,8	-17,1	-9,6	5,9	11,9	18,1	18,1	15	13,4	5,3	-9,1	-16,1	1,1
2012	-21	-21	-8,1	8,9	13	20	22,7	18,1	11,9	4,2	-6,8	-23,8	1,5
2013	-17,7	-13,6	-8,3	5,1	10,4	17,1	18,4	16,8	10,8	2,5	0,2	-9,4	2,7
2014	-16,5	-19,6	-4,5	3,7	12,8	18,3	15,3	19	8,5	0,2	-7,9	-11,7	1,5
2015	-14,9	-13,9	-8,2	3,8	14,1	19,9	17,9	15,1	9,9	1,5	-9,7	-7,9	2,3
2016	-21,9	-9,3	-5,1	8,3	13,1	17,6	19,2	19,8	12,8	-0,1	-11,9	-15,8	2,2
2017	-15,4	-16,2	-8,2	4,8	12,9	19,2	18,3	18,4	9,9	1,2	-3,7	-13,5	2,3
2018	-22	-16,9	-10,4	2,6	8,4	16,1	20,2	15,9	11,2	4,1	-6,1	-17,5	0,5
2019	-16	-18,1	-5,1	4,1	12,3	15,6	20,6	17,8	10,8	6,1	-8,2	-10	2,5
2020	-9,7	-7,7	-2,2	9,1	17,3	16,6	21,7	20,3	11,5	4,9	-5,6	-14,7	5,1
2021	-20,5	-17,7	-9,3	3,6	18,1	17,7	20,7	20,1	9,8	3,9	-7,1	-10,8	2,4
2022	-14,5	-12,6	-9,5	7,4	14,9	18,6	21,2	18,1	12,6	4	-8,9	-16,5	2,9
2023	-13,4	-15,4	-4,5	4,6	13,7	18,9	23,1	17,8	12,7	5	-1,8	-14,2	3,9

MS Kiskenekol	1	2	3	4	5	6	7	8	9	10	11	12	Averagefortheyear
2003	-15,5	-16	-10,6	2	15,6	18,3	18,7	20,7	13,3	3,7	-9,8	-10,5	2,5
2004	-18,7	-12,9	-9,6	2,9	16,6	19,6	21	17,3	11,9	5,2	-2,8	-16,1	2,9
2005	-16,5	-21,5	-6,5	4,5	13,8	19,9	20,2	17,4	11,6	5,1	-3	-10,3	2,9
2006	-25,7	-16,8	-4,6	2,8	12,3	21,4	19,4	16,2	12,4	3,4	-6,8	-6,8	2,3
2007	-8,9	-14	-10,1	6,7	14	17,1	20,7	18	12,9	4,7	-6,4	-12,9	3,5
2008	-22,5	-14	-2,3	5,2	14	19	23,2	19,5	9,1	4,8	-0,3	-12,9	3,6
2009	-17,1	-19,3	-7,6	5	13	17,9	18,7	16,7	11,2	4,3	-5,9	-16,1	1,7
2010	-25,7	-22,7	-9,4	4,6	12,4	19,8	19,1	20,3	12,3	4	-1,6	-16,9	1,4
2011	-23	-17,2	-9,8	7,9	12,8	19,5	19,4	16,5	14,3	5,6	-8,7	-16,7	1,7
2012	-21,3	-21,7	-7,7	9,6	13,5	21,1	24	19,6	12,9	4,6	-7,7	-23,8	1,9
2013	-17	-13,9	-7,5	6	11	17,8	19,2	17,5	11,3	2,9	0	-9,7	3,1
2014	-16,5	-20,2	-5	4,4	13,6	19,8	16,8	20,5	9,4	1,2	-8,5	-14,2	1,8
2015	-14,5	-13,8	-8,4	4,2	14,6	20,7	18,9	16,3	10,7	2,7	-8,2	-7,2	3,0
2016	-21,7	-8,9	-3,3	8,7	13,4	18,2	19,7	20	14	-0,1	-11,5	-14,2	2,9
2017	-14,3	-15	-8,2	6,1	13,7	20,7	19,6	19,8	11,3	1,9	-4	-13,8	3,2
2018	-21,4	-16,9	-9,8	3,5	8,8	17,4	20,7	16,8	11,4	4,3	-5,6	-17,8	1,0
2019	-15,9	-17,4	-4,8	4,5	12,3	15,7	21,4	18,9	11,1	6,6	-8,8	-9,6	2,8
2020	-9,6	-8	-2,6	9,6	17,6	17,8	22,1	20	11,7	4,7	-5,7	-14,8	5,2
2021	-20,5	-16,7	-9,4	3,9	17,7	18	21,2	20,3	10	3,9	-6,9	-10,3	2,6
2022	-14,7	-13,7	-10	7,9	15,5	19,1	21,1	18	13,4	4,1	-8,3	-16,8	3,0
2023	-12,9	-15,6	-3,6	4,7	14,2	19,8	23,7	18,6	13	5,4	-1,1	-13,4	4,4

MS Petropavlovsk	1	2	3	4	5	6	7	8	9	10	11	12	Averagefortheyear
2003	-14,4	-16,6	-9,8	1,3	15,3	18,1	21,2	12,5	3,9	-10	-8,6	2,5	1,3
2004	-16,8	-11,9	-8,3	2	16,1	19	20,6	17	11,6	4,4	-3	-16,3	2,9
2005	-16,7	-21,1	-6,1	4,2	14,1	19	19	16,9	11,5	5,2	-3	-16,3	2,2
2006	-25,1	-14,8	-3	3,1	12,2	20,2	17,8	15,3	12,2	3,4	-6,4	-6,9	2,3
2007	-8,7	-15,3	-8,3	5,5	13,8	16,3	20,4	17,9	12,7	5,5	-6,3	-14	3,3
2008	-20,1	-13,1	-2,4	5,7	12,8	17,1	21,5	17,9	8,3	6,2	0,1	-10,7	3,6
2009	-16,2	-17,3	-5	4	11,9	17,2	21,5	17,9	8,3	6,2	0,1	-10,7	3,2
2010	-23,5	-20,8	-8,1	6,1	13,3	19,6	19,2	20,8	12,3	5,1	-2	-16,3	2,1
2011	-21,1	-16,9	-8,9	5,9	12,2	18,2	18,5	15,2	14	6,2	-9,4	-16,2	1,5
2012	-20,8	-20,4	-7	9,6	13,7	20,2	21,7	18,2	12,2	5,3	-5,4	-22,3	2,1
2013	-16,9	-12,8	-7,8	5,4	10,8	17,7	19,2	17,6	11,4	2,8	1,1	-9	3,3
2014	-16,3	-19	-3,4	4	13,8	19	15,6	19,5	9	0,3	-7,4	-11	2,0
2015	-14,8	-12,4	-7,2	4,3	14,5	20,5	18,4	15,3	10,8	2	-9	-7,9	2,9
2016	-20,8	-8,4	-4,6	8,9	13,4	17,6	19,8	20,6	13,1	0,6	-11,1	-15,9	2,8
2017	-15	-15,3	-7	5,4	13,3	19,2	18,7	18,9	10,2	1,6	-1,9	-11,9	3,0
2018	-20,6	-15,7	-9,1	3,2	9,4	16,1	21	16,3	11,9	4,9	-5,6	-16,5	1,3
2019	-14,2	-16	-3,5	4	13,6	16,1	20,8	17,5	10,8	6,5	-7,6	-9,9	3,2
2020	-9,4	-6,5	-1,4	9,4	17,5	16,7	21,7	19,8	11,4	5,3	-5,4	-14,4	5,4
2021	-20,4	-17,6	-8,2	4,6	18,7	18	20,5	19,9	9,8	4,3	-6,5	-10,7	2,7
2022	-14,5	-11,5	-9,2	8,1	14,5	18,1	20,6	18,1	12,5	4,7	-8	-15,1	3,2
2023	-13,3	-13,4	-2,5	5,6	14,6	18,7	23,2	18	12,9	6,2	-1,2	-13,7	4,6

FromRuzaevka	1	2	3	4	5	6	7	8	9	10	11	12	Averagefortheyear
2003	-15	-15,8	-11,1	0,9	15,1	17	18	21,7	13,9	3	-8,3	-9,1	2,5
2004	-16	-12	-8,5	3,3	16,1	19,4	21,4	18,7	13,4	5,1	-2,8	-13,6	3,7
2005	-15,6	-21,2	-5,6	3,3	15,3	19,5	19,8	16,8	11,8	5,3	-2,7	-10,4	3,0
2006	-22,6	-12,3	-3	5,7	13,1	20,4	18,4	16,3	12,3	3,3	-5,2	-7,8	3,2
2007	-8,5	-13,5	-10,5	4,3	14,2	17,1	20	18,1	12,7	5	-5,9	-15,1	3,2
2008	-21,9	-13,8	-1,9	5,6	14	18,2	22,2	19,3	9,3	4,7	-0,4	-11,8	3,6
2009	-14,9	-16,7	-6,2	4,1	12,8	18,4	18	17,5	12,2	4,2	-4,7	-14,9	2,5
2010	-19,5	-20,2	-8,3	4,9	14,6	21,2	19,6	21,3	12,6	3,9	-0,5	-13,2	3,0
2011	-19,2	-16,9	-8,8	6,4	13,1	17,5	19,4	15,7	14,6	4,8	-9,7	-17,3	1,6
2012	-19,4	-21	-6,9	10,3	14,8	20,8	22,9	19,8	11,9	5,8	-5	-20,4	2,8
2013	-16,2	-13,3	-6,4	6,6	12,1	18,5	18,8	17,6	12,1	3,4	0,3	-9,9	3,6
2014	-17,1	-21,1	-4,9	3,5	15,7	20,1	15,9	20,2	9,4	1,7	-7,6	-11,9	2,0
2015	-14,6	-13,7	-8,2	3,3	15	20,7	18,9	16,1	11,4	2,3	-6,8	-7,1	3,1
2016	-16,8	-8,6	-2,6	8,3	13,7	17,2	19,2	20,4	13,1	0,8	-10,3	-14	3,4
2017	-13,6	-15,3	-7,8	4,3	13,4	19	18,4	19	11,5	2,6	-1,4	-11,9	3,2
2018	-20,2	-16	-9,9	3,2	10,2	16,3	20,7	17	11,5	4,8	-5,7	-15,9	1,3
2019	-14,4	-15,6	-4,1	4,6	13,5	16,4	21,4	17,8	10	6	-9,2	-9,8	3,1
2020	-9,3	-7,5	-3,7	8,1	16,9	17	21,2	19	10,6	3,9	-6,6	-14,9	4,6
2021	-17,5	-15,1	-9,2	4,6	18,1	18,7	20,8	20,8	10,1	3,8	-7,5	-11	3,1
2022	-13,2	-10,5	-9,6	8,7	14,1	18,2	20,9	18,1	13,7	3,4	-7,7	-15,5	3,4
2023	-16,1	-13	-3,7	5,5	14,9	18,7	22,8	18,5	12,1	5,4	0	-12,6	4,4

WithSaumalcolь	1	2	3	4	5	6	7	8	9	10	11	12	Averagefortheyear
2003	-14,1	-15,5	-9,6	1,2	14,4	16,4	17,3	21,1	12,9	3,5	-8,7	-9	2,5
2004	-14,8	-11	-7,8	2,6	15,9	18,7	20,4	17,6	12,8	4,6	-3,5	-13,7	3,5
2005	-14,8	-19,6	-5,4	3,4	13,9	18,7	18,8	16,2	11,1	5,3	-3,1	-10,2	2,9
2006	-22,8	-12	-3,3	4,1	12,4	19,5	17,6	14,9	11,5	2,8	-6,1	-7,9	2,6
2007	-8,2	-13,8	-8,8	4,6	13,2	16	19,2	17,2	12,2	5,1	-5,8	-14,5	3,0
2008	-20,3	-13,3	-2	5,4	13,1	17,1	21,4	18,2	8,1	4,6	-0,6	-11,7	3,3
2009	-14,8	-15,8	-4,8	3,5	12,4	17,6	17,3	16,4	11,5	4,5	-5,1	-16	2,2
2010	-21,7	-21,2	-8,1	4,9	13,5	20,1	18,6	20,2	12,5	4	-1,3	-14,7	2,2
2011	-18,4	-15,9	-7,9	6,1	12,4	16,9	17,9	14,3	14	4,9	-9,9	-15,8	1,6
2012	-17,5	-19,3	-6,4	10,1	13,8	19,3	21,5	18,3	11,8	5,3	-5,3	-20,3	2,6
2013	-15,3	-11,6	-6,5	5,9	11	17,2	18,1	16,6	11	2,6	0,4	-9,7	3,3
2014	-16,8	-18,5	-4	3,1	14,1	18,6	14,5	18,9	8,5	0,6	-7,9	-11,6	1,6
2015	-13,8	-11,4	-7	3,6	13,9	19,7	17,5	15	10,5	1,6	-8,5	-7,5	2,8
2016	-17,1	-7,8	-3,4	7,8	12,3	16,3	18,2	19,3	12,2	-0,5	-11,1	-14,1	2,7
2017	-12,8	-14,6	-6,7	4,4	12,9	17,9	17,7	18,2	10,6	1,9	-2,2	-10,3	3,1
2018	-19	-15	-9,7	2,8	9,1	15,5	19,5	15,8	11,1	4,2	-6,4	-14,8	1,1
2019	-13,9	-15,2	-3,7	4	12,6	15,1	20,2	16,6	9,3	5,7	-8,7	-9,4	2,7
2020	-9,5	-7,5	-3,4	8	16,4	16,2	20,3	18,2	10,3	4,1	-6,1	-14,3	4,4
2021	-17	-14,7	-8,5	4,5	18	17,5	20	19,6	9,4	3,7	-7,2	-10,1	2,9
2022	-12,7	-9,9	-9,4	8,6	13,8	17,5	20	17,8	13,2	3,4	-8,5	-14,6	3,3
2023	-13,9	-12,4	-3,6	5,4	14,2	17,9	22,4	18	12,1	5,1	-0,7	-12,7	4,3

MS Sergeevka	1	2	3	4	5	6	7	8	9	10	11	12	Averagefortheyear
2003	-14,6	-16,5	-10,6	1,1	15	17,3	18,4	22,3	13,4	3,5	-9,2	-8,4	2,6
2004	-16,3	-12,3	-7,8	2,7	16,6	19,5	21,5	18,1	13,2	5	-3	-14,5	3,6
2005	-16	-21,5	-5,9	3,7	14,7	19,9	19,6	17,2	11,6	5,4	-3	-10,4	2,9
2006	-23,6	-14,9	-2,9	4,2	13,2	20,7	18,4	15,9	12,6	3,5	-6,3	-7,2	2,8
2007	-7,8	-14,1	-9,8	4,8	14,1	17,1	20,5	18,8	13,1	5,5	-6,5	-14,6	3,4
2008	-21,4	-13,7	-1,7	5,3	13,4	18,2	22	18,5	8,7	5,2	0,1	-11,3	3,6
2009	-15,7	-17,7	-5,5	4	12,8	18,6	18,6	17,3	12,2	4,7	-4,8	-16,6	2,3
2010	-23,7	-21,7	-8,6	5,4	14,7	21,1	19,9	21,4	13	3,8	-0,9	-15,3	2,4
2011	-21,5	-17	-8,8	6,1	13	17,7	19	15,3	14,7	5,8	-9,9	-17	1,5
2012	-20,5	-21,3	-7	10,1	14,4	20,1	22,5	18,7	12,1	5,9	-4,6	-21	2,5
2013	-16,7	-12,9	-6,9	5,9	11,9	18,5	19,3	17,8	11,6	3,3	1,1	-9,6	3,6
2014	-16,5	-19,1	-3,7	3,9	15	19,6	15,5	19,4	9,3	0,9	-7,2	-11,4	2,1
2015	-14,9	-13,2	-8	3,3	14,7	20,9	18,5	15,9	11,5	2,3	-8,2	-7,2	3,0
2016	-19,6	-8,2	-4,3	8,4	13,2	17,4	19,4	20,7	12,8	0,5	-10,6	-15,5	2,9
2017	-14,1	-14,9	-7,6	4,7	13,3	18,7	18,4	19,1	11,3	2,2	-1,7	-11,4	3,2
2018	-20,1	-15,8	-10	3,7	9,9	16,1	20,6	16,8	12,1	5,1	-5,3	-16,2	1,4
2019	-14,6	-15,4	-3,7	4,3	13,9	16,4	21,3	17,6	10,3	6,1	-7,7	-10,1	3,2
2020	-9,4	-6,8	-2,8	8,6	17,3	16,8	21,5	19,5	11,2	4,6	-6,2	-14,5	5,0
2021	-19,1	-16,2	-9,3	4,6	18,8	18,5	20,2	20,1	9,9	4,1	-7,2	-10,9	2,8
2022	-14,3	-10,9	-9,8	8,8	14,2	17,8	20,2	18,1	13	3,7	-8,1	-15,4	3,1
2023	-14,7	-13,5	-3,8	5,9	14,8	18,9	23,3	18,6	12,8	5,8	-0,7	-12,8	4,6

MS Melting	1	2	3	4	5	6	7	8	9	10	11	12	Averagefortheyear
2003	-12,9	-15,6	-9,1	2,5	15,4	17,8	18,5	21,7	13,3	4	-9,2	-7,9	3,2
2004	-16,4	-10,9	-7,3	3	16,7	19,8	21,3	17,8	12,8	5,4	-2,6	-14,9	3,7
2005	-15,7	-19,5	-5,4	5,1	14,3	19,8	19,9	17,2	11,6	5,5	-2,3	-11,9	3,2
2006	-23,7	-15,5	-3,2	3,3	12,5	20,5	18,2	15,6	12,2	3,8	-6,6	-6,1	2,6
2007	-6,9	-13,3	-8,2	6,4	14	16,9	20,3	18,1	13	5,7	-5,4	-12,2	4,0
2008	-20,5	-12,2	-0,9	6,3	14	18,9	22,8	19,7	9,2	6,3	1,4	-10,5	4,5
2009	-14,4	-16,2	-4,1	5,1	13,2	18,7	19,3	17,2	12,3	5,1	-4,6	-15,3	3,0
2010	-25,1	-21,9	-8	5,5	13,7	20,4	19,4	20,8	12,6	4,3	-1	-15,1	2,1
2011	-21,1	-15,6	-8	7,6	12,4	18,2	18,9	15,8	14,5	6	-8	-15	2,1
2012	-18,9	-20,8	-6,1	10,3	14,2	20,6	22,9	18,9	12,8	5,2	-5,8	-22,2	2,6
2013	-15,3	-11,9	-6,7	6,6	11,4	18,1	18,8	17,4	11,4	3,2	1,3	-8,8	3,8
2014	-16	-19,1	-3	4,2	14,1	19,8	15,6	19,4	9,1	0,8	-7,4	-10,7	2,2
2015	-13,3	-11,6	-7,5	4,5	14,4	20,6	18,8	16,3	11	2,2	-9,3	-6,8	3,3
2016	-20,9	-8,5	-4	9	13,4	17,8	19,3	20,5	13,4	0,4	-10,6	-14	3,0
2017	-13,2	-13,9	-6,6	6	13,7	19,6	19	19,5	10,9	1,7	-2,4	-11,9	3,5
2018	-20,5	-16,1	-9	3,8	9,6	16,8	20,4	16,3	11,9	4,7	-5,4	-16,4	1,3
2019	-14,3	-15,7	-2,9	4,3	12,9	15,9	20,9	17,8	10,7	6,4	-7,7	-9	3,3
2020	-8,6	-6,4	-1,3	9,4	17,3	16,9	21,6	19,8	11,4	5,4	-5,5	-14,2	5,5
2021	-19,5	-15,7	-7,6	5	18,7	18,2	20,9	20	9,9	4,3	-6,3	-9,5	3,2
2022	-13,2	-11,4	-8,9	8,6	15,2	18,9	20,6	17,9	13,1	4	-8,5	-15	3,4
2023	-12	-13,5	-2,2	5,7	14,5	19,5	23,6	18,4	13,2	5,9	-0,8	-12,8	5,0

MS Timiryazevo	1	2	3	4	5	6	7	8	9	10	11	12	Averagefortheyear
2003	-14,6	-16,3	-10,5	1,4	14,9	17,1	18,6	22,5	13,4	3,5	-8,9	-8,2	2,7
2004	-15,3	-12,3	-7,5	2,7	16,4	19,5	22	18,8	13,9	4,8	-3,1	-14,1	3,8
2005	-16,1	-21,2	-6	3,8	14,9	19,9	19,4	17	11,6	5,5	-3,3	-10,2	2,9
2006	-22,9	-14,8	-3,1	4,5	13,5	20,9	18,6	16,3	13	3,6	-6	-7,1	3,0
2007	-7,7	-14	-9,9	4,8	14,3	17,3	20,4	19,2	13,2	5,7	-6,5	-14,6	3,5
2008	-21,4	-13,8	-2,1	5,4	13,3	18,1	22,7	19	9,1	5,7	0,1	-10,9	3,8
2009	-15,3	-17	-5,7	4,1	13	19,1	18,8	17,3	12,4	4,8	-4,6	-16,2	2,6
2010	-22,6	-21,4	-8,7	5,4	14,8	21,4	20,4	21,7	13,1	3,6	-0,6	-14,8	2,7
2011	-21	-17,5	-9,1	6,2	13,2	17,9	19,4	15,4	14,7	5,5	-10,3	-17,2	1,4
2012	-20,4	-21,6	-7,6	10,1	14,6	20,3	22,5	19,1	12,2	5,8	-4,7	-20,7	2,5
2013	-16,9	-13	-7,6	5,7	12	18,8	19,3	17,8	11,5	3,1	1,1	-9,8	3,5
2014	-16,4	-19,1	-4,2	3,7	15,3	19,6	15,5	19,8	9,4	1	-7,1	-11,6	2,2
2015	-15,5	-13,6	-8,5	3,3	14,7	20,9	18,7	15,8	11,4	2	-7,9	-7,6	2,8
2016	-19,2	-8,9	-5,3	8,2	13,5	17,5	19,2	21	12,2	0,6	-10	-15,6	2,8
2017	-14,3	-15,5	-7,6	4,3	13,1	18,7	19	19,5	11,2	1,6	-2	-11,7	3,0
2018	-20,2	-16,2	-10,6	3	9,9	15,8	20,6	16,9	12,2	4,9	-5,1	-16,2	1,3
2019	-15,1	-15,8	-4,4	4,1	13,9	16,6	21,3	17,7	10,5	6,2	-7,7	-10,6	3,1
2020	-9,7	-7,4	-3	8	16,9	16,8	21,9	19,4	11,2	4,5	-6,7	-14,6	4,8
2021	-19,2	-16,4	-9,3	4,5	19	18,7	20,7	21,1	10,2	4,1	-7,1	-11,1	2,9
2022	-14,6	-11,2	-9,9	8,2	13,7	18	20,7	18,9	13,5	3,6	-8,2	-14,9	3,2
2023	-14,1	-13,8	-3,9	5,7	15	19	23,6	18,6	12,8	5,6	-0,9	-12,7	4,6

MS Chkalova	1	2	3	4	5	6	7	8	9	10	11	12	Averagefortheyear
2003	-12,4	-15,2	-8,4	3,3	15,5	17,9	18,7	21,3	13,5	4	-8,9	-8	3,4
2004	-16,1	-10,1	-6,8	3,4	16,8	20	20,9	17,7	13	5,7	-2,4	-14,3	4,0
2005	-15,3	-18,9	-5	5,6	14,1	20	19,9	17	11,5	5,6	-2,4	-12,1	3,3
2006	-23,4	-15,7	-3,2	3,4	12,6	20,4	18,5	15,6	12,4	3,9	-6,4	-5,9	2,7
2007	-6,7	-12,6	-8,3	6,9	14	17	20,4	18,2	13,1	5,7	-5,2	-11,9	4,2
2008	-20,6	-12,2	-1,2	6	13,7	18,5	22,6	19,3	8,7	5,6	1	-11,3	4,2
2009	-14,7	-16,6	-4,9	4,8	12,9	18,2	18,6	16,7	11,6	5,2	-4,4	-14,6	2,7
2010	-24,9	-21,5	-7,9	5,4	13,4	20,6	19,5	21	12,9	4,5	-0,8	-14,8	2,3
2011	-21	-15,1	-7,6	8,5	12,6	18,5	19,3	16,1	14,8	6,1	-7,7	-14,7	2,5
2012	-19	-20,8	-5,8	10,7	14,3	20,7	23	19,2	12,7	5,3	-5,7	-22	2,7
2013	-14,5	-11,5	-6,1	7,2	11,6	18,4	18,9	17,6	11,5	3,5	1,5	-8,1	4,2
2014	-15,1	-18,5	-2,4	4,5	14,3	20,2	16	19,9	9,6	1,2	-7,1	-9,9	2,7
2015	-12,4	-10,4	-6,6	5,4	14,6	20,7	19,3	16,6	11,2	2,6	-9,1	-6,4	3,8
2016	-20,4	-7,9	-2,9	9,1	13,4	17,7	19,4	20,2	13,4	0,3	-10,3	-13,1	3,2
2017	-12,5	-13	-5,7	6,7	14,1	20,2	19,3	19,8	11,2	2	-2,5	-11,8	4,0
2018	-19,8	-15,9	-8,8	4,1	9,5	17,1	20,1	16,3	11,8	4,9	-5,3	-16,3	1,5
2019	-13,9	-15,6	-2,7	4,3	12,8	15,7	21,1	18,3	11	6,7	-7,6	-8,5	3,5
2020	-8,2	-6,3	-1,1	9,7	17,4	17,4	21,9	20	11,8	5,6	-5,3	-13,8	5,8
2021	-19,2	-15,3	-7,3	5,3	18,9	18,4	21,5	20,4	10,4	4,5	-5,8	-8,8	3,6
2022	-12,5	-10,6	-8,6	9	15,9	19,2	21,3	17,9	14	4,5	-8,2	-15,1	3,9
2023	-11,3	-13,8	-1,7	6	14,6	19,8	24,1	18,5	13,1	6,3	-0,4	-12,3	5,2

MS Yavlenka	1	2	3	4	5	6	7	8	9	10	11	12	Averagefortheyear
2003	-13,9	-16,4	-9,8	1,5	15,3	17,7	18,5	22,1	12,9	3,4	-9,2	-7,7	2,9
2004	-16,2	-11,9	-8	2,6	16,9	19,7	21,2	17,6	12,4	5	-2,7	-15,4	3,4
2005	-16,4	-21,3	-5,8	4,4	14,9	19,9	19,7	17,1	11,7	5,2	-2,9	-11,1	3,0
2006	-24,2	-15,5	-3,3	3,2	12,8	20,3	18,2	15,3	12,4	3,7	-7,1	-6,5	2,4
2007	-7,6	-14,6	-9,4	5,3	13,6	16,7	20,5	18,3	12,9	5,4	-6,5	-13,9	3,4
2008	-21,1	-13,1	-1,3	5,4	12,8	17,8	21,6	18,4	8,6	5,4	0,4	-11	3,7
2009	-15,6	-17,3	-5,2	4,1	12,4	18	18,5	17,1	12	5	-4,7	-16,6	2,3
2010	-24,2	-21,6	-8,4	5,7	14,3	20,3	19,4	20,9	12,5	3,8	-1,1	-15,8	2,2
2011	-21,3	-16,8	-8,7	6,4	12,5	17,7	18,5	15	14	5,8	-9,3	-16,3	1,5
2012	-20,8	-21,1	-6,9	10,1	13,9	20	21,6	18,1	12	5,6	-5,1	-21,7	2,1
2013	-16,3	-12,7	-7,3	5,9	11,1	17,6	18,9	17,5	11,4	3,3	1,2	-8,8	3,5
2014	-16,1	-18,8	-3	4,1	14,4	19,1	15,5	19	9	0,6	-7,3	-10,9	2,1
2015	-14,3	-12,7	-7,5	4	14,6	20,6	18,3	15,4	11	2,3	-8,5	-7,3	3,0
2016	-20,5	-8,3	-4,6	8,6	13	17,4	19,4	20,3	12,7	0,5	-10,8	-15,4	2,7
2017	-14,4	-14,9	-7,2	5,1	13,3	18,8	18,5	18,5	10,6	2	-1,9	-11,8	3,1
2018	-20,2	-15,8	-9,6	3,3	9,5	15,8	20,2	16,3	11,8	4,8	-5,5	-16	1,2
2019	-14,6	-15,5	-3,5	4	13,5	15,9	20,7	17,3	10,3	6,3	-7,6	-9,9	3,1
2020	-9,2	-6,6	-1,6	8,9	17,2	16,2	21	19,4	11,1	5	-6	-14,1	5,1
2021	-19,7	-16,9	-8,4	4,5	18,2	17,7	20	19,2	9,7	4,1	-6,6	-10,7	2,6
2022	-14,1	-11,2	-9	8,4	14,1	17,9	20,1	17,5	12,4	4	-8,4	-15,3	3,0
2023	-13,5	-13,3	-2,9	5,9	14,4	18,4	22,6	17,9	12,6	5,8	-1	-13,2	4,5

APPENDIX B

The amount of precipitation (mm) according to the meteorological stations of the North Kazakhstan region

MS Blagoveshchenka	1	2	3	4	5	6	7	8	9	10	11	12	The amount for the year
2003	16,1	8,7	8,8	18	40,2	87,8	25,6	1,7	22,9	33,7	15,9	15,8	295,2
2004	3,7	11,5	28,1	33,9	11,1	87,5	32,7	30,9	33	32,6	32,9	30,9	368,8
2005	14,4	4,3	22,9	8,2	28,6	45,9	94,8	89,2	27,2	18,3	1,6	7,5	362,9
2006	16,4	6	9,4	66,3	13,6	17,9	31	41,3	21,1	40,9	40,1	27,9	331,9
2007	24,9	34,1	10,4	41,4	41,9	29,9	92	4,9	26,3	6,8	20,9	7,3	340,8
2008	6,7	28,3	17,7	26,6	52,6	60,5	69,6	37,7	66,2	18,2	27,4	4,1	415,6
2009	25	12,6	19,6	27,5	34,9	27,8	24,9	60,1	40,3	32,8	8,6	25,8	339,9
2010	21,9	7	21,3	0,8	12,9	22,3	17,7	12	6,1	10,1	41,6	22,7	196,4
2011	0,6	16,7	21,9	30,4	39,8	100,3	64,1	52,5	66,4	29,4	34,5	5,9	462,5
2012	1,2	1,2	29,8	18,2	33,1	23	53,2	43,1	47,4	23	40,7	11,3	325,2
2013	25,8	12,3	39,2	43,4	19,1	7,5	114,5	134,1	59,6	18,2	27,7	23,8	525,2
2014	28,6	18	20,8	13,7	12,7	31,1	99	51,1	31,5	59,8	15,1	33,7	415,1
2015	22,4	6,7	10,6	21,2	42,5	22,1	94	41,6	39,8	39,5	23	33,1	396,5
2016	19,2	7,3	40,5	17,4	18,9	152,8	75,7	5,4	22,5	27,4	24,5	17,6	429,2
2017	10,6	8,5	13,5	27,8	18,5	47,9	33	25,2	9,4	46	5,8	5,3	251,5
2018	1,9	6,9	27,1	26,4	70,5	53,7	125,7	31,9	36	21,2	22,5	7,3	431,1
2019	9,1	9,9	12,2	20,1	26,1	47,7	36,7	55,1	47,8	34,9	8,7	17,1	325,4
2020	18,1	25,9	22,4	29	49,6	21,1	28,1	50,5	35,2	47,3	16,1	10	353,3
2021	18,5	25,9	12,8	11,3	15	19,8	67,8	45,2	16,9	8,9	9,3	20,9	272,3
2022	14,2	2,5	15,2	9,4	48,1	52,5	82,4	13,6	22,6	18,9	33	9,6	322
2023	10,4	26,9	18,6	1,8	48,9	48,2	21,1	50,9	52,5	47	47,4	33,7	407,4

MS Sublime	1	2	3	4	5	6	7	8	9	10	11	12	The amount for the year
2003	9,9	8	5,1	13	39,9	16,8	118,8	26,6	18	17,1	13,6	14,6	301,4
2004	4,8	14,6	22,7	33,9	8,7	43,3	36,7	17,1	43,2	18,2	25,9	38,4	307,5
2005	13,5	4	14,4	6,5	38,7	106,9	85,9	78,8	11,5	16,8	6,7	7,8	391,5
2006	14,9	7,9	13,3	39,5	28,1	69,1	29,5	48,1	45,5	39,4	39,8	21,3	396,4
2007	19,3	30,6	7,6	42,6	50,4	70	43,6	35,9	39,7	11,4	15,1	11	377,2
2008	7,9	7,5	15,9	13,3	38,4	36,6	101,9	23,6	64	18	20,4	1,7	349,2
2009	21	15,3	5	23,1	43,5	17,2	45,9	96,5	22,2	32	9,9	17	348,6
2010	10,9	10,4	15,8	22,3	15	31,7	14,7	10,8	1,7	3,3	44,6	24,1	205,3
2011	1,7	7,9	24,4	37	36,3	103,4	53,7	76,5	8,7	52,9	25,7	4,8	433
2012	2,9	0,8	17,7	9,3	32,2	43,4	73,8	28,5	12,7	13,2	46,1	7,1	287,7
2013	15,8	8,6	15,1	44,5	40,7	15,2	125,4	59,6	44,6	25,1	18,3	21,8	434,7
2014	26,2	11,3	5,9	19	15,4	29,3	123,6	11,8	28,5	60,2	9,6	18,9	359,7
2015	13,1	14,5	6,9	29,7	50,9	104,8	114,5	48,1	33,1	79,4	27,7	17,6	540,3
2016	5	6,7	24,5	15,8	6,5	79,8	76,2	7,5	31,8	33,7	22,9	28,9	339,3
2017	6,9	6,9	15,9	15,8	32,8	25,4	110,6	8,5	23,1	47,2	13,1	13,8	320
2018	9,7	7,6	21,7	23,7	43,1	78,8	18,6	164,6	13	38,9	23,7	8,1	451,5
2019	7,3	8,7	17,7	20,6	17,3	53,8	60,3	24,4	51,6	17,9	8,4	18	306
2020	15,5	24,2	9,6	28,1	14,2	22,7	15,3	10	30,4	21	11,2	7,5	209,7
2021	21,3	26,9	12,7	19,2	17,9	41,5	51,5	43,7	20,7	12,5	12	10,1	290
2022	10,2	7,6	4,5	7,3	11,6	19	19,7	42,5	26,5	18	41,2	8,2	216,3
2023	14,5	8,5	18,8	0,3	12,7	51,1	12,5	31,7	61,3	38,2	46,4	27,1	323,1

MS Kiskenekol	1	2	3	4	5	6	7	8	9	10	11	12	The amount for the year
2003	7,8	10,9	0,5	9,6	44	61,8	85,2	37,3	21,8	20,2	11,7	17,2	328
2004	13,7	13,8	26,4	33,9	22,4	30,2	73,2	18,5	15,7	15,7	11,2	33,6	308,3
2005	12,3	2,6	12,5	6,9	21,2	97	56,8	69,7	5,6	16,5	9,2	7	317,3
2006	6,5	4,6	7,4	78,6	28	38,8	21,5	38,1	4,5	25,9	52,9	15	321,8
2007	16,4	30,3	3,1	21,5	31,4	24,5	152,2	37,9	13,6	7,6	4,7	8,7	351,9
2008	8,3	6,5	27,3	2,7	33,7	22,7	23,6	12,5	60,7	12,7	14,4	5,3	230,4
2009	21,4	5,3	3,2	5,9	26,9	20,6	88,5	108,9	14,2	15	36,1	15,4	361,4
2010	17,6	6,4	17,8	13,2	12,7	23,7	10,5	31,1	10,3	8,3	21,7	28,6	201,9
2011	1,3	13,2	12,6	15,4	37,7	41,8	44	69,3	8,8	26,1	5,8	9,2	285,2
2012	7,4	5	16,4	15	47,5	37,5	28,5	31,5	14,2	12,9	46,3	18,7	280,9
2013	22	16,1	49,8	18,6	39,8	30,5	70,3	133,7	10,7	24,9	9,1	36,7	462,2
2014	20,2	12,8	6,8	14,3	7,8	8,7	46,3	24,3	13,8	49,9	17	20,3	242,2
2015	20,4	5,4	7,7	18,4	22	52,6	89,6	39,3	47,5	47	21,3	16,1	387,3
2016	1,6	12,6	23,1	15,7	9,7	52,1	117,8	8,7	19,6	29,2	19,4	33,7	343,2
2017	7,7	9,9	2,9	12,7	19,6	23,4	33,1	4,6	8,2	19,9	32,4	18,7	193,1
2018	5,7	8,1	13,1	23,6	49,6	15,1	41,6	105,6	21,2	27,2	26,8	10,6	348,2
2019	8,7	13,9	16,8	24,6	26,7	45,6	22,9	22	54,7	17,2	11,6	24,1	288,8
2020	28,3	37,7	0,9	38,2	9,7	59,8	18,4	58,8	20,5	20,6	6,8	6	305,7
2021	20,5	24,4	16,2	9,6	11,7	45,2	23,8	27,8	21,1	15,3	18,7	9,6	243,9
2022	13,8	17,3	6,2	16,3	12,9	39,1	38,8	48,8	27,5	28,8	29,1	12	290,6
2023	10,5	9,8	21,5	1,1	5	36,6	20,2	42,8	54	49,9	32,6	33	317

MS Petropavlovsk	1	2	3	4	5	6	7	8	9	10	11	12	The amount for the year
2003	18,9	14,4	8,2	14,5	34,1	40,1	51,6	25,2	21,4	34,9	9,8	15,6	288,7
2004	3,7	15,6	32,6	35	12	41,1	78,5	21,7	44,9	22,6	35,8	46,7	390,2
2005	18,6	5,8	23,9	10,3	25,4	64,3	54,7	62,3	19,2	24,5	3,6	8,8	321,4
2006	23,6	8	17,5	56,4	25,2	40,6	39,1	39,6	32,8	43,8	56	40	422,6
2007	29,6	47	11,5	44,5	41	48,8	81,6	37,9	30,9	9,5	18,8	14,5	415,6
2008	5,3	25,6	27,5	16,9	53,6	38,1	62,8	35,3	58,2	22,3	25,9	3,9	375,4
2009	27,6	17,3	13,5	32,5	58,2	30,1	50,3	72,4	26,3	18,8	21,9	26,8	395,7
2010	20,9	12,5	26,3	13,5	3,2	42,2	17,4	36,8	19,4	10,4	48,2	46,0	296,8
2011	4,4	18,8	23,1	48,7	95,9	85,2	50,4	46,7	12,6	26	51,9	8,6	472,3
2012	0,8	0,9	24,6	16,6	31,9	97,1	56,5	43,8	20,4	30,4	44,9	8,3	376,2
2013	24,6	13,8	35,8	46,5	34,6	6,7	109,7	45,5	24,1	28,3	29,6	23,6	422,8
2014	29,3	19,4	18	27,7	16,5	9,9	105	21,6	18,6	74,4	18,6	37,5	396,5
2015	20,2	11,6	11,2	33,6	43,6	72,3	118,1	52	59,3	61,6	32,1	40,1	555,7
2016	4,3	13,9	34,9	16,2	20,2	85,9	59,6	12,7	54,1	41	35,3	36,1	414,2
2017	22,6	15,7	19,1	22,6	41	39	70,9	16,6	17,8	31,4	6,9	10,2	313,8
2018	3,6	7,3	26,3	26,3	62,6	45,2	21,7	107,9	10,8	32,9	34,8	17,7	397,1
2019	11,5	18,7	16	26,4	20,5	51	44,2	34,8	39,7	21,3	20,5	19,6	324,2
2020	29,2	27,9	25,6	20,6	36,6	24,6	26,6	31,4	29,2	27,3	14,2	11,9	305,1
2021	17,8	39,1	26,3	8,8	7,3	15,8	57	34,1	15,8	13,2	23,4	21	279,6
2022	25,1	7,9	12,1	13,1	24,2	38,1	55,6	23,3	40,8	11,1	48,2	12,5	312
2023	16,8	26,2	19,6	1	20,1	86,2	26,2	43,4	48,1	44,7	33,7	58,4	424,4

MS Ruzaevka	1	2	3	4	5	6	7	8	9	10	11	12	The amount for the year
2003	9,5	15,1	6,4	15	86,9	52,4	95,6	1,7	17,2	35,3	19,3	14,5	368,9
2004	8,2	16,8	22,3	41,5	4,4	21,7	50,6	1,8	13,6	35,4	44,1	44,1	304,5
2005	20,6	8,7	15,4	9,5	67	31,4	114,7	104	8,5	26,4	7,4	7,8	421,4
2006	12,7	27,4	17,8	38,9	41,7	28	36,2	12,8	26,5	52	36,1	36,5	366,6
2007	19,8	31	9,7	32,6	100,2	20,4	111,9	26,2	12,3	12,9	22,8	8,7	408,5
2008	8,2	20,9	33	19,6	15,4	43,4	58,9	19,2	18,3	31,8	18,2	6	292,9
2009	22,1	19,6	30,9	38,7	76,4	23,7	26,3	66,2	4,7	33,5	20,1	23,5	385,7
2010	21,6	9,9	25,3	9,1	20,5	14,9	32,2	7,4	2,3	2,1	49,6	29,3	224,2
2011	2,4	14,7	23,9	50,8	74,9	98,2	23,4	24,6	46,7	28	29,4	8,5	425,5
2012	1,8	1	38,9	12,3	72,1	3,3	36,9	46	23,1	25,5	42,7	12,1	315,7
2013	26,6	12,8	20,4	66,5	24,9	38	109,3	95,6	20,9	33,8	18	34,4	501,2
2014	27,4	19,3	10,3	24,9	21,8	17,1	103,9	18,2	25,8	49,3	22,1	33,4	373,5
2015	21,5	19,5	14,4	24,3	99,2	25,4	33,5	35,8	34,3	40,6	37,7	43,9	430,1
2016	30,5	21,9	25,1	40,7	35,9	105,8	77,9	12,5	29,5	28,3	33,9	55,8	497,8
2017	27,9	18,8	20,2	30	52	23,8	54,5	56,7	9,5	42,5	24,6	11	371,5
2018	17,3	7	51,8	36,1	36,9	44,7	85,8	73,5	25,4	35,4	28,5	9,6	452
2019	15,1	16,9	19	23,5	7,1	26,5	36	69,4	51,7	35,2	32,8	39,2	372,4
2020	41	39,2	20,9	25,5	49,2	24	30,5	26,1	36,8	30,6	18,7	14,1	356,6
2021	23,1	37,2	17,3	10,9	16,4	14,7	37	22,2	15	9,3	30,3	17,9	251,3
2022	31,1	14,4	11,6	3,6	18,1	52,3	69,2	11,5	5,9	53,1	66,9	20,5	358,2
2023	23,4	25,5	35,9	3,1	13,3	32,9	24	54,1	43,3	46,8	60	57,6	419,9

MS Saumalcol	1	2	3	4	5	6	7	8	9	10	11	12	The amount for the year
2003	13,6	15,1	9,1	24	51,3	48,6	53,1	9	14,2	34,9	31,3	26,1	330,3
2004	7,3	19,1	32,2	41,6	15,5	26,5	52,9	5,4	23,1	47,8	52,1	61	384,5
2005	33,3	8,5	26,9	32,7	44,3	84,1	94,6	105,8	19,9	22,6	6,8	15,3	494,8
2006	23,3	21	27,3	97,1	29,5	45,4	49	33,1	50,9	59,2	37,2	55,5	528,5
2007	36,7	37,8	16,9	47,2	78,4	26	93,8	52,2	7,3	19,6	26,7	16,3	458,9
2008	10,9	23,2	38,3	17,7	22,6	54,5	72,7	23,4	43,6	40,7	25,5	5,3	378,4
2009	16	22,5	8,1	29,9	44	22,7	70,4	76,5	20,1	36,4	18,1	27,6	392,3
2010	27,6	13	25,6	11,1	11,8	25,2	50,6	18,8	3,7	9,9	62,4	49,2	308,9
2011	2,5	21,5	28,2	57,8	86,1	107,7	48,3	42,6	45,6	37,3	54,2	22,4	554,2
2012	3,2	3,8	40	12,5	71,4	56,3	39,6	58,2	30,5	38,7	63,4	19,3	436,9
2013	30,1	20,7	40,4	42,7	34,1	19,4	190,2	145,2	28,3	49,6	22,7	45,8	669,2
2014	40,2	32,5	18,1	31,3	28,8	16	163,3	16,1	30,3	88,9	33,2	37,3	536
2015	27,8	21,1	19,8	20,8	100,9	26,8	96,8	44	33,8	78,8	48,1	63,4	582,1
2016	32,5	36,4	43,3	41,7	8,2	130,3	137,2	15,5	45,6	35,9	44	74,2	644,8
2017	37,8	24,6	32,1	30,5	49	76,9	64,8	10,6	26,4	56,3	24,6	14,6	448,2
2018	20,9	9,5	56	44,3	52,5	52,2	91,6	105,9	33,5	62,9	44,9	16,2	590,4
2019	12	19,4	20,7	23,8	22,2	29,9	45,4	74,7	85,8	53,2	19,3	40,3	446,7
2020	64,9	44,2	19,6	28,2	39,6	28	77,7	45,7	46,1	34,4	30,2	16,1	474,7
2021	25,9	40,6	38,2	11,7	12,5	16,7	49,9	30,3	26,9	22	34	15,9	324,6
2022	29,7	13,1	18,6	5,6	25,9	52,1	67,9	13,8	8,6	38,5	75,3	19,1	368,2
2023	34,3	35,6	39,4	1,7	19,3	57,4	23,1	43,2	61,7	64,8	76,4	67,7	524,6

MS Sergeevka	1	2	3	4	5	6	7	8	9	10	11	12	The amount for the year
2003	17,3	8,7	9,9	9,9	151	69,7	32,7	5	18,7	28,3	13,2	14,2	378,6
2004	3,6	15,4	38,1	31,2	16,5	36,4	72,2	12	25,5	41,8	45,1	44,8	382,6
2005	23,5	6,5	25,2	11,8	31,4	80,4	74,1	122,8	37,1	18,2	2,4	7,7	441,1
2006	20,9	12,3	12,2	66	34,7	34,6	41,2	35,3	28,1	41,2	43,4	29,2	399,1
2007	29,4	33,9	10,6	49,3	50,8	25,5	73,7	32,2	23,7	16,2	29,9	9	384,2
2008	8,9	31	31	23,8	26,6	34,1	155,5	88,8	44,2	24,5	20	2,4	490,8
2009	23,2	10,1	32,3	38,7	49,2	13,5	38,6	45,6	8,5	18	6,4	23,8	307,9
2010	24,1	7	22,2	0,7	10,9	22,4	19,7	23,4	1,8	10,9	36,6	30,6	210,3
2011	3	15,9	17,1	51,7	88,8	121,9	56,7	69,8	47,4	19,6	34,5	8	534,4
2012	0,8	1,3	38,6	15	39,9	41,8	46,4	116,5	19,3	26,5	39,7	14,4	400,2
2013	21	20,2	16,4	52,6	22,3	5,7	85	93,6	25,4	26,3	20,6	22,7	411,8
2014	27,3	17	9,2	17,6	13,7	23,8	119,6	41,1	28,9	69	15,8	37,5	420,5
2015	27,8	10,7	11,7	43,1	68,9	11,6	60,5	29,8	44,3	63,3	30,7	47,4	449,8
2016	28,2	11	51,7	34,1	10,7	92,9	45,5	36,1	20,2	27,5	35,9	41,6	435,4
2017	18,1	13,7	27,2	26,5	65,7	31,2	56,5	14,3	8,7	48,9	5,9	9	325,7
2018	5,8	7,5	34,6	31,4	59,4	34,5	75	52,7	23,8	15,9	25,5	10,1	376,2
2019	13,1	13,7	14,1	23,6	24,7	35,5	43,2	46,8	76	37,7	14,4	30,8	373,6
2020	29,7	26,4	23,5	12,6	45,7	41,5	79,6	53,2	39,7	30,7	16	17,9	416,5
2021	29,9	35,3	17	15,5	8,8	22	132,3	34,6	19,5	6,5	23,4	17,8	362,6
2022	18,9	2,9	15,4	13,8	21,4	75,8	114,4	7,7	16,1	20,6	43,6	9,6	360,2
2023	21,7	27,6	22	1	19,3	41	42,2	53,9	59,2	49,6	68,1	51	456,6

MS Melting	1	2	3	4	5	6	7	8	9	10	11	12	The amount for the year
2003	5,4	6,7	2,9	12	32,4	42,5	48,2	20,5	12,8	18,4	13,7	12,7	228,2
2004	7,3	13,6	22,5	38,2	11,6	61,2	53,2	14,7	19,3	17,4	21,6	34,4	315
2005	17,4	4,2	16	5,9	40,6	103,8	47,9	74,1	24,7	20,7	3,2	7,5	366
2006	16,7	5,8	15,6	84,9	33,2	72,1	39,9	27,9	49	42,5	25,7	14,4	427,7
2007	19,3	30,5	9,5	30,5	54,2	42,7	72,1	39,9	21,8	14,2	10,9	8,8	354,4
2008	9	4,3	21,7	8,7	40,4	21,6	87,8	14,9	57,8	14,2	22,2	4,9	307,5
2009	15,5	10,3	2,1	24,3	33,7	44,4	67,4	78,7	40,3	25,9	12	17,6	372,2
2010	18,1	7,1	19,9	13,2	13,5	13,8	34,2	10,5	4,5	7,6	41,7	21,6	205,7
2011	1,1	13,7	16,9	46,5	50,4	77,3	24,9	34,7	14,5	46,6	8,8	4,3	339,7
2012	1,8	2,4	20,8	17,4	31,4	26,9	43,7	52	15,1	28,3	47,7	10,8	298,3
2013	21,1	12,4	18	39,6	28,4	7,8	77,4	91,4	39	33,1	11,9	27,6	407,7
2014	18,9	16	5,8	18,6	9,6	12,2	133,7	23,2	21,1	56,6	17,7	23,5	356,9
2015	14,1	17,9	10,7	16,7	49,2	47	46	32,1	53,9	59,5	28,9	25,8	401,8
2016	9,7	9,3	31,5	20,5	8,2	65,6	85,7	30,5	55,1	41,6	33,7	42,9	434,3
2017	9,5	7,7	16,3	23,7	33,4	37,8	41,4	1,5	17,4	37,4	9,4	12,6	248,1
2018	9,5	6,3	21,4	25,3	30,2	59,8	95	138,2	12,6	35,7	26,1	14,7	474,8
2019	9,9	16,4	17,7	24,4	20,6	95,7	27,3	65,1	52,8	29,9	10,8	21,5	392,1
2020	21,4	23	12,2	24,2	21,2	21,4	34,8	33,7	21,1	25,5	9,9	14,4	262,8
2021	24,5	28,5	13,5	15,1	9	27,1	75,3	61,1	16,1	14,9	13,2	11,5	309,8
2022	13,7	5,9	8,3	16,8	9,2	25,1	77,3	20,4	11,9	24,6	46,7	9	268,9
2023	12,2	10,9	16,3	4,7	11,5	41,9	29,2	59,2	54,9	27,1	46,6	38,5	353

MS Timiryazevo	1	2	3	4	5	6	7	8	9	10	11	12	The amount for the year
2003	14,7	5,2	8,6	17,3	65,8	54,9	46,3	1,6	28,9	19,2	13	16	291,5
2004	3,2	9,2	34,5	36,5	7,2	33	36,5	15,9	24,4	33,3	36,5	32,4	302,6
2005	10,8	7,1	19,7	13,9	25,4	45,6	102,8	106,5	45,5	28,1	9,2	4,4	419
2006	14,6	9,7	8,4	62,6	22,8	33,3	38	50,3	13,6	42,8	37,2	20,2	353,5
2007	17,1	31,1	6,1	41,1	38,6	32,9	123,8	25,9	14,6	9,2	22,5	5,9	368,8
2008	7,7	17,4	25,9	29,5	19,7	32,9	74,7	35,7	39,9	20,6	14,7	2,1	320,8
2009	20,7	7,1	25,1	32,6	30,1	18,5	34	56,9	17,3	33	4,3	25,7	305,3
2010	13,7	4,8	17	0	9,1	26,7	10,4	11,8	4	16,7	25,2	20,2	159,6
2011	1,4	14	16,2	42,2	42,3	67,2	64,3	74,2	32,5	25,5	29,8	6,4	416
2012	1,3	1,6	30,4	7,6	19,1	67,5	55,5	52,3	21,7	22,6	36	21,8	337,4
2013	23,8	11,6	24,8	45,9	25,2	4,8	83,8	123,9	19	27,2	16,7	18,8	425,5
2014	21,1	16,1	12,1	16,8	6,8	29,9	93,5	17,8	29,1	56,4	12	34,4	346
2015	26,9	7,8	8,9	33,2	95,8	36,9	71,2	29,5	63,1	50,3	28,4	39,9	491,9
2016	26,5	13,1	45,6	28,7	12	106,4	92,7	31,7	25,5	26,1	26,7	25,6	460,6
2017	11,7	13,9	23,1	25	26,7	20	49	29,6	10,6	44	4,3	7,8	265,7
2018	3,2	10,1	36,9	24,8	53,4	80,4	36,4	35,7	25,9	13,9	24,4	8,8	353,9
2019	13,3	14,6	20,3	27,8	11,9	34,8	67,5	59,7	63,3	51,6	10,6	25,9	401,3
2020	25,6	27,7	18,2	19,8	38,5	25,8	55,8	38,4	33,6	44,5	14,7	16,7	359,3
2021	29,4	62,1	25,8	14	9,4	14,3	25,7	18,5	25,7	7,1	18,6	24,7	275,3
2022	20,8	7,2	22,4	10,2	30,8	66,6	26,8	5,8	20,2	20,6	38,7	9,2	279,3
2023	17,4	30,4	19,7	2,1	17,2	48,6	40,1	79,2	42,7	40,7	54,9	46	439

MS Chkalova	1	2	3	4	5	6	7	8	9	10	11	12	The amount for the year
2003	8,4	5,9	0,9	15,1	49,2	15,9	49	31,5	8,4	16,7	13,6	14,6	229,2
2004	4,7	13,6	23,2	30,6	4,2	59,7	40,7	30	13,8	10,6	14,8	40	285,9
2005	17,7	1,1	14,8	7,6	38,8	108,8	91,3	103,9	8,9	16,5	6	8,9	424,3
2006	16,5	11,1	18,1	81,6	26,5	81,5	23	33,3	28,7	34,5	32,8	14,3	401,9
2007	15,6	39,7	8,2	19,5	66,4	33,4	55,4	22,9	13,4	28,9	9,5	8,4	321,3
2008	11,3	6,6	28,8	3,8	47,9	31	92,6	10,1	65,7	13,7	17,5	6,9	335,9
2009	14,6	12	2,6	21,9	32	25,8	120,5	79,1	27,3	29,3	20,4	15,3	400,8
2010	21,3	8,4	26,4	46,9	17,9	23,4	9,9	5,4	3,4	7,4	23,9	22,6	216,9
2011	2	13,1	21,5	24,2	33,6	100,5	37,9	39,6	8	45,7	9,5	5,4	341
2012	3,5	3,9	16,8	15	32,1	83,5	85,8	60	12,2	17,3	45,2	15,4	390,7
2013	25,6	17	21,2	16,9	27,2	18,3	87	91,6	17	33,1	9,8	23,5	388,2
2014	18,9	10,1	5,4	12,4	24,2	8,9	154,4	19	8,7	60,7	15,6	10,1	348,4
2015	11,9	7,7	9,3	13,6	57,6	70,2	38,7	45,3	39,6	43,3	26,3	18,7	382,2
2016	7,3	13,1	25	22,6	23,8	58,4	116,2	6,9	37,8	39	22,8	34,7	407,6
2017	8,9	8,2	14,1	16,1	16,3	36,6	60,5	1,4	11,1	32,3	20,5	14,1	240,1
2018	6,7	11,8	16,7	25,7	43,2	56,1	76,5	166,4	14,2	35,4	19,1	10,8	482,6
2019	8,8	15,1	16,5	28,6	25,5	74,6	22	37,7	66,2	18,8	19,8	21,7	355,3
2020	23	20,7	5,4	35,3	6,8	13,1	33,4	22,5	15,4	20,4	9,4	9,3	214,7
2021	26,6	14,8	11,4	10,8	12,7	30,9	29,5	35	21,2	12,9	11,8	2,4	220
2022	7,4	7,4	6	14,6	12,4	40	68,9	28	8	22,5	31,6	10,2	257
2023	8,8	9,1	16,7	2,5	6,4	38,2	19,1	47,1	32,9	30,9	37,8	29,5	279

MS Yavlenka	1	2	3	4	5	6	7	8	9	10	11	12	The amount for the year
2003	14,2	11,2	6,8	7,9	39,2	64,6	21,5	12,4	18,2	31,8	8,2	13,6	249,6
2004	5,1	14,7	26,5	26,9	6,6	140,9	31,7	23,9	41,5	29	26,9	33,4	407,1
2005	16	4,1	10	12,3	36,1	84,2	118,3	77,3	38,1	17,3	0,7	6,5	420,9
2006	16,2	9,8	11,6	84,9	33	44,8	83,7	41,2	34,2	33	39,7	23,4	455,5
2007	22,1	26,9	8,8	43	47,2	31,9	83,5	23,5	34,4	13,2	18,8	8,6	361,9
2008	7,3	15,2	25,5	24,4	68,1	44,9	105,9	31	49,3	17,5	19,5	2,7	411,3
2009	19,7	11,6	17,1	31,4	58,1	31,6	50	63,8	19,6	17,3	10,7	20,4	351,3
2010	18,3	9,5	21,1	12,7	4	44,1	28,5	11,8	1,5	18,5	30,8	32,1	232,9
2011	2,9	13,4	15,8	51,6	86,8	103,6	98,4	39,1	36,6	22,3	33,4	7,4	511,3
2012	1,3	1,2	31,7	15,4	51,6	48,9	124,7	75,3	18,9	31,9	40,2	13,2	454,3
2013	23,1	14,5	27,3	60,6	25,6	9,1	61,7	96,4	55,2	24,8	20,4	19,6	438,3
2014	27,3	13,4	14,5	19,1	11,9	16,8	119,1	29,2	29,8	74,4	14	34,4	403,9
2015	20,3	14,4	6,8	31,5	56,1	16,6	67,9	34,5	46,8	49,4	28,7	35,2	408,2
2016	15,3	11	39,5	24	40,7	58,1	66,2	29,6	34	32,6	25,7	34,3	411
2017	9,6	8,5	24,3	31,4	55,9	23,1	29,9	34,9	7,8	36,7	6,2	7	275,3
2018	3,9	7,8	32,2	32,7	56,8	51,4	91,6	69,7	21,4	13,2	22,2	12,6	415,5
2019	7,7	18,8	15,3	27,1	11,2	26,4	71,4	54,2	60,9	22	10,4	17,1	342,5
2020	24,2	22,7	19,7	22,9	34,7	42,1	55,2	33,7	29,6	30	11,1	11,3	337,2
2021	23,8	37,9	15,5	17,7	16,5	17,7	109,8	73,4	10,1	5	12,1	18,5	358
2022	18	3,1	13,5	18,5	16,5	26,5	120,8	26,5	24,9	15,9	44,6	7,3	336,1
2023	12,1	18,1	18,4	0,3	51,2	109,1	13,1	29,8	48	46,9	48,7	37,2	432,9

APPENDIX C

Snow cover height (cm) according to the meteorological stations of the North Kazakhstan region

MS Blagoveshchenka	10	11	12	1	2	3	4	5	Average
2002-2003	4	4	24	29	31	30	21		20
2003-2004	3	6	11	11	16	8	2		8
2004-2005	1	4	24	34	36	39	26		23
2005-2006	2	0	6	17	30	21	5		12
2006-2007	1	10	9	16	26	34	13		16
2007-2008		3	8	10	13	7		4	8
2008-2009	1	6	1	21	25	25	5		12
2009-2010	4	4	12	29	29	28	8		16
2010-2011		3	13	21	33	40	26		23
2011-2012	4	8	9	11	10	13	10		9
2012-2013	0	8	16	25	40	30	18		20
2013-2014	1	1	13	24	32	28	4		15
2014-2015	5	9	16	28	28	28	18		19
2015-2016	3	9	17	40	43	45	17		25
2016-2017	3	11	14	17	24	13	8		13
2017-2018	11	1	2	4	8	8	3		5
2018-2019	2	7	19	24	32	22	2		15
2019-2020	2	4	11	13	19	8	4		9
2020-2021	1	7	10	18	22	37	18		16
2021-2022		4	9	15	17	17	7		12
2022-2023	4	5	7	11	14	12			9
2023-2024	1	6	13	26	28	24	2		14

MS Sublime	10	11	12	1	2	3	4	5	Average
2002-2003	3	13	25	28	29	30	24		22
2003-2004	2	7	21	23	37	41	12		20
2004-2005	1	3	18	26	28	27	16		17
2005-2006	1	1	7	16	21	15	7		10
2006-2007	1	21	23	36	46	51	40		31
2007-2008		3	10	21	25	30			18
2008-2009		2	1	14	21	18	2	2	10
2009-2010	9	8	12	26	29	35	23	4	20
2010-2011		4	18	29	34	49	41		29
2011-2012	2	9	17	19	19	17	1		12
2012-2013	1	19	24	30	40	42	30		27
2013-2014	1	1	14	34	44	47	11		22
2014-2015	3	6	23	39	68	77	51		38
2015-2016	9	7	16	32	32	36	16		21
2016-2017	1	10	25	46	52	51	29		31
2017-2018	2	1	8	15	19	26	21		13
2018-2019	1	5	15	22	29	27	5	2	15
2019-2020	2	2	8	14	28	25	3		12
2020-2021	1	4	13	33	61	73	58		35
2021-2022	3	6	22	44	53	65	42		34
2022-2023	1	3	10	31	43	60	24		25
2023-2024	2	7	12	39	59	64	28		30

MS Kiskenekol	9	10	11	12	1	2	3	4	5	Average
2002-2003		2	6	16	22	25	26	10	15,6	15
2003-2004		2	6	14	19	23	18	2		12
2004-2005			1	11	19	22	17	5		13
2005-2006			2	3	10	14	7	2		6
2006-2007			7	12	18	22	17	4		13
2007-2008			1	6	13	18	4			8
2008-2009			2	3	16	26	17	1		11
2009-2010		1	4	8	25	29	31	13		16
2010-2011			2	19	27	35	37	19		23
2011-2012		3	3	9	14	20	19	2		10
2012-2013			12	30	39	49	45	19		32
2013-2014			0	12	25	37	33	3		18
2014-2015		0	4	13	21	26	27	15		15
2015-2016		2	3	14	19	21	19			13
2016-2017		0	4	17	27	44	45	5		20
2017-2018		0	3	12	27	44	46	33		24
2018-2019			11	35	46	56	54	5	0	30
2019-2020		0	4	21	46	72	73	19		34
2020-2021		1	7	15	37	63	85	60		38
2021-2022		0	9	24	39	60	68	40		34
2022-2023	0	10	6	14	56	75	82	30		39
2023-2024		0	3	15	69	102	106	45		49

MS Petropavlovsk	10	11	12	1	2	3	4	Average
2010-2011				30	32	34	23	30
2011-2012	3	12	13	15	18	18	6	14
2012-2013		8	17	26	34	34	25	30
2013-2014	1	0	10	23	34	32	2	23
2014-2015	4	7	25	38	44	44	23	37
2015-2016	6	7	19	31	37	34	9	28
2016-2017	0	10	27	40	49	39	16	36
2017-2018	2	1	6	10	15	15	7	12
2018-2019	1	5	21	31	41	31	2	26
2019-2020	1	5	10	19	33	19		24
2020-2021	1	6	11	22	32	51	23	32
2021-2022	2	6	11	19	22	19	4	16
2022-2023		3	3	16	19	21		19
2023-2024	2	6	17	35	46	43	6	33

MS Ruzaevka	10	11	12	1	2	3	4	5	Average
2002-2003	1	2	11	21	28	27	14		15
2003-2004	1	4	11	15	20	18	3		10
2004-2005	0	2	11	23	28	27	14		15
2005-2006	0	0	2	6	14	12	1	1	5
2006-2007	0	3	13	20	20	24	13	16	13
2007-2008		2	8	14	20	19			13
2008-2009		3	1	12	23	20	1		10
2009-2010	2	4	9	27	34	38	11		18
2010-2011		1	8	16	25	27	9		14
2011-2012	2	7	17	20	22	23	2		13
2012-2013	1	8	11	22	34	24	3		15
2013-2014	1	0	15	28	38	30	1		16
2014-2015	1	7	20	28	36	36	19		21
2015-2016	3	11	16	37	44	37	8		22
2016-2017	1	2	15	20	26	25	13		15
2017-2018	1	1	4	11	11	11	7		7
2018-2019	1	4	12	14	18	13	10		10
2019-2020		11	21	38	39	25	1		23
2020-2021	1	4	7	13	25	42	21		16
2021-2022	0	3	3	14	15	20	4		8
2022-2023	5	6	11	21	25	28	1		14
2023-2024	1	2	11	16	15	13	0		8

MS Saumalcol	9	10	11	12	1	2	3	4	5	Average
2002-2003		1	2	11	29	32	30	22		18
2003-2004		4	9	13	16	22	8	2		11
2004-2005		2	7	32	40	38	38	28		26
2005-2006		3	2	7	21	25	12	6	7	11
2006-2007		8	8	15	15	22	26	16	12	16
2007-2008			11	12	13	16	11			13
2008-2009	3	1	5	7	14	13	10	5	3	8
2009-2010		9	5	14	25	27	28	10		17
2010-2011		2	4	14	17	23	20	7		12
2011-2012		4	13	17	19	17	17	4		13
2012-2013		1	8	20	30	34	24	7		18
2013-2014		1	2	11	14	21	22	2		10
2014-2015		6	13	28	19	21	19	7		16
2015-2016		5	12	22	49	53	41	7		27
2016-2017		5	13	31	39	47	36	23		28
2017-2018		3	2	4	16	20	21	13	1	11
2018-2019		3	8	17	22	30	24	3	6	15
2019-2020		4	6	20	27	32	23	3		16
2020-2021		2	9	14	21	27	31	16		17
2021-2022		0	5	3	9	15	19	6		8
2022-2023		10	9	15	22	27	33	5		17
2023-2024		4	10	23	16	15	13	0		12

MS Sergeevka	10	11	12	1	2	3	4	Average
2002-2003	7	6	20	22	22	23	18	17
2003-2004	1	9	17	16	23	12		13
2004-2005	1	8	33	45	49	46	32	31
2005-2006	1	1	6	20	32	23	2	12
2006-2007	3	10	16	21	25	33	18	18
2007-2008		7	10	16	20	13		13
2008-2009		9	2	19	22	19	4	13
2009-2010	3	3	13	33	38	40	21	22
2010-2011		1	22	26	30	31	18	21
2011-2012	3	8	8	9	10	12	2	7
2012-2013		12	22	30	42	57	35	33
2013-2014		1	8	16	25	24	2	13
2014-2015	1	7	17	34	45	50	29	26
2015-2016	5	11	17	36	37	42	11	23
2016-2017	1	11	24	36	42	36	26	25
2017-2018	5	2	2	5	8	10	7	6
2018-2019	4	4	12	17	20	16	3	11
2019-2020	8	5	14	26	31	21		18
2020-2021	2	7	12	23	35	56	31	24
2021-2022		5	9	26	31	31	13	19
2022-2023	6	5	9	18	25	36	7	15
2023-2024	1	7	19	49	49	65	49	34

MS Sergeevka	9	10	11	12	1	2	3	4	5	Average
2002-2003		4	16	27	33	38	30	9		22
2003-2004		1	6	17	19	22	8	1		11
2004-2005		0	3	18	26	28	18	4		14
2005-2006		1	1	3	13	22	14	8	1	8
2006-2007			10	12	13	18	22	5		13
2007-2008			2	5	12	14	2		1	6
2008-2009			2	2	9	14	7	3		6
2009-2010		3	4	8	23	24	23	2		12
2010-2011			1	11	16	15	12			11
2011-2012		2	4	7	7	9	4	0		5
2012-2013		2	16	25	26	26	19	5		17
2013-2014		2	1	11	20	18	13	1		9
2014-2015		2	5	15	18	17	12	1		10
2015-2016		13	15	17	26	26	16			19
2016-2017		1	8	17	18	17	7	3		10
2017-2018		1	1	4	7	9	6	1		4
2018-2019		2	5	12	18	23	10	3	3	10
2019-2020	1	4	3	8	9	8	3	0		5
2020-2021		3	5	6	17	22	17	3		10
2021-2022		0	6	4	8	8	5			5
2022-2023		8	6	9	8	6	3			7
2023-2024		2	6	12	14	18	14			11

MS Timiryazevo	10	11	12	1	2	3	4	5	Average
2002-2003		6	21	44	50	48	32		34
2003-2004	1	7	18	21	28	18	4		14
2004-2005	0	5	28	51	58	62	39		35
2005-2006	3	7	7	15	24	21	1		11
2006-2007	4	10	12	22	29	41	17		19
2007-2008		4	10	12	19	17			12
2008-2009	0	9	4	18	18	16	4		10
2009-2010	1	4	10	23	31	31	8		15
2010-2011		0	23	34	37	28	5		21
2011-2012	3	10	12	13	13	13	3		10
2012-2013	1	10	21	37	51	52	29		29
2013-2014	1	1	6	17	34	36	4		14
2014-2015	2	4	20	62	70	68	34		37
2015-2016	4	9	23	66	71	86	39		43
2016-2017	1	4	13	31	42	42	26		23
2017-2018	4	2	2	6	9	14	13		7
2018-2019	1	3	14	21	51	40	1	1	17
2019-2020	2	4	15	48	71	52	2		28
2020-2021	1	6	10	29	63	129	68		44
2021-2022		3	11	51	69	77	32		41
2022-2023	3	5	10	23	31	56	14		20
2023-2024	2	14	24	68	100	96	38		49

MS Chkalova	9	10	11	12	1	2	3	4	5	Average
2002-2003		5	12	14	14	13	10	1		10
2003-2004			8	13	14	16	6	2		10
2004-2005		0	1	19	21	22	15	4		12
2005-2006		1	2	5	14	21	15	6	0	8
2006-2007		0	12	14	16	22	28	6		14
2007-2008			2	6	12	14	5	0	2	6
2008-2009			2	8	9	11	8	2		7
2009-2010		1	5	7	18	20	26	8		12
2010-2011			1	7	10	12	13	1		7
2011-2012		4	4	10	9	12	6			8
2012-2013		1	18	23	28	31	21	5		18
2013-2014		1	1	12	23	35	29	0		14
2014-2015		3	5	8	16	20	19	2		10
2015-2016		14	10	12	31	40	35	4		21
2016-2017		3	2	9	16	18	11	1		9
2017-2018		2	2	5	12	16	13	3		8
2018-2019		1	2	6	14	29	20	5	4	10
2019-2020		6	4	8	15	14	6			9
2020-2021		3	3	13	39	54	70	34		31
2021-2022		1	6	4	8	19	17	1		8
2022-2023	1	9	5	9	18	20	16	0		8
2023-2024		2	5	12	30	38	30			20

MS Yavlenka	9	10	11	12	1	2	3	4	5	Average
2002-2003		4	4	21	26	27	26	16		18
2003-2004		1	4	12	14	23	17	0		10
2004-2005		1	5	21	34	38	32	17		21
2005-2006		1	0	4	10	19	9	5		7
2006-2007		0	11	10	8	12	22	13		
2007-2008			6	9	17	18	2		3	9
2008-2009			5	4	12	15	11	5	2	8
2009-2010		5	6	10	21	25	30	14		16
2010-2011			4	19	25	26	30	15		20
2011-2012		5	11	10	10	12	12	2		9
2012-2013			13	18	23	30	24	10		20
2013-2014		1	1	4	11	20	17	2		8
2014-2015		3	4	17	26	33	33	20		19
2015-2016		5	5	8	26	25	25	3		14
2016-2017		1	3	9	21	28	22	14		14
2017-2018		2	0	4	4	6	9	6		4
2018-2019		1	2	15	22	32	24	1		14
2019-2020	0	2	3	8	12	18	11	2		7
2020-2021		1	6	9	17	29	41	23		18
2021-2022		0	3	7	16	18	18	9		10
2022-2023		3	8	9	17	20	23			13
2023-2024		1	10	18	34	50	50	14		25

APPENDIX G

Wind speed (m/s) according to meteorological stations of the North Kazakhstan region

MS Blagoveshchenka	1	2	3	4	5	6	7	8	9	10	11	12	Average за год
2003	3,9	3,5	2,6	3	2,8	2,5	1,8	1,6	2,4	2,1	2,3	4,1	2,7
2004	1,1	2,2	2,7	2,9	2,9	2,7	1,4	2,6	2,3	3,8	3	2,1	2,5
2005	2	1,7	4,4	2,9	2,6	1,9	1,3	1,8	2,1	2,7	3	2,9	2,4
2006	1,9	2,2	3,1	2,9	2,5	2,4	3,1	2,5	3,4	3,1	2,8	5,6	3,0
2007	4,5	3,5	2,4	3,4	4	2,7	1,9	2,4	2,4	1,9	2,7	2,6	2,9
2008	1,8	4,8	3,1	2,6	2,9	3,1	2,3	2,8	2,4	2,6	3,8	2,3	2,9
2009	3,1	2,3	2,5	4,1	2,9	2,1	2,4	2,3	1,6	2,9	2,8	3,2	2,7
2010	3	3,2	4,2	3,1	3	3,4	3	2,9	3,3	2,8	4,5	3,7	3,3
2011	3,2	3,3	4,5	4,2	3,7	3,5	2,9	2,7	3,5	3,1	4,9	3,7	3,6
2012	1,8	2,3	4,2	4,4	3,5	3,1	2,7	3,1	3,5	3,8	4,3	3,3	3,3
2013	3,6	4	5,2	4,6	4,4	3,2	2,9	2,8	2,6	4,6	4,6	5,2	4,0
2014	4,6	4,2	5,6	5,4	3,9	3,4	3,8	2,9	3	4,3	4	4,7	4,2
2015	4,8	3,9	4,2	4,2	4,1	3,3	3,9	3,2	2,9	4,4	4,1	3,8	3,9
2016	3,5	3	4,2	2,4	2,6	2,9	2,6	2,1	3,1	2,4	3,9	3,8	3,0
2017	3,5	4,4	2,4	4,7	4,8	3,7	2,6	2,4	3,3	3,7	3,3	2,7	3,5
2018	3,4	2,2	4,2	4,2	5	3,2	2,5	2,9	3,3	4,5	3,8	2,1	3,4
2019	3,5	3,8	4,9	3,1	3,3	2,8	2,7	2,5	3,3	3,8	3,6	3,6	3,4
2020	4,8	5	5,7	5,7	3,5	2,8	2	2,6	3,4	3,5	3,1	2,8	3,7
2021	3,2	3,9	4,2	3,7	3,6	2,6	3,5	2,6	5,2	4,9	6,5	5	4,1
2022	5,2	5,7	4,9	5,8	6,1	3,8	3	2,6	3,7	3,9	4,1	3,8	4,4
2023	4,2	4	5,7	4,7	3,7	4,1	3,1	2,9	2,7	5,4	5,2	4,9	4,2

MS Sublime	1	2	3	4	5	6	7	8	9	10	11	12	Average за год
2003	3,6	3,6	3,5	3,7	3,1	2,7	2,7	1,9	2,6	2,7	2,8	4,4	3,1
2004	2,4	3,6	3,5	4,1	3,7	3,4	2,4	3,2	3,3	4,3	4,4	3,2	3,5
2005	3	2,7	4,8	3,4	3,2	2,9	2,1	2,4	2,4	2,5	3,2	2,7	2,9
2006	2,7	2,8	4,2	3,8	3,3	2,5	2,9	2,8	3,3	3,1	2,6	5,3	3,3
2007	4,3	3,8	3,3	3,5	4,4	3,2	2,2	2,3	2,9	2,7	3,2	3,1	3,2
2008	1,3	4,5	4,3	3,7	3,3	2,9	2,3	2,9	2,4	2,5	3,7	2,5	3,0
2009	3	2,6	2,7	4	3,2	3,1	2,7	2,3	2,1	2,9	2,8	3,4	2,9
2010	2,6	3,3	4,3	2,9	2,9	2,6	2,5	2,6	3	2,4	4,4	3,7	3,1
2011	2,1	3,2	3,7	3,6	2,9	2,3	3	2,4	3	2,5	4,5	3,1	3,0
2012	1,3	1,3	3,4	3,7	3,1	2,5	2,8	3,1	3,9	4,1	4,7	2,9	3,1
2013	4,2	4	4,9	4,6	4,6	3,2	2,6	2,6	2,1	3,4	3	4,2	3,6
2014	4,1	2,7	4,6	4,5	3,2	2,7	2,5	2,1	2,8	4	3,8	4	3,4
2015	4,1	3,8	4	3,9	3,6	2,7	3,7	3,6	3	4,3	3,6	4,9	3,8
2016	3,4	3,8	4,6	3,3	3	3,1	2,3	2	2,8	2,2	4,2	4,6	3,3
2017	3,9	4,1	3,5	5	4,2	3,1	2,2	1,8	2,6	3	2,5	2,4	3,2
2018	3,2	2	4,6	3,9	5,2	3,1	2,6	2,6	3,4	3,9	4,3	3	3,5
2019	3,2	3,1	4,1	3,2	3,2	2,9	2,8	3,3	4,3	4	3,9	3,6	3,5
2020	4,8	4,7	5,6	5,7	3,7	3,5	2,9	3,6	4,2	3,9	3,8	4,2	4,2
2021	3,4	4	6,5	4,8	3,9	3,3	3,7	3	4,6	4,7	5,6	4,6	4,3
2022	4,1	4,2	5,2	4,6	5,6	4,5	3,9	2,9	3,7	4	4,6	3,6	4,2
2023	5,6	3,9	5,7	5,1	3,8	4,2	3,4	2,8	2,7	4,4	4,1	5	4,2

MS Kiskenekol	1	2	3	4	5	6	7	8	9	10	11	12	Average за год
2003	2,9	3	2,2	2,5	2	2,2	1,8	1,1	1,8	1,9	2,2	2,3	2,2
2004	1,2	2	1,8	2,7	1,5	2,2	1,2	2,6	3,3	4,1	2,7	2,2	2,3
2005	1,9	1,3	3,7	3,7	3	2,1	2,8	2,5	2	2,2	2,8	1,9	2,5
2006	1,9	2,5	3,4	3,1	2,7	2,3	2,7	2,6	3,5	2,9	2,5	4,6	2,9
2007	3,1	3,7	2,6	3,2	4,2	3,1	1,7	2,3	2,8	2,8	3	3,2	3,0
2008	1,6	4,4	3,9	3,7	2,9	2,9	2,6	3,1	2,8	2,3	3,4	1,9	3,0
2009	2,2	2,1	2	3,1	2,8	3,6	3,1	2,5	1,7	5,5	5	6,8	3,4
2010	5,6	6,7	7,9	2,4	4,5	3,9	2,9	2	2,8	2,3	4,7	4,1	4,2
2011	1,7	3	3,8	3,4	2,7	2,4	2,2	2,8	2,5	2,7	3,8	2,6	2,8
2012	1,5	2	3,1	3,5	2,8	2,5	1,6	1,5	2	1,8	3,1	2,1	2,3
2013	2,6	3	4,1	2,8	4,1	2,6	2,3	2,5	2,6	4,1	4,1	4,5	3,3
2014	4,5	3,3	3,9	4,9	3,9	3,6	3,3	2,9	3,3	4,6	4,7	4,4	3,9
2015	4,1	4	3,9	3,8	3,4	2,9	3,8	3,7	2,9	4	3,9	4,9	3,8
2016	3,5	3	4,7	3,5	3,2	3,5	2,9	2,4	2,8	2,6	4,5	4,9	3,5
2017	4,4	4,4	3,3	5,8	5	3,5	3,2	2,7	3,5	3,6	3,5	2,7	3,8
2018	3,6	2,4	4,8	4,8	5,3	4,1	3	3,6	3,7	4,5	5,2	3,4	4,0
2019	3,3	3,4	4,4	3,8	3,8	3,5	3,3	3,5	4,3	4,1	3,7	4	3,8
2020	4,9	4,9	5	4,8	3,4	3,8	2,9	3,5	4,4	4,3	4,1	4,5	4,2
2021	3,7	4	5,2	3,9	4	3,4	3,4	3	5,3	5,1	5,6	4,5	4,3
2022	4,1	4,1	5,7	4,4	5,4	4,9	4,1	3,2	3,9	4	5,2	3,9	4,4
2023	6,7	3,9	5,5	5,1	3,7	4,6	3,9	3,3	3,5	5,1	5,1	6	4,7

MS Petropavlovsk	1	2	3	4	5	6	7	8	9	10	11	12	Average за год
2011	2,2	2,2	2,5	2,6	2,6	2,7	2,6	2,2	2,9	2,1	3	2	2,5
2012	1,1	1,7	2,7	3,1	2,9	2,6	2,3	2,4	2,4	2,5	1,9	1,2	2,2
2013	1,7	1,8	2,9	2,4	2,9	3,4	3,1	3,4	2,9	3,6	3,4	3,8	2,9
2014	3,3	2,8	4,1	4,3	4,2	3,5	3,4	2,8	2,9	3,5	3,1	3,3	3,4
2015	3,5	2,6	3,1	3,1	3,8	2,8	3,9	3,2	2,8	4,5	3,6	3,6	3,4
2016	4	2,8	4,4	2,9	2,4	3,5	3	2,1	2,6	2,5	3,5	3,5	3,1
2017	3,3	3,8	3	4,5	4,5	3,4	2,7	2,6	3,2	3,4	3	2,1	3,3
2018	2,7	2,6	4	3,9	5,1	3,5	3,9	3,6	3,4	4,4	3,7	3,1	3,7
2019	3,3	3,3	4,5	3,9	4,2	3,6	3,8	3,7	4,1	3,9	3,3	3,5	3,8
2020	3,9	3,9	4,5	5	3,9	4	3,4	3,4	4	3,9	3,6	3,3	3,9
2021	3,7	4	4,3	4,3	4,1	3,5	3,8	3	4,4	3,7	4,1	3,3	3,9
2022	3,3	3,8	4,1	4,3	4,8	3,9	3,6	2,9	3,5	3,6	3,6	3	3,7
2023	3,6	3,3	4,5	4,2	3,6	4,2	3,2	3,2	3,2	4,3	4,3	4,1	3,8

MS Ruzaevka	1	2	3	4	5	6	7	8	9	10	11	12	Average за год
2003	4,5	4,1	3,8	3,4	4	4,1	2,4	2,3	3,4	2,4	2,9	4,9	3,7
2004	2	3,1	3,7	4,5	4,8	4,4	2,6	4	3,4	5,6	4,6	4,4	3,8
2005	3,3	3,3	7,1	4	4,3	2,9	2,7	2,9	2,7	2,8	3,5	4	4,0
2006	3,6	3,8	5,1	5,4	3,7	3,8	4,9	3,4	3,8	3,4	3,6	6,9	4,0
2007	5,6	4,5	2,8	3,7	5,4	4,4	2,7	2,8	3,4	2,5	4,2	3,4	3,7
2008	2,5	6,3	5,5	3,5	3,5	3,1	2,7	3,6	3,4	2,6	4,5	2,3	3,6
2009	3,8	2,9	3,5	5,2	4,3	3,8	3	3,3	2,6	3,4	2,5	3,5	3,4
2010	3,6	3,5	5,3	3,5	3,3	3,6	2,8	2,4	2,4	2,1	3,9	4,2	3,4
2011	2,5	4,2	4,9	4	3,4	3,4	3	2,8	3,2	2,5	4,6	2,6	3,4
2012	1,8	2,5	4,9	3,6	3,3	3,6	3,1	2,7	3,3	3,9	4,4	3,6	3,7
2013	3,6	3,4	5,1	4,7	4,5	3,3	3,1	2,9	2,9	4,4	4	5,3	4,0
2014	4,7	4,1	5,4	4,5	4,2	3,3	3,8	3,4	2,9	4,3	3,5	4,7	3,9
2015	4,2	3,4	3,6	4	4,1	3	3,8	3,2	2,6	4,1	4,7	5,1	3,8
2016	5,1	4,4	5,7	3,6	3,5	3,4	2,9	2,1	3	2,5	4,1	5	3,7
2017	4,4	4,8	3,8	4,5	4,5	3,3	2,9	2,2	3,4	4,6	3,1	2,8	3,5
2018	2,9	2	4,1	4,1	4,7	3,3	3,1	2,9	2,9	4,1	3,6	0,8	3,3
2019	3,2	3,2	4,5	2,6	2,7	2,7	3,4	3,3	3,7	3,6	3,4	4,2	3,4
2020	5,1	5,4	4,5	5	3,7	2,5	2,1	2,2	2,6	2,5	2,5	2,2	3,1
2021	2,8	3,7	3,7	3	2,3	2,4	2,9	2,1	3,2	2,7	3,1	2,9	2,9
2022	3,3	3,8	3,2	3,1	3,7	2,6	2,5	1,9	2,5	2,2	3,1	2,3	2,9
2023	2,7	3,2	3,7	3,2	2,5	2,8	2,3	2,4	1,8	3,2	3,8	3,8	3,0

MS Saumalcol	1	2	3	4	5	6	7	8	9	10	11	12	Average за год
2003	4,8	4,8	3,5	3,5	3,8	3,3	2,2	1,8	2,8	2,4	2,9	4,5	3,4
2004	1,5	2,8	3,4	4,4	3,8	3,5	2	3,2	2,9	4,3	3,9	3,1	3,2
2005	2,9	2,6	5,3	3,6	3,5	2,2	2,1	2,5	2,6	2,5	3	2,6	3,0
2006	2,8	2,7	4,2	4,6	3,3	2,4	3,5	2,8	3,3	3	2,8	6	3,5
2007	5,3	4,4	2,7	3,1	5,2	3	1,8	2,1	2,3	2,3	3,4	2,8	3,2
2008	1,6	5,5	4,1	3	2,6	2,4	2,1	2,8	2,7	2,6	4	2,5	3,0
2009	3	2,8	2,8	3,8	3,6	2,7	2,5	2,6	2,3	3,1	2,9	3,4	3,0
2010	3,2	3,3	4	2,8	3	3,2	2,6	2,8	3	2,5	4,5	3,5	3,2
2011	2,7	3,4	3,7	2,9	2,7	2,3	2,3	2,4	3,6	3,3	4,7	2,7	3,1
2012	1,1	3,5	7,1	3,9	3,2	2,8	2,5	3,2	4,9	3,1	3	2,4	3,4
2013	2,9	3,7	4,4	4,4	3,7	2,8	3,1	3,4	3,1	5,1	5,5	6,3	4,0
2014	5,2	4,1	6	5,3	4,3	3,6	3,8	2,8	3,4	5,2	4,6	5,4	4,5
2015	4,2	2,3	2,4	2,4	2,7	3,3	3,8	3,4	2,8	4,4	4,3	3,9	3,3
2016	1,9	2,6	4	2,7	2,7	3,1	2,1	1,7	2,5	2,2	4,3	4,1	2,8
2017	3,7	3,5	2,5	3,4	3,9	2,8	2,2	1,6	2,7	2,6	2,2	2,1	2,8
2018	2,1	1,1	3,6	3,4	5,1	3,4	2,9	2,4	3,1	4,8	4	1,6	3,1
2019	3	2,9	4,1	3,2	3,1	2,8	2,8	2,2	3,5	2,8	2,2	2,7	2,9
2020	3,7	3,6	3,5	3,8	2,6	2,7	1,8	2,2	3	3,1	2,4	2	2,9
2021	2	2,6	3,3	2,6	2,2	2,1	2,3	1,4	2,6	2,4	3	2,3	2,4
2022	2,1	1,8	2,6	2,4	2,8	1,8	1,7	1,2	1,7	1,5	2,1	1,5	1,9
2023	2,4	2,1	2,8	2,6	2	1,9	1,6	1,9	1,4	2,8	2,5	3	2,3

MS Sergeevka	1	2	3	4	5	6	7	8	9	10	11	12	Average за год
2003	4,8	4,1	3,4	3,5	2,7	3,1	2,1	1,7	2,6	2,5	2,8	5	3,2
2004	1,6	3,1	3,3	3,8	3,4	3,6	1,8	3	3,1	4,4	4,1	2,9	3,2
2005	2,6	2,7	4,3	3,3	2,6	2,2	1,6	2	2,1	2,4	2,7	2,3	2,6
2006	2,5	2,9	3,8	3,2	3	2	2,7	1,7	2,6	3,3	2,7	5,5	3,0
2007	4,7	3,9	2,9	3,4	4	3,2	1,9	2,4	2,7	2,4	3,2	3,3	3,2
2008	2,2	5	3,8	3,2	3	2,7	2,1	2,7	2,5	2,8	4,1	2,7	3,1
2009	2,9	2,8	2,6	4	3	2,7	2,3	2,4	2,1	3,2	2,8	3,3	2,8
2010	2,9	3,2	4,1	2,7	2,7	2,8	2,1	2,6	2,9	2,5	4,5	3,2	3,0
2011	2,8	3,3	3,7	3,5	2,7	2,5	2,4	2,1	2,4	2,6	4,4	2,9	2,9
2012	1,5	1,9	3,5	3,5	2,7	2,2	2,2	2,3	3,2	3,3	3,9	2,9	2,8
2013	3,4	3,6	4,4	3,7	3,4	2,3	2,1	2,3	2,1	3,8	4	4,4	3,3
2014	4	3,6	4,8	4,6	3,3	2,7	2,9	2,3	2,6	3,5	3,2	4,2	3,5
2015	4	3,3	3,4	3	2,9	2,6	3,3	2,9	2,5	3,9	3,7	4,1	3,3
2016	2,8	3,2	3,9	3	2,8	2,5	2	1,9	2,5	2	3,6	4	2,9
2017	3,7	4,6	3,3	4,1	3,9	2,9	2,1	1,7	2,4	2,8	2,8	2,1	3,0
2018	2,6	2,1	3,8	3,8	4	3,1	2,2	2,2	2,6	3,8	3,6	2	3,0
2019	3,2	3,4	4	2,8	3,1	2,4	2,4	2,5	3,2	3,3	3,2	3,2	3,1
2020	4,3	4	4,2	4,2	2,9	2,2	1,7	2,4	2,9	3,2	2,9	3,3	3,2
2021	2,9	3,6	4,2	3,2	2,8	2,2	2,4	1,8	3,2	3,1	4	3,4	3,1
2022	3,5	3,5	3,8	3,4	3,9	2,8	2,1	1,8	2,4	2,8	2,9	2,8	3,0
2023	3,8	3,2	4,4	3,4	2,7	2,8	2,2	2,1	2	3,8	3,4	3,7	3,1

MS Sergeevka	1	2	3	4	5	6	7	8	9	10	11	12	Average за год
2003	4,2	4,2	3,3	3,8	3,7	3,5	3,1	2,7	3,3	2,9	3,2	3,6	3,5
2004	2,6	3,3	3,4	3,9	3,7	4,4	2,6	3,5	3,7	4,5	3,5	3,4	3,5
2005	3,1	3,1	4,5	3,7	4	3,5	2,7	3,3	3,3	3,2	3,4	3	3,4
2006	3,6	3,5	4	4,5	3,6	3,3	3,8	3,2	4	3,7	3	5,5	3,8
2007	4,8	4,8	3,5	4,4	5,9	4	3	3,4	3,9	3,3	4,2	4,1	4,1
2008	2,4	6	4,9	4,8	4,2	3,9	3,2	4,1	3,6	3,6	4,6	3,3	4,1
2009	3,9	3,3	3,2	5,3	4,1	4	3,5	3,1	2,6	3,6	3,4	4	3,7
2010	3,5	3,8	4,6	3,1	3,4	3,4	3	2,9	3,3	2,7	5,5	5,7	3,7
2011	4,1	5,1	5,4	5,4	4,6	4,1	4,2	4,6	4,7	4,1	5	3,6	4,6
2012	2,3	2,9	4,6	5,7	5	4,5	4,2	4,3	4,9	4,9	5,5	3,7	4,4
2013	4,9	5,3	5,7	5,6	6,2	4,8	4	4,1	4	5,5	5,6	5,7	5,1
2014	5,7	4,9	6,2	6	5,4	5	4,5	3,9	4,5	5,3	5,2	5,5	5,2
2015	5,7	5	5,4	5	5,1	4,4	5,5	4,7	4,1	5,5	5,3	5,9	5,1
2016	4,9	4,3	5,8	4,7	4,6	4,9	4	3,4	4	3,4	5,3	5,8	4,6
2017	5,2	6,2	4,5	6,2	5,6	4,7	4	3,5	4,7	4,4	4,2	3,2	4,7
2018	4,2	3,3	6	5,6	6,6	5,4	4,1	4	4,5	5,6	5,7	4	4,9
2019	4,7	4,8	5,8	4,6	4,7	4	4,2	4,1	5,1	4,9	4,9	4,7	4,7
2020	5,8	5,7	6,3	6	4,8	4,6	3,7	4,2	5	5,6	5	5,2	5,2
2021	5	5,6	6,7	5,3	5,2	4,4	4,2	3,6	5,2	5,2	6,2	4,8	5,1
2022	4,7	4,9	6	5,3	5,9	4,8	4,2	3,5	4,3	4,6	5	4,8	4,8
2023	6,4	4,8	6,7	5,8	4,9	4,8	4,1	3,8	3,9	5,3	5,4	5,8	5,1

MS Timiryazevo	1	2	3	4	5	6	7	8	9	10	11	12	Average за год
2003	4	3,2	2,1	2,1	2,2	2,7	2,1	1,8	2,4	2	2,1	3,3	2,5
2004	1,1	2,3	2,7	2,9	2,7	3,1	1,5	2,7	2,5	3,3	3,1	2,7	2,6
2005	2	2,4	4,2	2,7	3	2,1	2,2	2,7	2,3	2,5	2,3	2,3	2,6
2006	2,3	2,9	3,5	3,6	2,6	2,7	3,4	2,5	3,2	2,8	2,6	4,9	3,1
2007	4,7	3,7	2,7	3,4	4,2	3	1,9	2,5	2,8	2,3	3	3	3,1
2008	2,4	5,4	3,9	2,7	1,8	2,1	3,2	3,3	3,4	2,9	4,2	2,9	3,2
2009	3,7	3	3,3	4,4	3,9	3,5	2,8	3	2,2	3,3	3,2	3,6	3,3
2010	3,8	3,6	3,9	3,4	4,4	5,1	4,3	4,5	4,8	3,8	5,9	5,2	4,4
2011	5	4,8	5,6	5,1	4,7	4,5	4,1	3,7	4,2	3,8	5,7	4,1	4,6
2012	2,6	3,6	5,4	5	4,7	4,4	4	3,9	4,6	4,6	5,3	4,8	4,4
2013	4,5	4,6	6,3	5,8	5,4	4,5	4,1	4,2	3,7	5	5,1	6,1	4,9
2014	5,8	5,2	6,3	5,5	5,1	4,4	5,3	4,2	4,2	5,1	4,6	5,9	5,1
2015	5,6	4,7	5,2	4,7	5	4	5	4,5	3,8	5,5	6,2	5,6	5,0
2016	5,6	5,1	6,3	4,4	4,7	4,6	4	3,2	4	3,2	5,1	5,2	4,6
2017	4,4	6,1	4,7	5,5	5,3	4,4	3,9	3,3	4,3	4,5	4,1	3,5	4,5
2018	4,2	3,6	5,1	5	6,1	4,9	4,3	4,3	4,4	5,6	5	3	4,6
2019	4,5	5,2	5,8	4,4	4,7	4,8	4,4	4,5	4,9	4,9	4,7	5,1	4,8
2020	5,6	5,9	5,8	5,7	4,6	4,2	3,7	4,3	5,1	5	4,4	4,7	4,9
2021	4,7	5,5	5,9	5,1	4,6	4,3	5	4,3	5,3	4,7	5,6	5	5,0
2022	5,2	5,6	5,8	5,1	5,7	4,7	4,3	3,8	4,4	4,4	4,2	4	4,8
2023	5,1	5,12	6,4	5,3	4,8	5	4,1	4,4	3,7	5,5	5,5	5,7	5,1

MS Chkalova	1	2	3	4	5	6	7	8	9	10	11	12	Average за год
2003	3	3,2	2,6	2,7	2,5	2,6	2,2	1,3	1,9	1,7	2	2,7	2,4
2004	1,3	2,6	2,4	3,3	3	3,1	1,5	3	3,1	4,4	4,1	2,8	2,9
2005	2,1	2,4	4,5	3,4	3,2	3,1	2,2	2,3	2,4	2,2	2,8	2,2	2,7
2006	2,4	2,2	3,4	3,5	2,5	2	2,7	3,2	3,9	4,1	3,6	6,5	3,3
2007	5,4	4,8	4,1	4,4	4,5	2,7	1,7	3,2	3,7	3,4	4,6	4,5	3,9
2008	2,4	5,5	5	4,8	3,9	3,6	3,2	4	3,1	2,3	3,8	2,1	3,6
2009	2,7	2,3	2,7	4,8	3,8	3,7	3,2	2,7	2,2	3,4	3,3	4,1	3,2
2010	3	3,7	4,1	2,3	3,1	3,4	3,5	3,4	3,8	3,4	4,8	3,4	3,5
2011	2,4	3	3,3	3,6	2,6	2,4	2,4	2,4	2,5	1,8	3,4	2,2	2,7
2012	0,8	1,3	3	3,1	2,2	2,1	2,1	2,2	2,6	2,7	3,3	2,3	2,3
2013	3,5	4	4,4	4,3	4,1	2,8	2,7	2,9	2,6	4,1	4,2	4,6	3,7
2014	4,5	3,6	4,5	4,1	3,4	2,8	2,6	2,2	3,8	4,5	5,8	6,7	4,0
2015	6,4	5,7	6,2	5,9	5,6	4,7	5,8	5,4	4,6	6,5	6	7	5,8
2016	5,3	5,2	7,1	5	5,4	5,4	3,3	3,5	4,5	4,2	6,3	6,9	5,2
2017	5,9	6,6	5,2	7,4	6,8	5,4	5	4	5,2	4,5	3,6	3	5,2
2018	4,5	3,5	5,9	5,8	6,2	5	4,2	4,2	4,5	5,7	5,9	3,9	4,9
2019	4,4	4,4	5,8	4,2	3,9	3,5	4,6	4,7	5,5	5,3	5,3	5	4,7
2020	6,2	6	6,6	6,3	4,9	4,3	4,4	4,7	5,7	6,1	5,6	5,7	5,5
2021	5,1	6	7	5,5	5,5	4,9	4,9	4,1	5,9	5,6	6,7	5,4	5,6
2022	5	5,4	6,4	5,9	6,3	5,3	5,3	3,9	4,9	4,8	5,7	4,9	5,3
2023	7	4,8	6,8	6,1	5	5,3	4,6	4,3	4,7	6,1	6,2	7	5,7

MS Yavlenka	1	2	3	4	5	6	7	8	9	10	11	12	Average за год
2003	4,2	3,8	3,2	3,4	3,2	3,2	2,2	2,2	2,7	2,8	3	4,4	3,2
2004	1,9	2,9	3	4	3,8	3,9	2,1	2,8	3,1	4,6	4,5	2,8	3,3
2005	2,6	2,7	5,4	3,9	3,2	2,5	1,6	2,2	2,6	2,6	3,2	2,8	2,9
2006	2,6	2,7	4,1	3,2	3,5	2,5	3,3	2,6	3,8	3,8	3,1	5,5	3,4
2007	4,9	4	3,1	4,1	4,9	3,5	2,3	2,6	3,2	2,9	3,7	3,7	3,6
2008	2,1	5,1	4,4	3,9	3,4	3	2,3	3,2	2,9	3,2	4,3	2,8	3,4
2009	3,3	2,9	2,7	4,4	3,5	2,9	2,7	3	2,5	3,4	3,1	3,6	3,2
2010	3,1	3,4	4,3	3,2	3,3	3	2,5	2,9	3,3	2,7	4,9	3,8	3,4
2011	2,8	3,4	4	4	2,8	2,5	1,9	1,8	2,8	2,7	4,7	3,1	3,0
2012	1,3	1,8	3,5	4	3,2	2,8	2,3	2,5	3,3	3,3	3,7	2,3	2,8
2013	3,4	3,6	4,5	4	3,9	2,7	2,2	2,5	2,4	4	4,2	4,6	3,5
2014	4,1	3,1	4,7	4,8	3,3	2,5	2,7	1,9	2,1	3,7	2,9	3,2	3,3
2015	4,1	3,3	3,7	3,8	3,4	2,7	3,7	3,1	2,8	4,4	4	4,3	3,6
2016	3,3	3,2	4,2	3,5	3,2	3,3	2,6	2,1	2,9	2,5	4,2	4,1	3,3
2017	4	4,5	3,4	5	4,5	3,2	2,5	2,2	2,9	3,4	3	2,4	3,4
2018	2,9	2,2	4	4,4	4,9	3,5	2,6	2,9	3,2	4,2	4,3	2,5	3,5
2019	3	3,4	4,5	3,4	3,6	3	3,1	2,6	3,6	3,6	3,7	3,8	3,4
2020	4,4	4,4	5,2	5,3	3,6	3,2	2,2	3	3,7	4	3,6	3,7	3,9
2021	3,6	4	5	4,3	3,4	2,6	2,8	2	3,5	3,5	4,5	3,4	3,6
2022	3,3	3,6	4	4	4,3	3,3	2,6	2	2,7	3,2	3,4	3	3,3
2023	4,1	3,1	4,5	4	2,9	3,3	2,5	2,4	2,4	4,3	4,1	4	3,5

APPENDIX D

Reserves of productive moisture (mm) in soil layers 0-20, 0-50 and 0-100 cm according to weather stations of the North Kazakhstan region

2018г.	May			June			July			August			October		
MS	0-100	0-50	0-20	0-100	0-50	0-20	0-100	0-50	0-20	0-100	0-50	0-20	0-100	0-50	0-20
Bulaevo	225	117	51	208	110	48	164	72	25	225	120	54	228	118	51
Blagoveshchenka	218	123	49	164	82	34	107	60	23	142	68	30	116	62	33
Yvlenko	204	99	35	146	67	22	154	81	29	153	84	33	143	84	32
Vosvshenko	173	88	35	152	98	47	48	17	6	190	106	45	167	85	35
Timiryazevo	187	115	49	197	98	38	122	42	16	111	49	21	125	49	22
Sergeevka	110	74	33	120	69	25	126	70	28	140	86	37	148	92	40
Tayynsha	176	84	32	181	83	33	101	46	20	226	81	41	160	73	26
Saumalcol	165	86	33	147	69	25	137	62	25	149	74	29	157	81	38
Chkalovo	119	59	25	227	108	46	100	36	16	244	124	50	141	70	29
Ruzaevka	122	77	31	118	76	37	100	52	19	144	93	42	99	68	32
Smirnovo	75	34	11	80	32	11	64	24	11	65	36	18	70	31	12
Mamlyutka	163	101	47	131	77	35	93	48	21	128	77	35	144	68	36

2019г.	May			June			July			August			October		
MS	0-100	0-50	0-20	0-100	0-50	0-20	0-100	0-50	0-20	0-100	0-50	0-20	0-100	0-50	0-20
Bulaevo	213	108	41	224	107	36	200	105	45	170	81	30	218	117	49
Blagoveshchenka	153	84	33	177	91	33	172	95	44	103	71	25	206	113	46
Yvlenko	134	65	21	131	58	18	110	52	19	129	57	27	152	81	30
Vosvshenko	166	84	35	159	78	33	98	51	28	45	15	3	92	59	30
Timiryazevo	141	68	30	117	53	17	84	27	8	94	41	18	130	75	47
Sergeevka	165	80	24	159	69	27	80	43	22	75	54	28	188	99	41
Tayynsha	166	79	34	208	99	42	107	45	18	67	21	14	129	79	37
Saumalcol	132	66	26	143	64	16	75	38	12	50	32	15	139	74	30
Chkalovo	138	64	28	178	88	34	47	11	6	66	29	13	138	93	40
Ruzaevka	134	79	28	157	72	22	131	52	14	114	38	9	155	90	38
Smirnovo	136	71	22	98	47	19	65	10	0	61	25	9	51	22	18
Mamlyutka	117	63	26	168	99	41	119	65	26	115	61	26	157	96	42

2020г.	May			June			July			August			October		
MS	0-100	0-50	0-20	0-100	0-50	0-20	0-100	0-50	0-20	0-100	0-50	0-20	0-100	0-50	0-20
Bulaevo	174	78	21	178	76	22	169	80	30	191	90	34	189	92	34
Blagoveshchenka	201	101	40	126	49	18	78	31	10	82	36	14	90	46	24
Yvlenko	177	84	27	141	65	19	112	44	11	86	31	13	62	30	14
Vosvshenko	108	50	15	114	50	15	54	13	1	35	9	1	45	12	2
Timiryazevo	170	90	37	172	84	28	183	97	39	180	86	32	176	91	32
Sergeevka	190	101	41	160	76	28	150	67	21	172	91	38	154	78	29
Tayynsha	113	65	27	99	40	12	57	20	6	35	13	4	63	26	9
Saumalcol	109	45	16	91	45	16	116	61	26	102	50	21	96	46	17
Chkalovo	130	44	15	77	25	11	73	27	12	53	25	11	63	12	6
Ruzaevka	118	70	27	81	40	16	97	47	19	90	39	12	100	59	21
Smirnovo	86	47	22	66	30	10	70	27	7	61	24	7	44	15	6
Mamlyutka	127	68	27	94	47	17	74	36	10	95	56	24	99	53	20

2021г.	May			June			July			August			October		
MS	0-100	0-50	0-20	0-100	0-50	0-20	0-100	0-50	0-20	0-100	0-50	0-20	0-100	0-50	0-20
Bulaevo	174	78	21	119	60	24	119	64	19	76	40	20	97	34	7
Blagoveshchenka	178	95	36	129	56	19	101	49	24	89	46	27	75	36	17
Yvlenko	103	46	16	56	14	4	88	46	16	68	42	26	62	24	8
Vosvshenko	122	64	24	110	51	19	68	25	6	37	15	4	45	22	8
Timiryazevo	157	85	26	129	48	8	92	32	11	61	22	4	98	44	21
Sergeevka	156	69	21	117	39	3	167	83	33	133	68	33	116	49	16
Tayynsha	126	70	28	104	46	16	109	43	11	165	81	36	98	46	20
Saumalcol	93	23	3	86	22	0	20	0	0	25	1	0	42	19	9
Chkalovo	130	60	22	134	48	19	70	24	9	66	26	12	88	38	18
Ruzaevka	94	64	27	86	52	24	71	35	14	65	28	10	53	28	12
Smirnovo	127	54	19	116	50	18	31	11	9	101	56	25	0	0	0
Mamlyutka	104	51	21	90	43	13	114	63	27	123	73	18	82	37	10

2022г.	May			June			July			August			October		
Station	0-100	0-50	0-20	0-100	0-50	0-20	0-100	0-50	0-20	0-100	0-50	0-20	0-100	0-50	0-20
Bulaevo	148	72	28	115	39	24	64	26	5	72	30	11	30	12	4
Blagoveshchenka	140	83	37	99	54	24	79	35	18	73	29	12	72	28	14
Yvlenko	97	50	19	90	36	10	91	49	22	71	31	8	74	38	18
Vosvshenko	95	42	16	79	37	11	41	17	7	47	15	5	56	36	17
Timiryazevo	132	78	35	136	72	27	67	22	7	47	10	2	70	19	3
Sergeevka	140	63	18	139	80	35	169	105	42	89	46	16	41	6	1
Tayynsha	106	58	24	*			75	26	10	52	18	6	57	13	2
Saumalcol	67	29	8	95	47	17	86	31	14	68	18	2	65	9	0
Chkalovo	77	26	12	73	27	12	84	34	15	84	32	15	74	31	12
Ruzaevka	63	44	19	53	32	15	72	41	17	77	47	16	30	10	2
Smirnovo	89	30	14	96	27	7	56	20	6	37	12	2	29	23	15
Mamlyutka	145	84	36	91	49	17	145	84	36	92	48	17	134	73	30
2023г.	May			June			July			August			October		
Station	0-100	0-50	0-20	0-100	0-50	0-20	0-100	0-50	0-20	0-100	0-50	0-20	0-100	0-50	0-20
Bulaevo	172	85	23	*			104	41	14	139	53	29	92	20	37
Blagoveshchenka	150	87	36	168	86	41	78	36	18	83	42	20	101	54	26
Yvlenko	131	63	24	151	82	32	48	22	7	31	16	5	82	48	18
Vosvshenko	111	61	26	145	93	44	46	12	5	75	48	32	39	30	16
Timiryazevo	135	77	33	143	88	45	93	42	16	112	50	26	128	76	37
Sergeevka	144	77	31	141	66	24	127	72	32	135	76	34	173	88	36
Tayynsha	63	37	12	132	65	26	94	31	7	90	49	29	106	51	18
Saumalcol	103	44	12	132	63	28	72	27	6	80	32	11	72	35	14
Chkalovo	161	75	30	154	71	28	94	29	8	121	53	27	104	48	18
Ruzaevka	113	62	25	121	61	27	71	36	17	101	52	22	70	44	19
Smirnovo	122	55	22	98	39	14	75	26	8	68	30	11	97	47	18
Mamlyutka	138	73	32	140	77	34	107	57	24	81	39	12	107	57	24

2024г.	May			June			July			August			October		
MS	0-100	0-50	0-20	0-100	0-50	0-20	0-100	0-50	0-20	0-100	0-50	0-20	0-100	0-50	0-20
Bulaevo	137	66	23	161	52	24	112	58	27	204	107	41	169	88	30
Blagoveshchenka	215	106	43	170	82	29	210	108	43	160	87	37	152	88	39
Yvlenko	188	93	34	111	47	15	185	91	33	170	91	34	152	80	30
Vosvshenko	138	79	29	124	61	22	168	92	36	136	75	32	103	51	16
Timiryazevo	186	111	45	156	73	22	146	74	26	138	80	48	147	80	41
Sergeevka	175	87	33	163	76	22	155	85	41	156	91	40	154	71	24
Tayynsha	134	68	27	109	44	10	164	79	31	170	86	37	138	75	32
Saumalcol	162	83	33	104	51	19	148	74	28	122	71	34	117	63	23
Chkalovo	187	105	40	172	80	30	166	87	38	159	78	33	168	87	40
Ruzaevka	106	68	30	83	45	20	116	73	35	138	89	43	139	90	40
Smirnovo	146	82	33	104	47	18	103	53	20	110	51	19	92	39	14
Mamlyutka	140	77	34	140	77	34	121	69	31	90	50	21	107	57	24

APPENDIX E

Socio-economic indicators of the development of the economy of the North Kazakhstan region in 2004-2010.

Indicators	Years						
	2004	2005	2006	2007	2008	2009	2010
1	2	3	4	5	6	7	8
Socio-demographicindicators							
The population at the end of the period (year), thousand people.	665,9	663,1	661,0	653,9	597,5	592,8	589,4
Naturalpopulationgrowth, people	-678	-470	-914	-870	392	936	697
Migration of the population, people							
Ithasarrived	13 288	18 117	18 303	14 490	15 916	13 415	12 992
droppedout	21 171	20 457	19 565	20 649	21 993	19 094	17 059
Migration balance across all flows, people	-7 883	-2 340	-1 262	-6 159	-6 077	-5 679	-4 067
Number of hospital organizations, units [1])	49	49	49	49	36	36	29
Number of hospital beds, units [1)]	5 503	5 493	5 531	5 681	5 650	5 540	5 099
Number of preschool organizations, units (since 2010, including mini-centers)[2)]	31	40	45	50	53	55	535
The number of children in preschool organizations, people [2)]	4,2	5,2	5,9	6,4	7,5	7,5	17,5
Numberofschools, units[2)]	728	707	684	665	645	633	622
The number of students in schools, people [2)]	112,6	105,1	98,7	92,3	86,7	82,7	80,1
Numberofcolleges, units[3)]	35	34	33	32	31	31	31
Number of college students, people [3)]	16 267	16 988	17 301	17 610	17 979	18 744	18 105
Number of higher education institutions, units	4	4	4	4	3	3	2
Students in higher education institutions	17,1	17,0	17,9	13,9	12,1	11,0	9,4
The number of reported crimes [4)]	4 784	4 851	5 120	5 111	4 881	4 655	5 191
Standardofliving							
The cost of living, tenge	5 224	5 759	7 943	8 838	11 317	11 886	12 650

1	2	3	4	5	6	7	8
The labor market and wages							
Labor force (aged 15 years and older), thousand people	399,8	395,6	394,7	393,9	389,8	382,4	380,1
Employedpopulation, thousandpeople	367,2	364,3	366,1	366,7	365,1	358,4	358,1
Employees, thousandpeople	198,9	202,5	205,7	208,3	214,4	212,3	214,6
Self-employed workers, thousand people	168,3	161,8	160,4	158,4	150,7	146,1	143,5
Unemployedpopulation, thousandpeople	32,6	31,2	28,6	27,2	24,6	24,1	22,0
Unemployment rate, as a percentage	8,1	7,9	7,2	6,9	6,3	6,3	5,8
Youthunemployment rate ((15-24years old), as apercentage[5])	13,3	13,6	12,4	9,4	10,8	7,9	5,9
Youth unemployment rate (15-28 years old), as a percentage[6)]	12,5	12,6	11,8	9,8	8,1	7,8	7,7
The average monthly nominal salary of one employee, tenge[7)]	19 166	23 011	27 182	34 522	39 790	45 755	51 689
Minimumwage, tenge	6600	7000	9 200	9 752	10515	13470	14952
Nationaleconomy							
Gross regional product, million tenge[8)]	151 916,0	184 672,3	236 876,6	320 390,7	403 003,3	403 921,1	466 955,2
Gross regional product per capita thousand tenge[8)]	226,7	277,9	357,8	487,4	619,0	678,7	790,1
Investments in fixed assets, million tenge	18 186,0	37 229,0	34 328,0	37 288,0	41 279,0	49 505,0	51 203,0
Number of registered legal entities (at the end of the year)	6721	7151	7492	7898	8235	8 806	8 599
Number of active legal entities (at the end of the year)	5522	5988	5640	5538	5449	5 928	5 513
Internal costs for research and development (hereinafter referred to as R&D), million tenge	145,7	63,7	68,3	94,3	131,1	129,8	112,1
The number of employees who carried out	281	230	216	147	200	136	106

1	2	3	4	5	6	7	8
NIOKR, human							
Real sector of the economy							
The volume of production of industrial products (goods, services), million tenge	36 494,6	40 897,5	47 451,4	53 203,3	71 351,0	78 110,0	85 111,4
including: mining, milliontenge	57,9	117,7	392,1	500,4	210,1	275,9	387,8
manufacturingindustry	27 778,9	30 439,9	34 379,9	38 367,3	53 395,8	58 465,6	61282,13
foodproduction, milliontenge	15 368,8	17 244,3	20 143,6	22 397,8	32 547,0	34 710,3	35 661,0
beverageproduction, milliontenge	296,2	389,2	397,4	430,9	609,4	576,9	706,3
lightindustry, milliontenge	1 080,0	711,4	462,2	464,6	505,7	457,3	620,9
production of wood products and their care, except furniture; production of straw and weaving products materials, million tenge	103,9	172,4	182,5	249,2	340,5	236,3	448,6
production of chemical industry products, million tenge	50,5	65,1	64,8	302,6	412,5	922,1	465,0
production of other non-metallic mineral products, million tenge	316,3	703,5	902,9	1 639,9	1 866,6	942,0	1 083,8
metallurgicalproduction, milliontenge	11,3	19,4	28,2	113,7	272,8	416,6	665,0
production of finished metal products, except machinery and equipment, million tenge	581,2	620,5	1 003,1	1 631,1	3 061,7	565,0	724,7
production of machinery and equipment not included in other groupings, million tenge	4 174,1	3 156,6	1 767,6	2 209,8	2 309,8	4 973,3	5 460,1
production of cars, trailers and semi-trailers, million tenge	76,6	814,8	2 760,3	751,0	607,1	1 752,1	1 838,0
production of other vehicles, million tenge	0,4	2,5	8,7	1 093,1	1 758,0	3 350,8	3 943,8

1	2	3	4	5	6	7	8
furnitureproduction, milliontenge	430,0	673,0	679,3	491,6	290,7	336,1	336,7
Supply of electricity, gas, steam, hot water and air-conditioned air, million tenge	7 405,7	8 843,3	10 225,0	11 603,4	14 224,9	16 379,9	19 358,0
Water supply; waste collection, treatment and disposal, pollution control activities, mln. tenge	1 252,2	1 496,6	2 454,5	2 732,2	3 520,1	2 988,6	4 083,5
Gross output of agricultural products (services), million tenge	85 129,5	89 030,9	95 885,5	131 091,0	190 245,7	214 391,0	199 178,4
including: cropproduction	60 274,2	62 192,5	67 519,3	98 591,4	142 739,4	163 355,0	121 942,6
animalhusbandry	24 762,6	26 695,2	28 360,7	32 322,5	47 331,8	50 796,3	77 092,3
Gross harvest of major crops, thousand tons							
cereals (including rice) and legumes	2 782,4	3 493,2	4 613,0	5 027,9	4 550,2	5 620,8	3 730,4
sunflowerseeds	2,3	9,8	8,8	2,9	6,8	14,4	17,1
potatoes	281,2	402,3	371,2	363,4	406,5	454,0	264,1
andvegetables	113,4	141,0	118,5	121,0	148,2	157,3	130,6
Yields of major crops, quintals per hectare							
cereals (including rice) and legumes	9,3	11,2	14,5	15,1	12,4	14,5	9,7
sunflowerseeds	5,2	8,3	4,0	6,2	5,6	3,7	3,2
potatoes	124,0	164,0	166,0	167,0	157,0	170,0	99,0
areopen-groundvegetables	287,0	284,0	292,0	310,0	315,0	323,0	270,0
The number of livestock and poultry, at the end of the year, thousand heads							
ofcattle	324,8	332,0	338,5	344,4	351,7	355,2	356,2
sheep and goats	181,9	196,8	220,6	234,0	246,5	258,7	279,0

1	2	3	4	5	6	7	8
pigs	204,3	204,4	224,1	240,9	247,6	254,7	261,0
horses	74,0	77,0	80,0	83,7	88,8	92,4	96,7
poultry, thousand heads	2 112,9	2 218,6	2 559,9	2 604,0	2 709,1	3 033,8	3 102,1
The volume of completed construction works (services), million tenge	4 000,0	6 889,0	8 706,0	13 001,0	14 800,0	20 044,0	22 534,0
The total area of commissioned residential buildings, thousand square meters of total area	62,3	120,2	148,6	143,2	216,5	107,3	103,7
Commissioning of social and cultural facilities:							
The number of student places in commissioned educational schools	150	520	270	2 212	360	480	250
The number of places in pre-school organizations put into operation	-	…	240	275	432	320	-
Commissioning of healthcare facilities:							
Number of beds in commissioned hospitals	95	100	400	100	-	-	100
The number of visits per shift in commissioned outpatient clinics	230	280	150	200	-	150	-
Passengers transported, million people 12)	374,4	329,0	329,8	334,2	332,0	344,9	27,4
Passenger turnover, million pkm 12)	2 217,9	2 057,8	1 987,2	2 070,5	2 055,3	2 039,5	638,6
Transported (transported) cargo, baggage, cargo baggage, million tons 12)	35,0	35,4	36,8	37,3	37,1	36,4	8,4
Cargo turnover, billion tons-km.12)	2,5	2,4	2,5	2,7	2,6	2,6	4,9
The volume of communication services, million tenge	2 242,5	2 551,5	3 344,5	3 709,9	4 271,1	4 627,4	4 878,8
The number of registered small and medium-sized businesses,	27 950	29 868	26 732	30 532	26 541	32 749	27 950

1	2	3	4	5	6	7	8
finally, the year of units	-						
Number of operating small and medium-sized businesses, 0 units at the end of the year)	-	21 921	21 210	18 858	23 030	20 911	19 797
The number of people employed in small and medium-sized enterprises, on average per year, people	-	77 377	82 401	82 253	80 971	94 250	106 350
Output of products by all subjects of small and medium-sized enterprises, million tenge	-	60 857	77 144	103 770	148 970	158 543	190 734
Fixed assets in the economy at initial cost (at the end of the year), million tenge	123 050,8	149 710,6	184 744,2	248 857,6	325 264,1	405 492,2	457 528,7
Trading							
Retail trade volume 11) in value terms , million tenge	32 191,0	36 444,5	39 074,9	43 039,3	51 738,5	52 313,7	76 433,4
Trade turnover in foreign currency (exports), USD million	532,6	754,4	906,5	1 172,4	1 454,8	739,4	686,2
Trade turnover in foreign currency (imports), USD million	439,2	594,1	669,1	872,8	1 153,8	602,6	541,9
Prices							
Consumer price index (at the end of the period, as a percentage of December of the previous year)	106,4	107,2	108,1	118,7	109,1	105,9	107,5
food price index	106,6	108,2	105,5	129,6	110,8	102,7	110,3
food price index non-food price index price	106,3	104,7	106,4	108,4	106,5	108,1	104,5
index for paid services for the population	106,2	107,8	114,6	113,2	109,1	108,5	106,4
Price index of manufacturing enterprises of industrial products (goods, services) (at the end of the period, as a percentage of December	107,8	108,4	100,7	127,1	119,1	97,5	116,0

1	2	3	4	5	6	7	8
the previous year)							
The price index for the purchase of industrial products by industrial enterprises (at the end of the period, as a percentage of December of the previous year)	105,4	96,0	108,4	129,9	106,9	88,8	141,5
The price index in construction (at the end	105,3	106,1	104,6	104,6	109,4	103,4	103,9
of the period, as a percentage of December of the previous year)							
The price index of agricultural producers (at the end of the period, as a percentage of December of the previous year)	99,0	93,0	108,4	142,4	124,6	82,0	124,8
Price index for forestry products and services (as a percentage of the corresponding period of the previous year)	-	-	104,0	100,1	112,1	102,4	106,7
The price index for fishery and fish farming products (as a percentage of the corresponding period of the previous year)	-	-	-	-	-	-	125,7
Index of tariffs for the transportation of goods by all modes of transport (at the end of the period, as a percentage of December of the previous year)	100,6	122,1	108,7	102,6	152,0	102,6	100,0
Index of tariffs for postal and courier services for legal entities (at the end of the period, as a percentage of December of the previous year)	-	-	185,2	100,5	119,9	102,4	105,2
The index of tariffs for communication services for	-	-	101,7	99,6	102,1	117,9	94,3

1	2	3	4	5	6	7	8
legal entities (at the end of the period, as a percentage of December of the previous year)							
Wholesale price index of goods and products (at the end of the period, as a percentage of December of the previous year)	-	-	107,0	109,1	106,0	95,2	104,7

1) For 2008-2010 and since 2014, according to the data of the North Kazakhstan branch of the Republican State Enterprise on the right of economic management "National Scientific Center for Health Development named after Salidatkairbekova" of the Ministry of Health of the Republic of Kazakhstan.
2) According to the Ministry of Education of the Republic of Kazakhstan.
3) According to the Law of the Republic of Kazakhstan "On Education", vocational lyceums have been transformed into colleges, and therefore the number of colleges has increased since the 2013/14 academic year.
4) According to the data of the Committee on Legal Statistics and Special Accounts of the Prosecutor General's Office of the Republic of Kazakhstan.
5) The age of attribution to youth according to the standards of the International Labour Organization.
6)The age of attribution to youth according to the Law of the Republic of Kazakhstan "On State youth policy in the Republic of Kazakhstan".

7) Excluding small businesses engaged in entrepreneurial activities.
8) Calculations of data for 2017-2019 were made in accordance with the new Methodology for assessing the unobserved economy, registered with the Ministry of Justice of the Republic of Kazakhstan No. 19215 dated 08/7/2019.
9) Data for 1991-1992 in millions of rubles.
10) In accordance with international practice, in order to apply uniform approaches to the formation of indicators on the number of SME entities and to eliminate discrepancies with the data of the State Revenue Committee of the Ministry of Finance of the Republic of Kazakhstan, starting from February 1, 2015, the indicator number of "active" entities, instead of "active", is published.
11) Data for 1991-1998 include the volume of catering services.
12) For 1991-2009, the data were compiled taking into account the assessment of the amount of work performed by individual entrepreneurs engaged in commercial transportation. 3a In 2010-2021, the data were recalculated taking into account changes in the methodological approach to the formation of indicators of the activities of individual entrepreneurs engaged in commercial transportation of goods and passengers by road transport.
From 2022 onwards, the data were formed taking into account changes in the methodological approach to the formation of indicators of the activities of individual entrepreneurs engaged in commercial transportation of goods and passengers by road.
Note: In some cases, minor discrepancies between the total and the sum of the terms are explained by rounding up the data.

APPENDIX J

Socio-economic indicators of the development of the economy of the North Kazakhstan region for 2011-2015.

Indicators	Years				
	2011	2012	2013	2014	2015
1	2	3	4	5	6
Socio-demographic indicators					
The population at the end of the period (year), thousand people.	583,8	579,7	575,9	571,8	569,6
Natural population growth, people	582	831	972	1 268	1 410
Migration of the population, people					
arrived	10 744	10 991	10 274	13 216	20 426
and left	16 975	15 894	15 001	18 599	24 072
Migration balance across all flows, people	-6 231	-4 903	-4 727	-5 383	-3 646
Number of hospital organizations, units [1)]	32	31	35	28	27
Number of hospital beds, units [1)]	5 017	4 494	4 441	4 077	3 900
Number of preschool organizations, units (since 2010, including mini-centers)[2)]	560	576	575	566	558
The number of children in preschool organizations, people [2)]	19,0	20,9	21,6	22,4	22,1
Number of schools, units [2)]	612	596	579	557	542
The number of students in schools, people [2)]	77,2	74,8	72,9	71,7	71,3
Number of colleges, units [3)]	30	28	29	25	25
Number of college students, people [3)]	17 499	16 118	15 027	13 430	12 193
Number of higher education institutions, units	2	2	2	2	2
Students in higher education institutions	8,4	7,2	5,8	4,9	4,6
The number of reported crimes [4)]	7 189	7 875	9 669	9 715	10 637
Standard of living					
The cost of living, tenge	14 360	14 865	16 272	17 620	18 200
The labor market and wages					
Labor force (aged 15 years and older), thousand	366,2	349,6	346,9	330,3	329,6

1	2	3	4	5	6
human					
Employed population, thousand people	346,3	331,2	329,3	313,8	312,8
Employees, thousand people	213,7	213,7	215,3	219,2	215,1
Self-employed workers, thousand people	132,6	117,5	114,0	94,6	97,7
Unemployed population, thousand people	19,9	18,3	17,6	16,5	16,8
Unemployment rate, as a percentage	5,4	5,2	5,1	5,0	5,1
Youth unemployment rate (15-24 years old), as a percentage [5)]	5,8	4,3	3,7	5,0	4,2
Youth unemployment rate (15-28 years old), as a percentage [6)]	7,3	6,5	7,6	3,8	3,0
The average monthly nominal salary of one employee, tenge [7)]	61 712	68 921	74 853	81 062	84 324
Minimum wage, tenge	15 999	17 439	18 660	19 966	21 364
National economy					
Gross regional product, million tenge [8)]	666 595,6	679 610,3	749 879,0	795 551,2	837 179,9
Gross regional product per capita thousand tenge [8)]	1 136,7	1 168,6	1 298,2	1 386,6	1 467,2
Investments in fixed assets, million tenge	68 990,0	97 999,0	101 758,0	116 943,0	155 431,0
Number of registered legal entities (at the end of the year)	8 885	9 148	9 367	9 489	9 548
Number of active legal entities (at the end of the year)	5 498	5 458	5 741	5 840	6 316
Internal costs for research and development (hereinafter referred to as R&D), million tenge	101,9	221,4	209,6	236,3	224,5
The number of employees who carried out NIOKR, people	77	325	312	229	182
The real sector of the economy					
The volume of production of industrial products (goods, services), million tenge	116 097,1	125 888,6	150 398,1	161 201,4	166 903,7
including: mining industry	799,3	1 540,4	1 785,9	2 001,1	1 558,1

1	2	3	4	5	6
and quarry development, million tenge					
manufacturing industry	88 492,0	97 771,1	115 583,1	119 391,3	120 537,4
food production, million tenge	47 652,6	53 440,7	64 786,9	73 601,6	69 362,40
beverage production, million tenge	952,3	1 513,5	1 220,3	688,2	803,4
light industry, million tenge	845,8	943,6	1 229,8	1 589,7	1 854,3
production of wooden and cork products, except furniture; production of straw products and materials for weaving, million tenge	600,5	1 155,3	956,8	811,4	1 382,9
production of chemical industry products, million tenge	68,7	153,8	184,1	144,7	579,9
production of other non-metallic mineral products, million tenge	1 158,0	1 370,9	1 535,9	2 741,9	4 399,3
metallurgical production, million tenge	691,4	620,8	2 321,1	1 976,4	2 564,5
production of finished metal products, except machinery and equipment, million tenge	1 505,8	2 657,4	3 923,9	4 314,4	4 087,1
production of machinery and equipment not included in other groupings, million tenge	6 714,5	7 558,0	7 904,4	8 505,9	7 699,5
production of cars, trailers and semi-trailers, million tenge	1 524,4	3 176,8	3 258,7	2 249,1	1 827,2
production of other vehicles, million tenge	7 434,1	3 955,2	4 001,0	716,5	3 456,4
furniture production, million tenge	611,1	1 114,2	965,6	765,8	661,6
Supply of electricity, gas, steam, hot water and air-conditioned air, million tenge	23 220,1	22 535,4	27 250,2	32 904,4	38 495,5
Water supply; waste collection, treatment and disposal, pollution control activities, mln. tenge	3 585,6	4 041,7	5 778,9	6 904,6	6 312,7
Gross output of agricultural products (services), million tenge including	405 603,8	272 266,5	330 696,5	350 269,2	380 814,2

1	2	3	4	5	6
crop	325 623,2	192 556,4	241 900,6	247 060,2	275 294,0
production and animal husbandry	79 735,3	79 489,0	88 543,6	102 737,3	104 949,8
Gross harvest of major crops, thousand tons					
cereals (including rice) and legumes	7 879,4	4 391,1	4 544,1	4 547,0	5 047,1
sunflower seeds	21,0	21,0	36,8	30,2	28,3
potatoes	491,2	476,5	500,9	517,2	533,2
and vegetables	176,5	170,0	190,3	191,9	197,6
Yields of major crops, quintals per hectare					
cereals (including rice) and legumes	20,4	11,7	12,8	14,6	15,8
sunflower seeds	7,5	9,2	10,3	7,7	8,9
potatoes	184,9	177,7	183,2	191,2	191,0
are open-ground vegetables	360,4	352,6	371,2	374,4	380,4
Number of livestock and poultry, at the end of the year, thousand heads					
of cattle	259,7	280,7	297,6	315,0	327,3
sheep and goats	288,0	315,1	331,3	352,7	365,1
pigs	221,8	213,0	195,8	173,4	167,4
horses	94,0	96,2	99,9	104,4	109,4
poultry, thousand heads	3 193,4	3 373,3	3 625,7	3 925,4	3 631,1
The volume of completed construction works (services). million tenge	22 230,1	28 041,5	35 313,5	38 511,8	54 585,5
The total area of commissioned residential buildings, thousand square meters of total area	99,0	100,6	115,0	120,1	140,4
Commissioning of social and cultural facilities:					
The number of student places in commissioned educational schools	-	330	80	-	720
The number of places put into operation	585	464	64	80	650

1	2	3	4	5	6
preschool organizations					
Commissioning of healthcare facilities:					-
Number of beds in commissioned hospitals	100	-	-	-	-
The number of visits per shift in commissioned outpatient clinics	500	-	-	1 000	-
Passengers transported, million people [12)]	25,3	23,6	20,2	19,3	18,5
Passenger turnover, million. pkm [12)]	735,8	867,5	841,7	933,4	846,1
Transported (transported) cargo, baggage, cargo baggage, million tons [12)]	10,4	10,3	8,8	15,2	13,3
Cargo turnover, billion tons-km.[12)]	6,4	7,3	6,4	10,0	9,4
The volume of communication services, million tenge	5 287,6	5 661,4	6 226,1	6 747,6	7 270,5
The number of registered small and medium-sized businesses, units at the end of the year	37 870	37 980	41 089	44 035	40 042
The number of operating small and medium-sized businesses, units at the end of the year [0)]	25 125	23 771	25 775	25 888	34 306
The number of people employed in small and medium-sized enterprises, on average per year, people	96 235	95 647	97 992	99 301	104 696
Output of products by all subjects of small and medium-sized enterprises, million tenge	259 814	268 798	297 243	312 725	334 893
Fixed assets in the economy at initial cost (at the end of the year), million tenge	496 185,2	553 849,1	598 312,7	692 681,1	778 474,0
Trading					
Retail trade volume [11)] in value terms , million tenge	92 410,9	121 918,6	145 194,5	158 340,3	161 298,9
Turnover in foreign currency (exports),	142,8	239,9	212,1	177,1	138,6

1	2	3	4	5	6
millions of US dollars					
Trade turnover in foreign currency (imports), USD million	727,9	906,9	872,7	725,3	459,1
Prices					
Consumer price index (at the end of the period, as a percentage of December of the previous year)	108,0	106,0	105,3	107,2	112,2
food price index	107,7	105,6	104,3	108,0	111,9
food price index non-food price index price	103,9	103,1	102,7	108,1	122,5
index for paid services for the population	112,7	109,4	108,9	105,6	103,3
Price index of manufacturing enterprises of industrial products (goods, services) (at the end of the period, as a percentage of December of the previous year)	110,9	109,9	106,8	107,9	102,8
Price index of purchase of industrial products by industrial enterprises (at the end of the period, as a percentage of December of the previous year)	93,4	142,2	92,1	117,6	105,7
Construction price index (at the end of the period, as a percentage of December of the previous year)	104,6	104,0	102,9	104,3	103,2
Agricultural producer price index (at the end of the period, as a percentage of December of the previous year)	94,4	140,6	79,7	120,8	100,7
Price index for forestry products and services (as a percentage of the corresponding period of the previous year)	101,2	101,9	100,6	103,3	100,0
The price index for fishery and fish farming products (as a percentage of the corresponding period of the previous year	107,4	130,1	105,8	109,9	107,3
The index of tariffs for the transportation of goods by all modes of transport (at the end of the period, in	101,1	114,0	102,4	101,0	100,8

1	2	3	4	5	6
The index of tariffs for postal and courier services for legal entities (at the end of the period, as a percentage of December of the previous year)	97,1	121,2	106,8	129,4	123,2
The index of tariffs for communication services for legal entities (at the end of the period, as a percentage of December of the previous year)	99,5	99,5	92,7	100,6	94,7
The price index of wholesale sales of goods, products (at the end of the period, as a percentage of December of the previous year)	104,7	111,9	99,3	111,4	100,4

APPLICATION I

Socio-economic indicators of the development of the economy of the North Kazakhstan region for 2016-2020.

Indicators	Годы				
	2016	2017	2018	2019	2020
1	2	3	4	5	6
Socio-demographic indicators					
The population at the end of the period (year), thousand people.	563,3	558,6	554,5	548,8	543,7
Natural population growth, people	950	747	626	181	-633
Migration of the population, people					
arrived	16 640	23 053	20 703	23 894	16 967
and left	23 884	28 516	25 400	29 850	21 354
Migration balance across all flows, people	-7 244	-5 463	-4 697	-5 956	-4 387
Number of hospital organizations, units [1)]	25	24	23	22	24
Number of hospital beds, units [1)]	3 847	3 672	3 615	3 439	4 818
The number of preschool organizations, units (since 2010, including mini-centers)[2)]					
The number of children in preschool organizations, people [2)]	22,8	21,9	20,1	19,5	18,4
Number of schools, units [2)]	526	506	494	484	480
Number of students in schools, people [2)]	71,7	71, 6	71,4	72,6	74,8
Number of colleges, units [3)]	25	25	25	25	25
Number of college students, people[3)]	12 073	12 260	11 850	10 951	10 724
Number of higher education institutions, units	2	2	2	2	2
Students in higher education institutions	5,2	6,0	7,5	7,8	8,0
The number of reported crimes [4)]	9 292	7 528	7 157	6 594	4 973
Standard of living					
The cost of living, tenge	20 301	21 726	25 069	27 388	31 201
The labor market and wages					
Labor force (aged 15 years and older), thousand	318,9	310,3	311,3	308,3	304,4

1	2	3	4	5	6
human					
Employed population, thousand people	303,1	295,2	296,2	293,4	289,3
Employees, thousand people	211,5	212,8	213,9	214,0	214,1
Self-employed workers, thousand people	91,6	82,3	82,3	79,4	75,2
Unemployed population, thousand people	93,7	89,9	100,0	96,4	94,7
Unemployment rate, as a percentage	5,0	4,9	4,9	4,8	5,0
Youth unemployment rate (15-24 years old), as a percentage [5)]	4,9	4,2	4,0	3,6	6,6
Youth unemployment rate (15-28 years old), as a percentage [6)]	3,0	2,7	3,0	3,0	3,9
The average monthly nominal salary of one employee, tenge [7)]	97 344	104 139	110 686	130 233	157 497
Minimum wage, tenge	22 859	24 459	28 284	42 500	42 500
National economy					
Gross regional product, million tenge [8)]	918 236,9	1113959,4	1 212 007,8	1 382 322,2	1 571 903,6
Gross regional product per capita thousand tenge [8)]	1 621,0	1 985,9	2 177,7	2 505,9	2 877,7
Investments in fixed assets, million tenge	167 066,2	191 689,5	214 181,2	234 490,1	286 251,5
Number of registered legal entities (at the end of the year)	10 016	10 322	10 445	10 303	10 294
Number of active legal entities (at the end of the year)	6 749	7 252	7 473	7 862	8 186
Internal costs for research and development (hereinafter referred to as R&D), million tenge	180,2	185,2	226,3	241,3	339,4
The number of employees who carried out NIOKR, human	135	93	90	92	120
The real sector of the economy					
The volume of production of industrial products (goods, services), million tenge	198 031,9	240 530,4	243 039,1	263 576,0	315 516,1
including: mining industry	3 170,8	2 063,8	2 760,0	4 594,0	7 127,8

1	2	3	4	5	6
and quarry development, million tenge					
manufacturing industry	144 188,8	171 909,2	171 240,9	195 535,4	241 422,8
food production, million tenge	87 052,9	98 497,4	102 119,4	122 478,7	142 235,1
beverage production, million tenge	1 595,2	2 169,1	x	1 651,8	2 789,4
light industry, million tenge	2 467,2	5 241,6	1 854,0	1 602,7	2 028,1
production of wooden and cork products, except furniture; production of straw products and materials for weaving, million tenge	1 327,1	1 169,0	1 910,4	1 448,6	1 241,9
production of chemical industry products, million tenge	952,5	1 769,9	1 349,5	1 216,5	2 991,3
production of other non-metallic mineral products, million tenge	4 701,6	6 192,3	8 909,5	8 090,7	10 364,4
metallurgical production, million tenge	1 541,1	213,6	524,9	1 643,5	3 951,6
production of finished metal products, except machinery and equipment, million tenge	5 859,8	4 531,2	3 576,7	5 421,8	5 723,4
production of machinery and equipment not included in other groupings, million tenge	10 031,1	10 399,6	7 386,9	9 132,9	9 477,7
production of cars, trailers and semi-trailers, million tenge	801,8	2 438,9	1 531,5	361,3	311,7
production of other vehicles, million tenge	4 945,4	14 209,2	10 406,6	2 977,6	11 743,1
furniture production, million tenge	486,7	1 029,8	1 117,7	1 609,3	1 793,0
Supply of electricity, gas, steam, hot water and air-conditioned air, million tenge	43 354,3	57 969,9	59 489,1	53 005,1	55 858,3
Water supply; waste collection, treatment and disposal, pollution control activities, mln. tenge	7 318,0	8 587,5	9 549,1	10 441,5	11 107,2
Gross output of agricultural products (services), million tenge	411 485,6	498 410,4	514 686,8	610 701,3	777 134,7
including: crop production	289 839,3	361 264,7	366 165,6	450 295,5	598 313,9

1	2	3	4	5	6
animal husbandry	121 000,3	136 319,7	147 714,5	159 332,3	178 087,7
Gross harvest of major crops, thousand tons					
cereals (including rice) and legumes	5 051,2	5 037,6	4 322,7	4 129,1	4 229,0
sunflower seeds	47,7	98,6	74,0	32,7	26,0
potatoes	523,0	502,6	590,0	605,5	592,3
and vegetables	203,1	179,1	207,8	203,7	204,3
Yields of major crops, quintals per hectare					
cereals (including rice) and legumes	15,7	16,3	15,5	14,4	14,3
sunflower seeds	11,0	13,9	11,0	9,8	11,7
potatoes	189,7	183,1	167,6	179,8	181,2
are open-ground vegetables	386,4	358,6	333,2	330,8	331,1
The number of livestock and poultry, at the end of the year, thousand heads					
of cattle	330,4	343,5	355,5	365,5	377,7
sheep and goats	373,4	386,6	404,2	419,3	433,4
pigs	141,8	142,0	149,6	173,9	180,4
horses	111,5	115,5	123,9	130,9	135,7
poultry, thousand heads	4 018,8	4 295,3	4 635,4	4 617,1	3 113,3
The volume of completed construction works (services). million tenge	58 635,9	65 476,8	79 406,2	88 069,8	97 255,1
The total area of commissioned residential buildings, thousand square meters of total area	164,3	200,1	217,8	250,5	306,1
Commissioning of social and cultural facilities:					
The number of student places in commissioned educational schools	1 090	-	-	600	300
The number of places in pre-school organizations put into operation	648	270	140	46	46

1	2	3	4	5	6
Commissioning of healthcare facilities:					
Number of beds in commissioned hospitals	-	-	43	-	-
The number of visits per shift in commissioned outpatient clinics	50				
Passengers transported, million human [12])	16,1	15,7	16,4	16,3	10,1
Passenger turnover, million pkm [12])	1 032,4	1 055,4	927,6	695,0	322,0
Transported (transported) cargo, baggage, cargo baggage, million tons [12])	17,4	20,0	20,1	17,1	22,9
Cargo turnover, billion tons-km.[12])	11,6	13,0	18,9	10,8	10,5
The volume of communication services, million tenge	7 477,1	7 782,3	8 378,9	8 628,7	9 320,4
The number of registered small and medium-sized businesses, units at the end of the year	37 528	36 656	36 154	35 260	34 719
Number of operating small and medium-sized businesses, units at the end of the year [0])	27 652	27 587	28 969	30 071	30 331
The number of people employed in small and medium-sized enterprises, on average per year, human	102 476	102 393	105 062	107 534	107 008
Output of products by all subjects of small and medium-sized enterprises, million tenge	374 662	490 388	570 829	647 121	776 754
Fixed assets in the economy at initial cost (at the end of the year), million tenge	923 208,6	950 099,2	1 051 061,5	1 132 328,1	1 281 701,2
Trading					
Retail trade volume [11]) in value terms , million tenge	194 784,6	220 123,5	261 554,3	279 805,5	242 068,9
Trade turnover in foreign currency (exports), USD million	150,7	167,0	200,2	236,8	245,5

1	2	3	4	5	6
Trade turnover in foreign currency (imports), USD million	352,0	438,7	367,5	389,9	533,2
Prices					
Consumer price index (at the end of the period, as a percentage of December of the previous year)	108,2	107,1	105,7	105,5	107,2
food price index	109,6	105,8	106,1	109,3	111,0
price index for non-food products	109,5	108,1	106,3	104,4	105,4
price index for paid services for the population	105,4	107,8	104,5	101,9	103,9
Price index of manufacturing enterprises of industrial products (goods, services) (at the end of the period, as a percentage of December of the previous year)	108,4	103,8	102,0	103,8	110,1
The price index for the purchase of industrial products by industrial enterprises (at the end of the period, as a percentage of December of the previous year)	112,3	106,4	111,7	111,0	106,9
The price index in construction (at the end of the period, as a percentage of December of the previous year)	105,0	105,7	101,5	101,3	99,4
The price index of agricultural producers (at the end of the period, as a percentage of December of the previous year)	106,5	101,4	109,2	120,2	123,3
Price index for forestry products and services (as a percentage of the corresponding period of the previous year)	102,9	107,3	100,2	104,1	100,2
The price index for fishery and fish farming products (as a percentage of the corresponding period of the previous year	104,8	96,4	100,6	108,7	98,9
The index of tariffs for the transportation of goods by all modes of transport (at the end of the period, as a percentage of December of the previous year)	105,9	101,5	100,1	100,4	100,3

1	2	3	4	5	6
Price index for forestry products and services (as a percentage of the corresponding period of the previous year)	127,2	101,3	103,5	103,1	100,1
The price index for fishery and fish farming products (as a percentage of the corresponding period of the previous year	100,3	102,3	100,7	100,1	100,0
The index of tariffs for the transportation of goods by all modes of transport (at the end of the period, as a percentage of December of the previous year)	108,8	105,9	105,1	104,4	108,6

APPENDIX K

Socio-economic indicators of the development of the economy of the North Kazakhstan region for 2021-2023.

Indicators	Годы		
	2021	2022	2023
1	2	3	4
Socio-demographic Indicators			
The population at the end of the period (year), thousand people.	676,7	534,1	530,1
Natural population growth, human	-1932	-362	-359
Population migration, human			
arrivals	13 818	14 262	16 666
and departures	18 573	18 903	20 322
Migration balance across all flows, human	-4 755	-4 641	-3 656
Number of hospital organizations, units [1])	24	24	25
Number of hospital beds, units [1])	5 119	3 598	3 396
Number of preschool organizations, units (since 2010, including mini-centers)[2])	473	465	461
The number of children in preschool organizations, human [2])	18,1	18,0	16,4
Number of schools, units [2])	464	467	463
Number of students in schools, human [2])	73,6	73,8	75,9
Number of colleges, units [3])	23	24	24
Number of college students, human [3])	10 828	10 903	11 134
Number of higher education institutions, units	2	2	2
Students in higher education institutions	7,3	6,5	6,2
The number of registered crimes is [4])	4 716	4 583	3 762
Standard of living			
The cost of living, tenge	35 660	42 821	47 845
The labor market and wages			
Labor force (aged 15 years and older), thousand human	301,9	293,3	288,4
Employed population, thousand people	287,2	279,1	274,5
Employees	214,1	208,0	207,5
Self-employed workers, thousand human	73,1	71,1	67,0

1	2	3	4
Unemployed population, thousand people	14,7	14,2	13,8
Unemployment rate, as a percentage	4,9	4,9	4,8
Youth unemployment	4,4	5,2	5,6
rate ((15-24 years old), as a percentage [5])	2,9	3,6	4,8
Youth unemployment	187 501	227 021	262 248
rate ((15-28 years old), as a percentage [6])	42 500	60 000	70 000
National economy			
Gross regional product, million tenge [8])	1 790 770,4	2 198 854,3	2 429 200,9
Gross regional product per capita thousand tenge [8])	3 313,8	4 097,7	4 565,3
Investments in fixed assets, million tenge	333 149,4	368 460,4	443 683,8
Number of registered legal entities (at the end of the year)	10 557	11 176	11 431
Number of active legal entities (at the end of the year)	8 692	9 561	9 655
Internal costs for research and development (hereinafter referred to as NIOKR), million tenge	411,1	8 839,7	1 144, 0
The real sector of the economy			
The volume of production of industrial products (goods, services), million tenge	394 666,2	519 686,1	674 861,9
including: mining and quarrying, million tenge	11 916,4	18 454,2	16 154,4
manufacturing industry	305 998,7	429 099,5	571 342,1
food production, million tenge	168 629,2	239 918,8	269 189,7
beverage production, million tenge	3 183,1	13 502,5	13 391,6
beverage production, million tenge	3 183,1	13 502,5	13 391,6
light industry, million tenge	4 169,9	6 797,6	9 264,7
production of wooden and cork products, except furniture; production of straw products and materials for weaving, million tenge	2 384,4	3 885,0	7 053,3
production of chemical industry products, million tenge	3 670,8	8 217,3	11 876,1
production of other non-metallic mineral products, million tenge	9 411,4	12 482,5	17 834,7

1	2	3	4
tenge			
metallurgical production, million tenge	4 776,4	5 994,1	6 704,2
production of finished metal products, except machinery and equipment, million tenge	7 575,9	8 080,5	6 029,3
production of machinery and equipment not included in other groupings, million tenge	22 733,7	48 853,3	77 047,2
production of cars, trailers and semi-trailers, million tenge	25,7	193,4	4 170,4
production of other vehicles, million tenge	29 818,1	24 204,4	81 106,8
furniture production, million tenge	2 373,2	3 098,5	3 098,5
Supply of electricity, gas, steam, hot water and air-conditioned air, million tenge	60 315,7	53 477,4	69 050,0
Water supply; waste collection, treatment and disposal, pollution control activities, mln. tenge	16 435,5	18 655,0	18 315,4
Gross output of agricultural products (services), million tenge	899 984,5	1 173 602,8	757 523,8
including: crop production	679 297,0	909 326,2	577 626,4
animal husbandry	219 863,2	263 024,8	179 154,0
Gross harvest of major agricultural crops, thousand tons			
cereals (including rice) and legumes	3 426,6	4 477,7	3 747,6
sunflower seeds	69,7	152,6	127,9
potatoes	551,4	466,7	377,1
and vegetables	186,5	169,5	147,6
Yields of major crops, quintals per hectare			
cereals (including rice) and legumes	11,5	14,7	11,2
sunflower seeds	11,3	12,9	10,1
potatoes	179,8	148,3	142,5
are open-ground vegetables	332,1	293,4	272,0
The number of livestock and poultry, at the end of the year, thousand heads			
of cattle	389,9	299,9	283,5
sheep and goats	447,9	383,3	264,4

1	2	3	4
pigs	194,5	103,7	112,0
horses	145,3	145,3	136,5
poultry, thousand heads	3 999,7	3 091,1	3 515,9
The volume of construction works (services) performed. million tenge	82 552,0	124 396,3	163 402,10
The total area of commissioned residential buildings, thousand square meters of total area	163,8	300,8	304,7
Commissioning of social and cultural facilities:			
The number of student places in commissioned educational schools	-	-	-
The number of places in pre-school organizations put into operation			96
Commissioning of healthcare facilities:			
Number of beds in commissioned hospitals	200		
The number of visits per shift in commissioned outpatient clinics			258
Passengers transported, million human [12])	21,0	36,6	32,2
Passenger turnover, million pkm [12])	440,3	681,5	615,6
Transported (transported) cargo, baggage, cargo baggage, million tons 12)	22,5	23,2	22,8
Cargo turnover, billion tons-km.[12])	10,0	11,1	9,9
The volume of communication services, million tenge	9 857,4	9 909,6	10 812,5
The number of registered small and medium-sized businesses, units at the end of the year	34 251	36 305	37 977
Number of operating small and medium			
-sized businesses, units at the end of the year[0])	30 228	33 066	34 891
The number of people employed in small and medium-sized enterprises, on average per year, human	105 280	106 846	107 392
Output of products by all subjects of small and medium-sized enterprises, million tenge	913 232	1 193 858	1 057 894
Fixed assets in the economy at initial cost (at the end of the year), million tenge	1 498 608,8	1 607 393,1	1 847 124,6

1	2	3	4
Trading			
Retail trade volume [11]) in value terms , million tenge	301 524,8	357 837,0	398 886,8
Trade turnover in foreign currency (exports), USD million	313,8	475,8	511,2
Trade turnover in foreign currency (imports), USD million	570,0	727,9	871,6
Prices			
Consumer price index (at the end of the period, as a percentage of December of the previous year)	108,4	120,6	110,5
food price index	110,0	125,7	109,8
price index for non-food products	108,5	119,6	109,0
price index for paid services for the population	106,4	114,2	113,8
Price index of manufacturing enterprises of industrial products (goods, services) (at the end of the period, as a percentage of December of the previous year)	114,1	114,8	103,7
Price index of purchase of industrial products by industrial enterprises (at the end of the period, as a percentage of December of the previous year)	113,0	118,7	96,7
Construction price index (at the end of the period, as a percentage of December of the previous year)	105,9	99,1	104,4
Agricultural producer price index (at the end of the period, as a percentage of December of the previous year)	122,3	107,7	92,5
Price index for forestry products and services (as a percentage of the corresponding period of the previous year)	108,3	106,8	101,1
The price index for fishery and fish farming products (as a percentage of the corresponding period of the previous year	101,1	107,9	100,6
The index of tariffs for the transportation of goods by all modes of transport (at the end of the period, as a percentage of December of the previous year)	101,2	100,0	102,4
Index of tariffs for postal and courier services for legal entities (at the end of the period, as a percentage of December of the previous year)	106,4	105,3	106,4
Index of tariffs for communication services for legal entities (at the end of the period, as a percentage of December of the previous year)	100,0	100,0	100,0
Index of prices of wholesale sales of goods, products (at the end of the period, as a percentage of December of the previous year)	115,1	111,2	98,3

APPENDIX L
Population of the North Kazakhstan region

Table L 1 - Population of the North Kazakhstan region, thousand people

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
North Kazakhstan region	713,6	702,6	691,3	682,1	674,5	665,9	663,1	661,0	653,9	597,5	592,8	589,4	583,8	579,7	575,9	571,8	569,6	563,3	558,6	554,5	548,8	543,7	539,1	534,1	530,1
Petropavlovsk	201,5	198,7	195,6	193,7	193,2	190,7	191,0	193,3	194,1	202,4	203,5	204,6	204,9	206,1	208,5	210,5	216,3	216,6	218,0	219,0	219,2	219,8	222,1	222,1	222,7
Ayyrtausky	57,1	55,9	54,7	53,6	52,3	51,1	50,4	49,8	48,8	44,3	43,6	42,9	42,1	41,2	40,5	39,6	38,9	38,1	37,3	37,0	36,4	35,7	33,4	32,6	32,0
Akzharsky	26,4	25,6	24,8	24,2	23,5	22,8	22,2	21,9	21,7	19,0	18,8	18,7	18,3	18,0	17,8	17,4	16,9	16,3	15,9	15,7	15,4	15,0	13,7	13,5	13,2
M.Zhumabayeva	49,1	48,5	47,8	4,7	46,4	45,8	45,5	44,8	43,7	37,1	36,2	35,7	35,0	34,1	33,1	32,3	31,6	31,0	30,4	29,9	29,2	28,5	27,8	27,3	26,8
Yesilsky	37,6	37,0	36,5	36,1	35,8	35,5	35,4	34,9	34,2	28,6	28,1	27,5	27,0	26,6	25,9	25,4	24,5	23,9	23,2	22,4	21,8	21,4	21,8	21,3	21,0
Zhambylsky	36,4	36,0	35,5	35,1	34,7	34,3	33,6	33,2	32,3	25,5	24,9	24,5	24,0	23,6	22,9	22,2	21,3	20,7	19,9	19,4	18,8	18,2	18,5	18,1	17,8
Kyzylzharsky	50,1	49,8	49,7	4,9	49,0	50,0	50,5	50,5	50,0	44,5	44,4	44,4	44,5	44,7	44,7	44,7	44,6	44,5	44,3	44,2	44,1	44,4	46,4	46,5	46,6
Mamlutsky	28,7	28,4	28,1	27,9	27,6	27,0	26,9	26,5	26,0	21,4	21,1	20,8	20,5	20,2	19,9	19,5	18,8	18,6	18,2	17,8	17,5	17,1	17,8	17,5	17,2
Shal akyna	31,9	31,3	30,6	3,0	29,4	28,7	28,2	27,9	27,3	23,2	22,7	22,2	21,6	21,0	20,6	20,2	19,6	19,2	18,9	18,6	18,1	17,7	18,2	17,9	17,7
Akkayinsky	31,3	30,7	30,1	29,5	29,2	28,7	28,5	28,2	27,8	23,0	22,6	22,3	21,9	21,5	21,2	20,9	20,2	19,9	19,3	19,0	18,6	18,2	18,4	18,1	17,8
Tayynshinsky	65,0	63,5	62,1	61,3	60,4	59,5	58,9	58,7	57,9	50,9	50,1	49,6	48,8	48,0	47,2	46,3	45,6	44,5	43,9	43,1	42,2	41,6	41,0	40,3	39,6
Timiryazevsky	19,7	19,4	19,0	18,7	18,2	17,6	17,9	17,8	17,6	14,0	13,8	13,6	13,2	13,0	12,8	12,5	12,1	11,8	11,5	11,3	10,9	10,6	10,2	9,9	9,7
Ualikhanovsky	25,3	25,0	24,8	24,3	24,0	23,9	23,8	23,5	23,2	18,0	17,8	17,7	17,6	17,6	17,3	17,1	17,0	16,6	16,4	16,3	16,2	15,9	13,5	13,2	12,9
G.Musrepova	53,6	52,8	51,9	51,4	50,9	50,4	50,4	50,0	49,3	45,6	45,2	45,0	44,5	44,1	43,7	43,2	42,3	41,6	41,2	40,9	40,3	39,7	36,4	35,7	35,1

Table L 2 - The urban population of the North Kazakhstan region, thousand people

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
North Kazakhstan region	270,4	266,3	261,7	255,4	246,9	227,4	227,7	230,1	230,2	237,4	238,0	238,9	238,5	239,3	241,3	243,2	248,9	250,2	251,7	252,7	252,8	253,2	259,1	258,9	259,3
Petropavlovsk	200,5	197,8	194,7	192,8	192,3	189,8	190,1	192,4	193,3	201,4	202,5	203,6	203,9	205,1	207,5	209,6	215,4	216,6	218,0	219,0	219,2	219,8	222,1	222,1	222,7
Ayyrtausky																									
Akzharsky	3,9	3,7	3,4																						
M.Zhumabayeva	9,5	9,4	9,3	9,2	9,2	9,3	9,6	9,6	9,4	8,5	8,3	8,2	8,1	7,9	7,7	7,6	7,7	7,7	7,7	7,7	7,7	7,7	8,6	8,6	8,5
Yesilsky																									
Zhambylsky																									
Kyzylzharsky																									
Mamlutsky	9,0	8,9	8,8	8,7	8,7	8,5	8,5	8,5	8,3	7,5	7,4	7,4	7,3	7,3	7,3	7,2	7,0	7,1	7,0	6,9	6,8	6,7	7,1	7,0	6,9
Shal akyna	9,2	8,9	8,6	8,4	8,2	7,9	7,8	7,9	7,7	7,7	7,6	7,6	7,4	7,4	7,4	7,4	7,4	7,4	7,6	7,7	7,6	7,6	8,2	8,2	8,1
Akkayinsky	7,4	7,2	7,0	6,8	6,7																				
Tayynshinsky	12,9	12,7	12,5	12,3	12,2	12,0	11,7	11,7	11,6	12,4	12,2	12,0	11,8	11,7	11,5	11,5	11,5	11,4	11,4	11,4	11,4	11,4	13,1	13,1	13,0
Timiryazevsky																									
Ualikhanovsky	7,8	7,7	7,6	7,4																					
G.Musrepova	10,1	9,9	9,8	9,7	9,8																				

Table L 3 – The number of the rural population of the North Kazakhstan region, thousand people

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
North Kazakhstan region	443,3	436,3	429,5	426,8	427,6	438,5	435,4	430,8	423,7	360,1	354,8	350,6	345,3	340,4	334,6	328,6	320,7	313,1	306,8	301,8	295,9	290,5	280,0	275,2	270,7
Petropavlovsk	0,9	0,9	0,9	0,9	0,9	0,9	0,9	0,8	0,8	1,0	1,0	1,0	1,0	1,0	1,0	0,9	0,9								
Ayyrtausky	57,1	55,9	54,7	53,6	52,3	51,1	50,4	49,8	48,8	44,3	43,6	42,9	42,1	41,2	40,5	39,6	38,9	38,1	37,3	37,0	36,4	35,7	33,4	32,6	32,0
Akzharsky	22,5	21,9	21,4	24,2	23,5	22,8	22,2	21,9	21,7	19,0	18,8	18,7	18,3	18,0	17,8	17,4	16,9	16,3	15,9	15,7	15,4	15,0	13,7	13,5	13,2
M.Zhumabayeva	39,5	39,1	38,5	37,9	37,2	36,6	35,9	35,2	34,3	28,6	28,0	27,5	26,9	26,2	25,4	24,7	24,0	23,3	22,7	22,2	21,4	20,9	19,1	18,7	18,3
Yesilsky	37,6	37,0	36,5	36,1	35,8	35,5	35,4	34,9	34,2	28,6	28,1	27,5	27,0	26,6	25,9	25,4	24,5	23,9	23,2	22,4	21,8	21,4	21,8	21,3	21,0
Zhambylsky	36,4	36,0	35,5	35,1	34,7	34,3	33,6	33,2	32,3	25,5	24,9	24,5	24,0	23,6	22,9	22,2	21,3	20,7	19,9	19,4	18,8	18,2	18,5	18,1	17,8
Kyzylzharsky	50,1	49,8	49,7	49,4	49,0	50,0	50,5	50,5	50,0	44,5	44,4	44,4	44,5	44,7	44,7	44,7	44,6	44,5	44,3	44,2	44,1	44,4	46,4	46,5	46,6
Mamlutsky	19,7	19,5	19,3	19,1	18,9	18,5	18,4	18,0	17,8	13,9	13,7	13,4	13,2	12,9	12,6	12,3	11,8	11,5	11,2	11,0	10,7	10,4	10,7	10,5	10,3
Shal akyna	22,7	22,4	22,0	21,6	21,2	20,8	20,4	20,0	19,5	15,5	15,0	14,6	14,1	13,6	13,2	12,8	12,2	11,8	11,3	10,9	10,5	10,1	10,1	9,8	9,6
Akkayinsky	23,9	23,5	23,1	22,7	22,5	28,7	28,5	28,2	27,8	23,0	22,6	22,3	21,9	21,5	21,2	20,9	20,2	19,9	19,3	19,0	18,6	18,2	18,4	18,1	17,8
Tayynshinsky	52,1	50,7	49,7	48,9	48,2	47,5	47,2	46,9	46,3	38,4	37,9	37,5	37,0	36,3	35,7	34,9	34,1	33,1	32,5	31,7	30,8	30,2	27,9	27,3	26,6
Timiryazevsky	19,7	19,4	19,0	18,7	18,2	17,6	17,9	17,8	17,6	14,0	13,8	13,6	13,2	13,0	12,8	12,5	12,1	11,8	11,5	11,3	10,9	10,6	10,2	9,9	9,7
Ualikhanovsky	17,6	17,3	17,2	16,9	24,0	23,9	23,8	23,5	23,2	18,0	17,8	17,7	17,6	17,6	17,3	17,1	17,0	16,6	16,4	16,3	16,2	15,9	13,5	13,2	12,9
G.Musrepova	43,5	42,9	42,1	41,7	41,2	50,4	50,4	50,0	49,3	45,6	45,2	45,0	44,5	44,1	43,7	43,2	42,3	41,6	41,2	40,9	40,3	39,7	36,4	35,7	35,1

Table L 4 - The number of men by districts of the North Kazakhstan region, thousand human

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
North Kazakhstan region	344,0	338,3	332,6	327,9	324,0	319,8	318,3	317,9	314,2	284,4	282,2	280,6	278,1	276,1	274,3	272,5	271,7	269,0	266,9	265,2	262,5	260,1	260,2	258,0	256,1
Petropavlovsk	91,4	89,9	88,2	87,2	86,8	85,6	85,5	86,9	87,2	90,9	91,3	91,8	92,0	92,5	93,5	94,6	97,4	97,5	98,2	98,7	98,8	99,1	102,4	102,5	102,9
Ayyrtausky	28,0	27,5	26,9	26,4	25,7	25,1	24,7	24,4	23,9	21,7	21,3	21,0	20,7	20,3	19,9	19,5	19,2	18,8	18,4	18,2	18,0	17,5	16,6	16,3	16,0
Akzharsky	13,3	12,8	12,5	12,2	11,8	11,5	11,2	11,1	10,9	9,4	9,3	9,2	9,1	8,9	8,8	8,7	8,4	8,1	8,0	7,9	7,8	7,6	7,0	6,9	6,7
M.Zhumabayeva	24,0	23,7	23,3	23,0	22,7	22,4	22,2	21,9	21,3	18,0	17,6	17,4	17,1	16,7	16,3	15,9	15,6	15,3	15,1	14,8	14,5	14,2	13,7	13,5	13,3
Yesilsky	18,7	18,3	18,1	17,9	17,7	17,6	17,6	17,3	17,0	14,1	13,8	13,6	13,3	13,1	12,8	12,5	12,1	11,8	11,5	11,0	10,8	10,6	10,9	10,7	10,5
Zhambylsky	18,2	17,9	17,7	17,5	17,2	17,0	16,7	16,5	16,1	12,5	12,2	12,0	11,7	11,6	11,2	10,9	10,5	10,3	9,9	9,7	9,4	9,1	9,3	9,0	8,9
Kyzylzharsky	24,4	24,2	24,2	24,0	23,8	24,3	24,6	24,6	24,4	21,6	21,6	21,7	21,8	21,8	21,8	21,9	21,9	21,9	21,9	22,0	21,9	22,1	23,0	23,1	23,2
Mamlutsky	14,1	14,0	13,8	13,7	13,6	13,3	13,3	13,1	12,9	10,5	10,4	10,3	10,1	10,0	9,8	9,7	9,4	9,3	9,1	9,0	8,8	8,6	8,9	8,7	8,6
Shal akyna	15,7	15,5	15,2	14,8	14,5	14,2	14,0	13,9	13,6	11,4	11,1	10,9	10,6	10,3	10,1	9,9	9,7	9,5	9,4	9,3	9,0	8,8	9,1	8,9	8,8
Akkayinsky	15,3	15,0	14,7	14,4	14,3	14,0	13,9	13,8	13,7	11,2	11,0	10,9	10,7	10,5	10,4	10,2	9,9	9,9	9,6	9,5	9,3	9,1	9,2	9,0	8,9
Tayynshinsky	31,9	31,2	30,6	30,1	29,7	29,3	29,0	28,9	28,6	24,9	24,5	24,4	24,0	23,6	23,3	22,8	22,5	22,0	21,7	21,4	20,9	20,6	20,3	19,9	19,6
Timiryazevsky	9,7	9,6	9,4	9,3	9,0	8,8	8,9	8,9	8,8	6,9	6,8	6,7	6,6	6,5	6,4	6,2	6,0	5,9	5,8	5,7	5,5	5,4	5,1	5,0	4,9
Ualikhanovsky	12,8	12,6	12,5	12,3	12,1	12,0	12,0	11,8	11,7	8,9	8,8	8,8	8,7	8,7	8,6	8,5	8,5	8,3	8,2	8,2	8,1	8,0	6,8	6,7	6,6
G.Musrepova	26,3	26,0	25,5	25,2	25,1	24,8	24,7	24,6	24,2	22,2	22,1	22,0	21,7	21,5	21,3	21,1	20,6	20,2	20,1	19,9	19,7	19,4	18,0	17,7	17,4

Table L 5 - Number of women by districts of the North Kazakhstan region, thousand human

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
North Kazakhstan region	369,7	364,3	358,7	354,3	350,5	346,1	344,8	343,1	339,7	313,1	310,6	308,8	305,7	303,6	301,6	299,3	297,9	294,3	291,7	289,3	286,2	283,7	278,9	276,1	274,0
Petropavlovsk	110,1	108,8	107,4	106,5	106,4	105,1	105,4	106,4	106,9	111,5	112,1	112,8	112,8	113,6	114,9	115,9	119,0	119,1	119,8	120,3	120,4	120,8	119,8	119,6	119,7
Ayyrtausky	29,1	28,4	27,8	27,2	26,6	26,1	25,7	25,4	24,9	22,6	22,2	21,8	21,4	21,0	20,6	20,1	19,7	19,3	18,9	18,7	18,5	18,2	16,8	16,4	16,0
Akzharsky	13,1	12,7	12,3	12,0	11,7	11,3	10,9	10,8	10,8	9,6	9,5	9,4	9,3	9,1	8,9	8,7	8,4	8,2	7,9	7,8	7,6	7,4	6,7	6,6	6,4
M.Zhumabayeva	25,1	24,8	24,5	24,1	23,8	23,5	23,3	23,0	22,4	19,1	18,6	18,3	17,9	17,4	16,8	16,4	16,0	15,6	15,3	15,1	14,6	14,3	14,1	13,8	13,5
Yesilsky	18,9	18,7	18,5	18,2	18,1	17,9	17,8	17,6	17,2	14,5	14,2	13,9	13,7	13,5	13,1	12,8	12,4	12,1	11,7	11,3	11,1	10,8	10,8	10,6	10,5
Zhambylsky	18,3	18,1	17,8	17,7	17,5	17,3	16,9	16,7	16,3	13,0	12,7	12,5	12,3	12,0	11,7	11,3	10,8	10,4	10,0	9,7	9,4	9,1	9,2	9,1	8,9
Kyzylzharsky	25,7	25,6	25,5	25,3	25,1	25,7	25,9	25,8	25,6	22,9	22,7	22,7	22,7	22,9	22,8	22,8	22,6	22,6	22,4	22,3	22,2	22,3	23,4	23,4	23,4
Mamlutsky	14,5	14,4	14,3	14,2	14,0	13,7	13,6	13,4	13,1	10,9	10,7	10,5	10,4	10,2	10,0	9,8	9,5	9,3	9,1	8,9	8,7	8,5	8,9	8,8	8,7
Shal akyna	16,2	15,9	15,5	15,2	14,8	14,5	14,2	14,0	13,7	11,8	11,5	11,3	11,0	10,7	10,4	10,3	9,9	9,7	9,6	9,3	9,1	8,9	9,2	9,0	8,9
Akkayinsky	16,0	15,7	15,4	15,1	14,9	14,6	14,5	14,4	14,1	11,8	11,6	11,4	11,2	11,0	10,8	10,6	10,3	10,0	9,7	9,5	9,4	9,2	9,3	9,1	8,9
Tayynshinsky	33,1	32,3	31,6	31,1	30,7	30,2	29,9	29,7	29,3	26,0	25,5	25,2	24,8	24,4	24,0	23,5	23,1	22,5	22,2	21,8	21,3	20,9	20,7	20,4	20,1
Timiryazevsky	9,9	9,8	9,6	9,4	9,2	8,9	9,0	9,0	8,9	7,1	7,0	6,8	6,7	6,5	6,4	6,3	6,1	5,9	5,7	5,6	5,4	5,2	5,0	4,9	4,8
Ualikhanovsky	12,5	12,3	12,2	12,1	11,9	11,9	11,8	11,7	11,5	9,1	9,0	8,9	8,8	8,9	8,7	8,6	8,5	8,3	8,2	8,1	8,1	7,9	6,6	6,5	6,4
G.Musrepova	27,2	26,8	26,4	26,2	25,9	25,6	25,6	25,4	25,1	23,4	23,1	23,0	22,8	22,6	22,4	22,1	21,7	21,3	21,1	20,9	20,6	20,3	18,4	18,1	17,8

Table L 6 - Number of births, human

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
The entire population																								
North Kazakhstan region	8 018	7 935	8 011	8 277	8 223	8 529	8 308	8 277	9 085	8 880	8 721	8 667	8 721	8 561	8 216	8 132	7 694	7 387	7 194	6 872	6 879	6 489	5 879	5 554
Petropavlovsk	1 777	1 886	1 965	2 295	2 271	2 636	2 621	2 871	3 148	3 172	3 186	3 334	3 386	3 342	3 348	3 316	3 309	3 085	3 120	2 922	2 846	2 696	2 494	2 307
Ayyrtausky	758	672	647	637	647	585	581	541	551	610	586	662	595	587	487	543	495	439	448	406	453	454	360	357
Akzharsky	329	305	344	376	332	359	354	324	350	385	289	331	340	303	263	235	242	222	193	192	203	196	188	188
M.Zhumabayeva	588	571	546	492	505	514	474	445	519	424	435	378	361	390	405	388	365	338	319	302	309	280	290	243
Yesilsky	410	458	463	406	406	400	404	374	426	396	384	362	351	350	316	311	269	278	270	244	275	241	217	197
Zhambylsky	528	484	468	430	456	404	389	332	388	363	352	287	312	364	336	256	276	267	230	254	238	231	205	193
Kyzylzharsky	511	505	522	534	504	488	508	554	605	608	564	568	598	576	596	597	536	531	544	495	523	510	424	457
Mamlutsky	319	327	347	305	321	300	273	267	307	305	300	293	280	268	269	267	248	209	220	213	202	204	152	181
Shal akyna	404	392	394	370	377	403	365	354	388	357	383	284	266	286	279	277	225	244	245	246	266	239	204	207
Akkayinsky	241	256	267	318	327	330	318	326	345	327	327	314	312	310	297	292	286	246	225	195	209	205	172	170
Tayynshinsky	877	852	869	851	849	803	756	775	853	776	751	711	746	687	624	672	542	548	499	522	542	466	421	413
Timiryazevsky	183	170	172	175	172	229	221	216	212	199	217	208	198	205	167	205	155	169	155	145	142	116	116	91
Ualikhanovsky	382	343	345	369	388	364	375	299	358	320	298	313	343	285	249	265	237	264	240	258	231	244	216	206
G.Musrepova	711	714	662	719	668	714	669	599	635	638	649	622	633	608	580	508	509	547	486	478	440	407	420	344

Urban population																								
North Kazakhstan region	2 599	2 688	2 734	3 030	2 728	3 145	3 116	3 373	3 751	3 711	3 731	3 805	3 916	3 849	3 878	3 879	3 778	3 559	3 566	3 390	3 306	3 133	2 896	2 713
Petropavlovsk	…	…	…	…	…	…	2 619	2 867	3 145	3 169	3 177	3 326	3 379	3 337	3 347	3 310	3 298	3 085	3 120	2 922	2 846	2 696	2 494	2 307
M.Zhumabaeva	…	…	…	…	…	…	128	108	143	102	116	104	124	117	117	122	131	118	100	98	91	92	99	91
Mamlutsky	…	…	…	…	…	…	87	91	105	96	106	98	96	98	106	101	97	70	85	88	70	71	59	68
Shal akyna	…	…	…	…	…	…	115	113	144	133	135	100	105	115	122	126	86	107	104	109	122	118	110	98
Tayynshinsky	…	…	…	…	…	…	167	194	214	211	197	177	212	182	186	220	166	179	157	173	177	156	134	149
Rural population																								
North Kazakhstan region	5 419	5 247	5 277	5 247	5 495	5 384	5 192	4 904	5 334	5 169	4 990	4 862	4 805	4 712	4 338	4 253	3 916	3 828	3 628	3 482	3 573	3 356	2 983	2 841
Petropavlovsk	…	…	…	…	…	…	2	4	3	3	9	8	7	5	1	6	11	-	-	-	-	-	-	-
Ayyrtausky	…	…	…	…	…	…	581	541	551	610	586	662	595	587	487	543	495	439	448	406	453	454	360	357
Akzharsky	…	…	…	…	…	…	354	324	350	385	289	331	340	303	263	235	242	222	193	192	203	196	188	188
M.Zhumabayeva	…	…	…	…	…	…	346	337	376	322	319	274	237	273	288	266	234	220	219	204	218	188	191	152
Yesilsky	…	…	…	…	…	…	404	374	426	396	384	362	351	350	316	311	269	278	270	244	275	241	217	197
Zhambylsky	…	…	…	…	…	…	389	332	388	363	352	287	312	364	336	256	276	267	230	254	238	231	205	193
Kyzylzharsky	…	…	…	…	…	…	508	554	605	608	564	568	598	576	596	597	536	531	544	495	523	510	424	457
Mamlutsky	…	…	…	…	…	…	186	176	202	209	194	195	184	170	163	166	151	139	135	125	132	133	93	113
Shal akyna	…	…	…	…	…	…	250	241	244	224	248	184	161	171	157	151	139	137	141	137	144	121	94	109
Akkayinsky	…	…	…	…	…	…	318	326	345	327	327	314	312	310	297	292	286	246	225	195	209	205	172	170
Tayynshinsky	…	…	…	…	…	…	589	581	639	565	554	534	534	505	438	452	376	369	342	349	365	310	287	264
Timiryazevsky	…	…	…	…	…	…	221	216	212	199	217	208	198	205	167	205	155	169	155	145	142	116	116	91
Ualikhanovsky	…	…	…	…	…	…	375	299	358	320	298	313	343	285	249	265	237	264	240	258	231	244	216	206
G.Musrepova	…	…	…	…	…	…	669	599	635	638	649	622	633	608	580	508	509	547	486	478	440	407	420	344

Table L 7 - The number of boys born in the North Kazakhstan region, human

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
The entire population																								
North Kazakhstan region	4 139	4 137	4 123	4 351	4 252	4 332	4 291	4 225	4 703	4 540	4 461	4 494	4 462	4 459	4 219	4 249	3 950	3 731	3 709	3 552	3 587	3 388	3 009	2 832
Petropavlovsk	877	966	1 014	1 193	1 181	1 351	1 378	1 478	1 630	1 664	1 631	1 751	1 783	1 717	1 759	1 718	1 702	1 547	1 599	1 539	1 496	1 420	1 263	1 197
Ayyrtausky	434	356	353	345	339	298	290	294	279	304	311	344	315	291	249	312	262	212	223	205	222	253	191	180
Akzharsky	169	163	178	191	171	188	174	138	183	203	146	171	169	144	152	127	114	121	102	107	101	109	104	94
M.Zhumabayeva	299	284	278	268	264	239	256	234	290	225	216	198	175	228	209	196	188	161	165	172	159	149	152	123
Yesilsky	198	223	241	211	200	204	202	205	226	189	208	185	163	176	165	171	138	136	144	133	145	124	120	98
Zhambylsky	262	248	222	215	237	205	210	174	193	174	169	130	165	189	173	123	142	138	121	133	126	115	98	91
Kyzylzharsky	264	273	259	282	263	252	276	291	296	305	296	301	298	287	299	304	286	300	273	241	287	275	217	242
Mamlutsky	165	173	185	153	157	152	143	135	146	152	146	139	137	150	131	149	136	99	108	96	100	92	75	91
Shal akyna	208	212	187	174	193	207	196	163	197	188	196	135	139	150	140	137	104	131	122	123	143	128	92	98
Akkayinsky	127	142	152	168	175	165	156	176	171	158	164	160	163	170	159	146	160	117	134	102	116	107	74	75
Tayynshinsky	463	459	447	450	423	418	369	394	450	370	383	382	378	364	308	370	267	265	287	245	293	209	225	219
Timiryazevsky	100	84	97	102	91	123	116	112	132	106	120	111	98	110	79	95	76	90	72	64	70	57	61	53
Ualikhanovsky	214	166	177	198	209	185	194	146	181	173	149	167	170	161	107	146	115	136	123	139	121	131	118	101
G.Musrepova	359	388	333	401	349	345	331	285	329	329	326	320	309	322	289	255	260	278	236	253	208	219	219	170
Urban population																								
North Kazakhstan region	1 306	1 403	1 407	1 606	1 415	1 601	1 642	1 735	1 959	1 931	1 893	1 995	2 055	2 001	2 040	2 017	1 946	1 782	1 838	1 781	1739	1 646	1 449	1 403
Petropavlovsk	…	…	…	…	…	…	1 377	1 477	1 628	1 661	1 627	1 747	1 781	1 714	1 759	1 714	1 698	1 547	1 599	1 539	1496	1 420	1 263	1 197
M.Zhumabaeva	…	…	…	…	…	…	73	57	93	54	53	57	65	61	61	63	76	64	58	64	48	50	39	41
Mamlutsky	…	…	…	…	…	…	40	48	57	47	50	46	43	58	59	50	50	37	43	40	37	30	27	39
Shal akyna	…	…	…	…	…	…	67	54	76	69	70	49	57	64	63	65	41	50	52	57	67	70	50	47
Tayynshinsky	…	…	…	…	…	…	85	99	105	100	93	96	109	104	98	125	81	84	86	81	91	76	70	79
Rural population																								
North Kazakhstan region	2 833	2 734	2 716	2 745	2 833	2 731	2 649	2 490	2 744	2 609	2 568	2 499	2 407	2 458	2 179	2 232	2 004	1 949	1 871	1 771	1 848	1 742	1 560	1 429
Petropavlovsk	…	…	…	…	…	…	1	1	2	3	4	4	2	3	-	4	4	-	-	-	-	-	-	-
Ayyrtausky	…	…	…	…	…	…	290	294	279	304	311	344	315	291	249	312	262	212	223	205	222	253	191	180
Akzharsky	…	…	…	…	…	…	174	138	183	203	146	171	169	144	152	127	114	121	102	107	101	109	104	94
M.Zhumabayeva	…	…	…	…	…	…	183	177	197	171	163	141	110	167	148	133	112	97	107	108	111	99	113	82
Yesilsky	…	…	…	…	…	…	202	205	226	189	208	185	163	176	165	171	138	136	144	133	145	124	120	98
Zhambylsky	…	…	…	…	…	…	210	174	193	174	169	130	165	189	173	123	142	138	121	133	126	115	98	91

Kyzylzharsky	…	…	…	…	…	…	275	291	296	305	296	301	298	287	299	304	286	300	273	241	287	275	217	242
Mamlutsky	…	…	…	…	…	…	103	87	89	105	96	93	94	92	72	99	86	62	65	56	63	62	48	52
Shal akyna	…	…	…	…	…	…	129	109	121	119	126	86	82	86	77	72	63	81	70	66	76	58	42	51
Akkayinsky	…	…	…	…	…	…	156	176	171	158	164	160	163	170	159	146	160	117	134	102	116	107	74	75
Tayynshinsky	…	…	…	…	…	…	284	295	345	270	290	286	269	260	210	245	186	181	201	164	202	133	155	140
Timiryazevsky	…	…	…	…	…	…	116	112	132	106	120	111	98	110	79	95	76	90	72	64	70	57	61	53
Ualikhanovsky	…	…	…	…	…	…	194	146	181	173	149	167	170	161	107	146	115	136	123	139	121	131	118	101
G.Musrepova	…	…	…	…	…	…	331	285	329	329	326	320	309	322	289	255	260	278	236	253	208	219	219	170

Table L 8 - The number of girls born in the North Kazakhstan region, human

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
The entire population																								
North Kazakhstan region	3 879	3 798	3 888	3 926	3 975	4 197	4 017	4 052	4 382	4 340	4 260	4 173	4 259	4 102	3 997	3 883	3 744	3 656	3 485	3 320	3 292	3 101	2 870	2 722
Petropavlovsk	900	920	951	1 102	1 090	1 285	1 243	1 393	1 518	1 508	1 555	1 583	1 603	1 625	1 589	1 598	1 607	1 538	1 521	1 383	1 350	1 276	1 231	1 110
Ayyrtausky	324	316	294	292	308	287	291	247	272	306	275	318	280	296	238	231	233	227	225	201	231	201	169	177
Akzharsky	160	142	166	185	161	171	180	186	167	182	143	160	171	159	111	108	128	101	91	85	102	87	84	94
M.Zhumabayeva	289	287	268	224	241	275	218	211	229	199	219	180	186	162	196	192	177	177	154	130	150	131	138	120
Yesilsky	212	235	222	195	206	196	202	169	200	207	176	177	188	174	151	140	131	142	126	111	130	117	97	99
Zhambylsky	266	236	246	215	219	199	179	158	195	189	183	157	147	175	163	133	134	129	109	121	112	116	107	102
Kyzylzharsky	247	232	263	252	241	236	232	263	309	303	268	267	300	289	297	293	250	231	271	254	236	235	207	215
Mamlutsky	154	154	162	152	164	148	130	132	161	153	154	154	143	118	138	118	112	110	112	117	102	112	77	90
Shal akyna	196	180	207	196	184	196	169	191	191	169	187	149	127	136	139	140	121	113	123	123	123	111	112	109
Akkayinsky	114	114	115	150	152	165	162	150	174	169	163	154	149	140	138	146	126	129	91	93	93	98	98	95
Tayynshinsky	414	393	422	401	426	385	387	381	403	406	368	329	368	323	316	302	275	283	212	277	249	257	196	194
Timiryazevsky	83	86	75	73	85	106	105	104	80	93	97	97	100	95	88	110	79	79	83	81	72	59	55	38
Ualikhanovsky	168	177	168	171	179	179	181	153	177	147	149	146	173	124	142	119	122	128	117	119	110	113	98	105
G.Musrepova	352	326	329	318	319	369	338	314	306	309	323	302	324	286	291	253	249	269	250	225	232	188	201	174
Urban population																								
North Kazakhstan region	1 293	1 285	1 327	1 424	1 313	1 544	1 474	1 638	1 792	1 780	1 838	1 810	1 861	1 848	1 838	1 862	1 832	1 777	1 728	1 609	1 567	1 487	1 447	1 310
Petropavlovsk	…	…	…	…	…	…	1 242	1 390	1 517	1 508	1 550	1 579	1 598	1 623	1 588	1 596	1 600	1 538	1 521	1 383	1 350	1 276	1 231	1 110

M.Zhumabayeva	…	…	…	…	…	…	55	51	50	48	63	47	59	56	56	59	55	54	42	34	43	42	60	50
Mamlutsky	…	…	…	…	…	…	47	43	48	49	56	52	53	40	47	51	47	33	42	48	33	41	32	29
Akyn's Shawl	…	…	…	…	…	…	48	59	68	64	65	51	48	51	59	61	45	57	52	52	55	48	60	51
Tayynshinsky	…	…	…	…	…	…	82	95	109	111	104	81	103	78	88	95	85	95	71	92	86	80	64	70
Rural population																								
North Kazakhstan region	2 586	2 513	2 561	2 502	2 662	2 653	2 543	2 414	2 590	2 560	2 422	2 363	2 398	2 254	2 159	2 021	1 912	1 879	1 757	1 711	1 725	1 614	1 423	1 412
Petropavlovsk	…	…	…	…	…	…	1	3	1	-	5	4	5	2	1	2	7	-	-	-	-	-	-	-
Ayyrtausky	…	…	…	…	…	…	291	247	272	306	275	318	280	296	238	231	233	227	225	201	231	201	169	177
Akzharsky	…	…	…	…	…	…	180	186	167	182	143	160	171	159	111	108	128	101	91	85	102	87	84	94
M.Zhumabayeva	…	…	…	…	…	…	163	160	179	151	156	133	127	106	140	133	122	123	112	96	107	89	78	70
Yesilsky	…	…	…	…	…	…	202	169	200	207	176	177	188	174	151	140	131	142	126	111	130	117	97	99
Zhambylsky	…	…	…	…	…	…	179	158	195	189	183	157	147	175	163	133	134	129	109	121	112	116	107	102
Kyzylzharsky	…	…	…	…	…	…	232	263	309	303	268	267	300	289	297	293	250	231	271	254	236	235	207	215
Mamlutsky	…	…	…	…	…	…	83	89	113	104	98	102	90	78	91	67	65	77	70	69	69	71	45	61
Shal akyna	…	…	…	…	…	…	121	132	123	105	122	98	79	85	80	79	76	56	71	71	68	63	52	58
Akkayinsky	…	…	…	…	…	…	162	150	174	169	163	154	149	140	138	146	126	129	91	93	93	98	98	95
Tayynshinsky	…	…	…	…	…	…	305	286	294	295	264	248	265	245	228	207	190	188	141	185	163	177	132	124
Timiryazevsky	…	…	…	…	…	…	105	104	80	93	97	97	100	95	88	110	79	79	83	81	72	59	55	38
Ualikhanovsky	…	…	…	…	…	…	181	153	177	147	149	146	173	124	142	119	122	128	117	119	110	113	98	105
G.Musrepova	…	…	…	…	…	…	338	314	306	309	323	302	324	286	291	253	249	269	250	225	232	188	201	174

Table L 9 - Total fertility rate in the North Kazakhstan region, per 1000 human

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
The entire population																								
North Kazakhstan region	11,32	11,39	11,67	12,20	12,27	12,83	12,55	12,59	13,95	14,92	14,75	14,78	14,99	14,82	14,32	14,25	13,58	13,17	12,93	12,46	12,59	12,01	10,96	10,44
Petropavlovsk	8,88	9,56	10,09	11,87	11,90	13,80	13,60	14,80	16,20	15,63	15,61	16,28	16,48	16,12	15,98	15,54	15,29	14,19	14,28	13,34	12,96	12,28	11,23	10,37
Ayyrtausky	13,42	12,15	11,94	12,04	12,50	11,50	11,60	11,00	11,30	13,89	13,56	15,59	14,29	14,37	12,16	13,83	12,85	11,64	12,07	11,06	12,55	12,83	10,9	11,05
Akzharsky	12,65	12,10	14,04	15,80	14,40	16,00	16,10	14,90	16,20	20,33	15,40	17,89	18,73	16,95	14,94	13,70	14,59	13,79	12,22	12,34	13,35	13,18	13,82	14,11
M.Zhumabayeva	12,05	11,85	11,52	10,51	10,90	11,20	10,50	10,00	12,00	11,57	12,10	10,70	10,45	11,61	12,38	12,13	11,67	11,01	10,57	10,22	10,71	9,93	10,53	8,97
Yesilsky	10,99	12,45	12,75	11,31	11,40	11,30	11,50	10,80	12,60	13,97	13,82	13,27	13,08	13,32	12,32	12,48	11,11	11,79	11,85	11,05	12,73	11,43	10,08	9,33
Zhambylsky	14,59	13,52	13,26	12,32	13,20	11,90	11,70	10,10	12,10	14,40	14,25	11,85	13,13	15,66	14,89	11,77	13,14	13,15	11,69	13,28	12,87	12,91	11,22	10,76
Kyzylzharsky	10,24	10,14	10,55	10,85	10,20	9,70	10,10	11,00	12,20	13,69	12,71	12,78	13,41	12,89	13,34	13,38	12,04	11,96	12,28	11,21	11,82	11,50	9,13	9,82
Mamlutsky	11,15	11,55	12,39	11,01	11,80	11,10	10,20	10,20	11,90	14,35	14,31	14,18	13,75	13,36	13,67	13,94	13,26	11,37	12,21	12,05	11,67	12,05	8,61	10,41
Shal akyna	12,78	12,65	13,00	12,46	13,00	14,20	13,00	12,80	14,40	15,56	17,05	12,97	12,52	13,78	13,70	13,93	11,61	12,81	13,07	13,42	14,88	13,70	11,28	11,62
Akkayinsky	7,77	8,42	8,96	10,85	11,40	11,60	11,20	11,60	12,50	14,34	14,56	14,20	14,35	14,52	14,14	14,23	14,27	12,54	11,75	10,37	11,34	11,37	9,41	9,45
Tayynshinsky	13,66	13,57	14,08	14,00	14,20	13,60	12,90	13,30	14,80	15,38	15,08	14,46	15,42	14,43	13,34	14,62	12,04	12,41	11,47	12,23	12,93	11,34	10,35	10,33
Timiryazevsky	9,38	8,85	9,10	9,46	9,60	12,90	12,40	12,20	12,10	14,30	15,88	15,53	15,12	15,93	13,22	16,67	12,96	14,46	13,57	13,05	13,19	11,09	11,59	9,31
Ualikhanovsky	15,22	13,78	14,08	15,25	16,20	15,30	15,90	12,80	15,40	17,84	16,76	17,73	19,50	16,32	14,44	15,54	14,11	15,97	14,67	15,90	14,43	15,50	16,21	15,78
G.Musrepova	13,36	13,65	12,80	14,04	13,20	14,20	13,30	12,10	13,00	14,05	14,39	13,90	14,29	13,84	13,35	11,89	12,14	13,22	11,85	11,79	11,01	10,36	11,65	9,71
	Urban population																							
North Kazakhstan region	9,69	10,19	10,58	12,07	11,50	13,82	13,61	14,65	16,31	15,61	15,65	15,94	16,39	16,02	16,01	15,76	15,17	14,18	14,14	13,41	13,07	12,40	11,18	10,47
Petropavlovsk	…	…	…	…	…	…	13,69	14,86	15,94	15,69	15,65	16,32	16,52	16,17	16,05	15,58	15,3	14,24	14,28	13,34	12,96	12,28	11,23	10,37
M.Zhumabaeva	…	…	…	…	…	…	13,31	11,39	16,04	12,18	14,11	12,82	15,59	15,04	15,24	15,94	17,05	15,3	12,94	12,68	11,84	12,12	11,50	10,62
Mamlutsky	…	…	…	…	…	…	10,24	10,88	13,33	12,87	14,28	13,29	13,1	13,45	14,69	14,23	13,77	9,99	12,3	12,84	10,32	10,60	8,34	9,72
Shal akyna	…	…	…	…	…	…	14,64	14,45	18,66	17,34	17,7	13,3	14,19	15,61	16,56	17,13	11,63	14,22	13,58	14,24	16,03	15,59	13,48	12,04
Tayynshinsky	…	…	…	…	…	…	14,27	16,65	17,84	17,14	16,26	14,85	18,09	15,72	16,2	19,15	14,52	15,72	13,76	15,15	15,51	13,74	10,24	11,42
Rural population																								
North Kazakhstan region	12,32	12,12	12,32	12,28	12,69	12,32	11,99	11,48	12,67	14,46	14,15	13,97	14,02	13,96	13,08	13,1	12,34	12,35	11,92	11,65	12,18	11,67	10,75	10,41
Petropavlovsk	…	…	…	…	…	…	2,35	4,77	3,26	2,98	9	8,14	7,26	5,2	1,05	6,42	12	-	-	-	-	-	-	-
Ayyrtausky	…	…	…	…	…	…	11,60	10,97	11,84	13,89	13,56	15,59	14,29	14,37	12,16	13,83	12,85	11,64	12,07	11,06	12,55	12,83	10,9	11,05
Akzharsky	…	…	…	…	…	…	16,06	14,87	17,19	20,33	15,4	17,89	18,73	16,95	14,94	13,7	14,59	13,79	12,22	12,34	13,35	13,18	13,82	14,11
M.Zhumabayeva	…	…	…	…	…	…	9,73	9,69	11,95	11,39	11,51	10,07	8,92	10,58	11,5	10,94	9,91	9,57	9,75	9,35	10,31	9,13	10,08	8,21
Yesilsky	…	…	…	…	…	…	11,49	10,83	13,56	13,97	13,82	13,27	13,08	13,32	12,32	12,48	11,11	11,79	11,85	11,05	12,73	11,43	10,08	9,33
Zhambylsky	…	…	…	…	…	…	11,65	10,14	13,42	14,4	14,25	11,85	13,13	15,66	14,89	11,77	13,14	13,15	11,69	13,28	12,87	12,91	11,22	10,76
Kyzylzharsky	…	…	…	…	…	…	10,07	11,03	12,81	13,69	12,71	12,78	13,41	12,89	13,34	13,38	12,04	11,96	12,29	11,21	11,82	11,50	9,13	9,82

Mamlutsky	…	…	…	…	…	…	10,20	9,83	12,76	15,16	14,32	14,68	14,11	13,32	13,09	13,77	12,95	12,21	12,15	11,55	12,55	12,99	8,79	10,88
Shal akyna	…	…	…	…	…	…	12,39	12,20	13,92	14,66	16,72	12,8	11,62	12,78	12,07	12,05	11,59	11,89	12,71	12,84	14,03	12,24	9,47	11,26
Akkayinsky	…	…	…	…	…	…	11,22	11,64	13,59	14,34	14,56	14,2	14,35	14,52	14,14	14,23	14,27	12,54	11,75	10,37	11,34	11,37	9,41	9,45
Tayynshinsky	…	…	…	…	…	…	12,51	12,46	15,08	14,81	14,7	14,33	14,56	14,02	12,41	13,12	11,19	11,25	10,66	11,16	11,97	10,42	10,4	9,81
Timiryazevsky	…	…	…	…	…	…	12,36	12,18	13,38	14,3	15,88	15,53	15,12	15,93	13,22	16,67	12,96	14,46	13,57	13,05	13,19	11,09	11,59	9,31
Ualikhanovsky	…	…	…	…	…	…	15,85	12,81	17,38	17,84	16,76	17,73	19,5	16,32	14,44	15,54	14,11	15,97	14,67	15,9	14,43	15,50	16,21	15,78
G.Musrepova	…	…	…	…	…	…	13,32	12,06	13,38	14,05	14,39	13,9	14,29	13,84	13,35	11,89	12,14	13,22	11,85	11,79	11,01	10,36	11,65	9,71

Table L 10 - The total fertility rate of boys in the North Kazakhstan region, per 1000 human

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
The entire population																							
North Kazakhstan region	12,13	12,33	12,49	13,35	13,20	13,58	13,49	13,37	15,04	16,03	15,85	16,09	16,1	16,2	15,43	15,62	14,61	13,92	13,94	13,46	13,73	13,11	11,61
Petropavlovsk	9,67	10,85	11,56	13,72	13,70	15,79	15,98	16,97	18,30	18,26	17,81	19,05	19,33	18,46	18,7	17,9	17,47	15,81	16,24	15,58	15,12	14,35	12,33
Ayyrtausky	15,62	13,08	13,26	13,26	13,37	11,98	11,81	12,16	12,22	14,13	14,69	16,51	15,39	14,49	12,64	16,13	13,79	11,4	12,18	11,33	12,5	14,56	11,62
Akzharsky	12,96	12,88	14,45	15,92	14,66	16,54	15,57	12,53	17,97	21,64	15,73	18,68	18,78	16,22	17,34	14,82	13,76	15,04	12,88	13,65	13,13	14,47	14,94
M.Zhumabayeva	12,54	12,09	12,02	11,75	11,72	10,73	11,62	10,84	14,77	12,64	12,34	11,5	10,37	13,85	12,99	12,44	12,15	10,57	11,02	11,71	11,05	10,59	11,18
Yesilsky	10,70	12,24	13,41	11,86	11,33	11,61	11,57	11,95	14,53	13,51	15,16	13,74	12,31	13,56	13,02	13,88	11,52	11,67	12,79	12,2	13,59	11,88	11,11
Zhambylsky	14,51	13,92	12,62	12,40	13,84	12,15	12,64	10,69	13,51	14,07	13,97	10,98	14,18	16,58	15,62	11,47	13,65	13,65	12,32	13,91	13,59	12,80	10,71
Kyzylzharsky	10,85	11,28	10,74	11,78	10,92	10,31	11,22	11,86	12,86	14,11	13,67	13,85	13,67	13,14	13,68	13,88	13,05	13,69	12,44	11,00	13,06	12,46	9,41
Mamlutsky	11,73	12,44	13,45	11,22	11,69	11,43	10,82	10,38	12,47	14,5	14,09	13,61	13,59	15,11	13,44	15,66	14,57	10,75	11,95	10,82	11,5	10,80	8,54
Shal akyna	13,33	13,84	12,47	11,86	13,43	14,67	14,05	11,87	15,80	16,71	17,79	12,57	13,32	14,71	13,97	13,99	10,86	13,9	13,11	13,47	16,04	14,70	10,23
Akkayinsky	8,38	9,57	10,44	11,69	12,36	11,81	11,23	12,79	13,74	14,2	14,96	14,81	15,32	16,25	15,42	14,46	16,16	12,02	14,03	10,87	12,65	11,91	8,12
Tayynshinsky	14,68	14,87	14,73	15,04	14,33	14,34	12,74	13,70	16,82	14,96	15,66	15,79	15,87	15,52	13,37	16,35	12,01	12,15	13,35	11,59	14,1	10,24	11,20
Timiryazevsky	10,36	8,85	10,38	11,14	10,23	13,93	13,06	12,70	16,82	15,44	17,73	16,69	15,04	17,16	12,55	15,51	12,69	15,28	12,47	11,38	12,83	10,74	12,05
Ualikhanovsky	16,80	13,20	14,28	16,27	17,36	15,44	16,31	12,44	17,59	19,47	16,9	19,06	19,46	18,53	12,46	17,16	13,69	16,44	15	17,08	15,07	16,56	17,45
G.Musrepova	13,73	15,07	13,11	15,94	14,00	13,93	13,42	11,69	14,18	14,84	14,8	14,67	14,3	15,03	13,63	12,24	12,73	13,78	11,79	12,77	10,64	11,41	12,29
Urban population																							
North Kazakhstan region	10,54	11,53	11,84	13,95	13,08	15,48	15,75	16,52	18,69	17,95	17,55	18,48	19,02	18,41	18,61	18,09	17,22	15,63	16,03	15,49	15,11	14,31	12,05
Petropavlovsk	…	…	…	…	…	…	16,05	17,05	18,38	18,33	17,87	19,11	19,41	18,52	18,79	17,94	17,51	15,88	16,24	15,58	15,12	14,35	12,33
M.Zhumabaeva	…	…	…	…	…	…	15,51	12,29	21,75	13,74	13,69	14,97	17,44	16,7	16,93	17,42	20,71	17,27	15,57	17,17	13,00	13,69	9,49
Mamlutsky	…	…	…	…	…	…	9,66	11,75	15,02	13,24	14,09	13,04	12,29	16,69	17,13	14,74	14,82	11,01	12,95	12,12	11,30	9,28	7,93
Shal akyna	…	…	…	…	…	…	17,43	14,01	20,46	19,13	19,53	13,91	16,42	18,47	18,15	18,69	11,71	14	14,22	15,49	18,31	19,26	12,65
Tayynshinsky	…	…	…	…	…	…	14,69	17,08	18,00	17,06	16,12	16,9	19,51	18,81	17,83	22,71	14,75	15,35	15,63	14,66	16,46	13,75	11,02
Rural population																							
North Kazakhstan region	13,04	12,79	12,85	13,02	13,26	12,67	12,39	11,80	13,20	14,85	14,80	14,58	14,24	14,76	13,30	13,9	12,74	12,66	12,36	11,89	12,64	12,14	11,24
Petropavlovsk	…	…	…	…	…	…	2,23	2,26	4,26	6,01	8,03	8,18	4,18	6,3	-	8,7	8,85	-	-	-	-	-	-

Ayyrtausky	…	…	…	…	…	…	11,81	12,16	12,22	14,13	14,69	16,51	15,39	14,49	12,64	16,13	13,79	11,4	12,18	11,33	12,50	14,56	11,62
Akzharsky	…	…	…	…	…	…	15,57	12,53	17,97	21,64	15,73	18,68	18,78	16,22	17,34	14,82	13,76	15,04	12,88	13,65	13,13	14,47	14,94
M.Zhumabayeva	…	…	…	…	…	…	10,56	10,45	12,82	12,33	11,96	10,51	8,37	13,04	11,86	10,96	9,49	8,42	9,52	9,85	10,38	9,50	11,9
Yesilsky	…	…	…	…	…	…	11,57	11,95	14,53	13,51	15,16	13,74	12,31	13,56	13,02	13,88	11,52	11,67	12,79	12,2	13,59	11,88	11,11
Zhambylsky	…	…	…	…	…	…	12,64	10,69	13,51	14,07	13,97	10,98	14,18	16,58	15,62	11,47	13,65	13,65	12,32	13,91	13,59	12,80	10,71
Kyzylzharsky	…	…	…	…	…	…	11,18	11,86	12,86	14,11	13,67	13,85	13,67	13,14	13,68	13,88	13,05	13,69	12,44	11,00	13,06	12,46	9,41
Mamlutsky	…	…	…	…	…	…	11,35	9,76	11,25	15,15	14,09	13,91	14,28	14,26	11,43	16,17	14,42	10,59	11,37	10,05	11,62	11,72	8,92
Shal akyna	…	…	…	…	…	…	12,77	11,03	13,82	15,57	16,95	11,92	11,78	12,77	11,76	11,4	10,38	13,84	12,39	12,1	14,46	11,43	8,34
Akkayinsky	…	…	…	…	…	…	11,23	12,79	13,74	14,2	14,96	14,81	15,32	16,25	15,42	14,46	16,16	12,02	14,03	10,87	12,65	11,91	8,12
Tayynshinsky	…	…	…	…	…	…	12,25	12,84	16,49	14,31	15,52	15,45	14,75	14,51	11,97	14,3	11,12	11,08	12,56	10,5	13,24	8,94	11,28
Timiryazevsky	…	…	…	…	…	…	13,06	12,70	16,82	15,44	17,73	16,69	15,04	17,16	12,55	15,51	12,69	15,28	12,47	11,38	12,83	10,74	12,05
Ualikhanovsky	…	…	…	…	…	…	16,31	12,44	17,59	19,47	16,9	19,06	19,46	18,53	12,46	17,16	13,69	16,44	15,00	17,08	15,07	16,56	17,45
G.Musrepova	…	…	…	…	…	…	13,42	11,69	14,18	14,84	14,8	14,67	14,3	15,03	13,63	12,24	12,73	13,78	11,79	12,77	10,64	11,41	12,29

Table L 11 - The total fertility rate of girls in the North Kazakhstan region, per 1000 human

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
The entire population																				
North Kazakhstan region	10,57	10,51	10,91	11,14	11,41	12,15	11,68	11,87	12,95	13,92	13,75	13,58	13,98	13,56	13,30	13,00	12,64	12,48	12,00	11,54
Petropavlovsk	8,22	8,51	8,89	10,35	10,31	12,21	11,74	13,06	13,90	13,49	13,82	14,03	14,16	14,22	13,77	13,61	13,5	12,87	12,67	11,49
Ayyrtausky	11,27	11,24	10,68	10,84	11,69	11,08	11,39	9,83	11,47	13,66	12,48	14,71	13,22	14,25	11,7	11,59	11,93	11,88	11,97	10,81
Akzharsky	12,38	11,34	13,66	15,65	14,04	15,39	16,57	17,27	16,40	19,03	15,09	17,12	18,67	17,67	12,57	12,58	15,42	12,55	11,56	11,01
M.Zhumabayeva	11,59	11,64	11,02	9,35	10,21	11,76	9,42	9,30	11,04	10,56	11,87	9,94	10,53	9,46	11,79	11,84	11,19	11,44	10,12	8,75
Yesilsky	11,27	12,65	12,11	10,75	11,46	10,98	11,41	9,72	12,61	14,42	12,5	12,81	13,83	13,08	11,63	11,1	10,7	11,91	10,93	9,92
Zhambylsky	14,65	13,16	13,87	12,25	12,61	11,64	10,67	9,60	13,33	14,71	14,52	12,69	12,12	14,77	14,18	12,05	12,65	12,66	11,06	12,65
Kyzylzharsky	9,64	9,08	10,35	9,99	9,49	9,15	8,97	10,23	12,76	13,29	11,79	11,75	13,17	12,65	13,02	12,9	11,06	10,27	12,13	11,43
Mamlutsky	10,63	10,74	11,40	10,78	11,81	10,81	9,62	9,95	13,42	14,21	14,52	14,75	13,9	11,65	13,9	12,24	11,96	11,99	12,47	13,29
Shal akyna	12,24	11,49	13,52	13,07	12,57	13,69	12,00	13,80	14,95	14,45	16,34	13,35	11,74	12,89	13,43	13,88	12,34	11,74	13,03	13,38
Akkayinsky	7,18	7,33	7,55	10,01	10,30	11,31	11,22	10,54	13,43	14,47	14,18	13,62	13,42	12,86	12,91	14	12,42	13,06	9,48	9,88
Tayynshinsky	12,66	12,30	13,46	12,98	14,00	12,81	12,98	12,92	14,59	15,78	14,52	13,17	14,98	13,37	13,31	12,95	12,06	12,66	9,63	12,86
Timiryazevsky	8,41	8,87	7,88	7,85	8,97	11,84	11,68	11,67	10,01	13,2	14,06	14,37	15,19	14,72	13,88	17,83	13,23	13,63	14,7	14,76
Ualikhanovsky	13,54	14,41	13,83	14,27	15,06	15,09	15,37	13,18	17,17	16,24	16,62	16,42	19,54	14,13	16,41	13,92	14,53	15,5	14,34	14,72
G.Musrepova	13,02	12,26	12,53	12,22	12,39	14,40	13,24	12,42	12,62	13,29	13,99	13,18	14,27	12,71	13,08	11,56	11,58	12,69	11,9	10,85
Urban population																				
North Kazakhstan region	8,96	9,03	9,51	10,47	10,18	12,44	11,82	13,09	14,32	13,67	14,07	13,85	14,22	14,04	13,85	13,84	13,46	12,97	12,56	11,68
Petropavlovsk	…	…	…	…	…	…	11,77	13,08	13,95	13,55	13,84	14,05	14,18	14,27	13,82	13,65	13,49	12,91	12,67	11,49
M.Zhumabaeva	…	…	…	…	…	…	11,20	10,54	10,78	10,8	14,47	10,92	13,96	13,57	13,76	14,61	13,7	13,48	10,49	8,5
Mamlutsky	…	…	…	…	…	…	10,80	10,05	11,76	12,54	14,44	13,52	13,84	10,49	12,46	13,76	12,81	9,05	11,69	13,52

Akyn's Shawl	…	…	…	…	…	…	11,97	14,89	16,99	15,75	16,08	12,75	12,23	13,07	15,15	15,73	11,57	14,42	13	13,08
Tayynshinsky	…	…	…	…	…	…	13,86	16,23	17,69	17,21	16,39	12,99	16,8	12,9	14,7	15,87	14,3	16,07	12,01	15,6
Rural population																				
North Kazakhstan region	11,61	11,46	11,81	11,56	12,13	11,99	11,60	11,16	12,15	14,09	13,52	13,39	13,80	13,19	12,87	12,32	11,95	12,04	11,49	11,41
Petropavlovsk	…	…	…	…	…	…	2,50	7,59	2,21	-	9,96	8,1	10,29	4,12	2,07	4,22	15,05	-	-	-
Ayyrtausky	…	…	…	…	…	…	11,39	9,83	11,47	13,66	12,48	14,71	13,22	14,25	11,7	11,59	11,93	11,88	11,97	10,81
Akzharsky	…	…	…	…	…	…	16,57	17,27	16,40	19,03	15,09	17,12	18,67	17,67	12,57	12,58	15,42	12,55	11,56	11,01
M.Zhumabayeva	…	…	…	…	…	…	8,94	8,96	11,11	10,48	11,07	9,64	9,45	8,16	11,15	10,92	10,34	10,73	9,99	8,84
Yesilsky	…	…	…	…	…	…	11,41	9,72	12,61	14,42	12,5	12,81	13,83	13,08	11,63	11,1	10,7	11,91	10,93	9,92
Zhambylsky	…	…	…	…	…	…	10,67	9,60	13,33	14,71	14,52	12,69	12,12	14,77	14,18	12,05	12,65	12,66	11,06	12,65
Kyzylzharsky	…	…	…	…	…	…	8,97	10,23	12,76	13,29	11,79	11,75	13,17	12,65	13,02	12,9	11,06	10,27	12,13	11,43
Mamlutsky	…	…	…	…	…	…	9,07	9,91	14,27	15,16	14,56	15,46	13,93	12,36	14,78	11,29	11,41	13,93	12,98	13,14
Shal akyna	…	…	…	…	…	…	12,01	13,36	14,02	13,75	16,49	13,69	11,46	12,78	12,39	12,72	12,84	9,87	13,05	13,61
Akkayinsky	…	…	…	…	…	…	11,22	10,54	13,43	14,47	14,18	13,62	13,42	12,86	12,91	14	12,42	13,06	9,48	9,88
Tayynshinsky	…	…	…	…	…	…	12,77	12,10	13,71	15,3	13,89	13,23	14,37	13,53	12,84	11,95	11,27	11,43	8,76	11,82
Timiryazevsky	…	…	…	…	…	…	11,68	11,67	10,01	13,2	14,06	14,37	15,19	14,72	13,88	17,83	13,23	13,63	14,7	14,76
Ualikhanovsky	…	…	…	…	…	…	15,37	13,18	17,17	16,24	16,62	16,42	19,54	14,13	16,41	13,92	14,53	15,5	14,34	14,72
G.Musrepova	…	…	…	…	…	…	13,24	12,42	12,62	13,29	13,99	13,18	14,27	12,71	13,08	11,56	11,58	12,69	11,9	10,85

Table L 12 - The number of deaths in the North Kazakhstan region, human

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
The entire population																								
North Kazakhstan region	8 930	8 961	9 113	9 272	8 901	8 999	9 222	9 147	8 693	7 944	8 024	8 085	7 890	7 589	6 948	6 722	6 744	6 640	6 564	6 691	7 512	8 421	6 241	5 913
Petropavlovsk	2 891	3 098	3 233	3 235	3 098	3 159	3 314	3 196	3 008	2 729	2 804	2 810	2 734	2 749	2 462	2 473	2 505	2 454	2 442	2 543	3 056	3 403	2 587	2 269
Ayyrtausky	749	724	703	723	696	688	646	661	615	613	604	551	578	518	494	437	453	486	429	430	483	521	434	389
Akzharsky	200	217	211	216	237	252	230	252	224	220	187	221	164	148	162	161	145	139	154	136	147	175	106	123
M.Zhumabayeva	677	669	657	660	578	600	598	590	537	518	502	527	518	499	428	429	423	386	402	410	450	496	356	346
Yesilsky	433	454	418	404	462	423	467	431	427	363	427	401	389	378	319	327	361	322	291	300	350	416	317	278
Zhambylsky	428	414	412	397	362	396	379	412	400	347	349	355	317	318	333	233	296	267	269	285	314	320	190	197
Kyzylzharsky	641	566	633	652	623	665	670	644	662	588	604	596	589	585	574	535	532	513	506	556	588	672	495	481
Mamlutsky	359	347	385	362	351	368	353	382	324	315	317	304	311	304	246	267	237	247	225	234	231	256	207	224
Shal akyna	380	388	412	391	335	381	376	403	375	340	349	345	361	295	275	275	255	266	275	258	251	323	252	239
Akkayinsky	396	388	458	445	448	409	476	420	432	388	365	389	407	348	326	320	319	322	305	318	333	381	247	244
Tayynshinsky	676	738	695	700	659	683	712	698	721	633	639	636	705	582	565	547	508	524	556	497	557	607	420	474
Timiryazevsky	213	176	155	226	212	187	169	180	174	167	174	198	151	156	128	132	152	133	130	139	144	144	116	113
Ualikhanovsky	242	170	173	222	217	189	205	198	194	172	150	186	148	183	127	109	123	121	124	116	126	133	99	107

G.Musrepova	645	612	568	639	623	599	627	680	600	551	553	566	518	526	509	477	435	460	456	469	482	574	415	429
Urban population																								
North Kazakhstan region	3 825	4 059	4 177	4 176	3 678	3 774	3 954	3 877	3 667	3 244	3 372	3 398	3 340	3 272	2 945	2 965	2 960	2 925	2 924	3 049	3 592	4 046	3 068	2 755
Petropavlovsk	2 888	3 093	3 228	3 233	3 096	3 156	3 304	3 189	3 004	2 729	2 795	2 803	2 726	2 744	2 454	2 471	2 499	2 454	2 442	2 543	3 056	3 403	2 587	2 269
Akzharsky	26	25	22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
M.Zhumabayeva	171	175	159	185	140	166	166	154	156	126	135	160	146	125	120	123	99	109	122	114	149	174	112	111
Mamlutsky	125	139	145	138	155	137	135	171	137	117	108	120	141	102	111	103	91	105	91	116	98	113	96	93
Shal akyna	127	137	140	164	132	129	140	147	155	120	140	131	137	124	89	100	95	100	96	102	104	141	116	108
Akkayinsky	119	130	142	150	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tayynshinsky	161	165	169	180	155	186	209	216	215	152	194	184	190	177	171	168	176	157	173	174	185	215	157	174
Ualikhanovsky	83	75	61	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G.Musrepova	125	120	111	126	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rural population																								
North Kazakhstan region	5 105	4 902	4 936	5 096	5 223	5 225	5 268	5 270	5 026	4 700	4 652	4 687	4 550	4 317	4 003	3 757	3784	3 715	3 640	3 642	3 920	4 375	3 173	3 158
Petropavlovsk	3	5	5	2	2	3	10	7	4	-	9	7	8	5	8	2	6	-	-	-	-	-	-	-
Ayyrtausky	749	724	703	723	696	688	646	661	615	613	604	551	578	518	494	437	453	486	429	430	483	521	434	389
Akzharsky	174	192	189	216	237	252	230	252	224	220	187	221	164	148	162	161	145	139	154	136	147	175	106	123
M.Zhumabayeva	506	494	498	475	438	434	432	436	381	392	367	367	372	374	308	306	324	277	280	296	301	322	244	235
Yesilsky	433	454	418	404	462	423	467	431	427	363	427	401	389	378	319	327	361	322	291	300	350	416	317	278
Zhambylsky	428	414	412	397	362	396	379	412	400	347	349	355	317	318	333	233	296	267	269	285	314	320	190	197
Kyzylzharsky	641	566	633	652	623	665	670	644	662	588	604	596	589	585	574	535	532	513	506	556	588	672	495	481
Mamlutsky	234	208	240	224	196	231	218	211	187	198	209	184	170	202	135	164	146	142	134	118	133	143	111	131
Shal akyna	253	251	272	227	203	252	236	256	220	220	209	214	224	171	186	175	160	166	179	156	147	182	136	131
Akkayinsky	277	258	316	295	448	409	476	420	432	388	365	389	407	348	326	320	319	322	305	318	333	381	247	244
Tayynshinsky	515	573	526	520	504	497	503	482	506	481	445	452	515	405	394	379	332	367	383	323	372	392	263	300
Timiryazevsky	213	176	155	226	212	187	169	180	174	167	174	198	151	156	128	132	152	133	130	139	144	144	116	113
Ualikhanovsky	159	95	112	222	217	189	205	198	194	172	150	186	148	183	127	109	123	121	124	116	126	133	99	107
G.Musrepova	520	492	457	513	623	599	627	680	600	551	553	566	518	526	509	477	435	460	456	469	482	574	415	429

Table L 13 - Total mortality rate in the North Kazakhstan region, per 1000 human

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
The entire population																								
North Kazakhstan region	12,61	12,86	13,27	13,67	13,28	13,54	13,93	13,91	13,89	13,35	13,57	13,78	13,56	13,13	12,11	11,78	11,91	11,84	11,79	12,13	13,75	15,58	11,63	11,11
Petropavlovsk	14,45	15,71	16,61	16,72	16,14	16,55	17,25	16,50	15,17	13,45	13,74	13,72	13,31	13,26	11,75	11,59	11,57	11,29	11,18	11,61	13,92	15,49	11,65	10,20
Ayyrtausky	13,25	13,09	12,98	13,65	13,46	13,55	12,90	13,41	13,21	13,96	13,98	12,98	13,88	12,68	12,34	11,13	11,76	12,89	11,56	11,72	13,38	14,75	13,14	12,04
Akzharsky	7,70	8,62	8,62	9,07	10,25	11,21	10,44	11,57	11,00	11,61	9,97	11,94	9,03	8,28	9,21	9,39	8,74	8,63	9,75	8,74	9,67	11,77	7,79	9,23
M.Zhumabayeva	13,88	13,89	13,85	14,11	12,53	13,14	13,24	13,33	13,30	14,13	13,96	14,92	15,00	14,86	13,08	13,41	13,52	12,57	13,32	13,88	15,60	17,60	12,92	12,78
Yesilsky	11,60	12,34	11,51	11,24	12,97	11,94	13,28	12,48	13,59	12,81	15,36	14,70	14,50	14,38	12,44	13,12	14,91	13,66	12,77	13,58	16,20	19,73	14,73	13,16
Zhambylsky	11,82	11,58	11,67	11,38	10,50	11,66	11,35	12,59	13,84	13,76	14,13	14,66	13,34	13,68	14,75	10,71	14,09	13,15	13,67	14,90	16,98	17,89	10,39	10,98
Kyzylzharsky	12,83	11,38	12,78	13,26	12,59	13,24	13,28	12,82	14,01	13,24	13,61	13,41	13,21	13,09	12,85	11,99	11,95	11,55	11,43	12,60	13,29	15,16	10,66	10,34
Mamlutsky	12,57	12,28	13,76	13,05	12,85	13,64	13,21	14,54	13,67	14,82	15,12	14,72	15,27	15,16	12,51	13,94	12,67	13,43	12,49	13,24	13,35	15,12	11,72	12,89
Shal akyna	12,02	12,52	13,59	13,18	11,55	13,40	13,41	14,61	14,86	14,82	15,54	15,76	16,99	14,21	13,50	13,83	13,16	13,96	14,67	14,08	14,04	18,51	13,94	13,42
Akkayinsky	12,77	12,76	15,37	15,16	15,49	14,32	16,80	15,00	17,01	17,02	16,26	17,59	18,72	16,30	15,52	15,59	15,92	16,42	15,92	16,91	18,07	21,13	13,51	13,57
Tayynshinsky	10,52	11,75	11,26	11,51	10,99	11,54	12,11	11,98	13,26	12,54	12,83	12,93	14,57	12,23	12,08	11,90	11,28	11,86	12,78	11,64	13,29	14,77	10,33	11,86
Timiryazevsky	10,91	9,17	8,22	12,25	11,83	10,51	9,46	10,15	10,98	12,00	12,73	14,78	11,53	12,12	10,13	10,74	12,71	11,38	11,38	12,51	13,38	13,77	11,59	11,56
Ualikhanovsky	9,62	6,84	7,05	9,19	9,07	7,93	8,66	8,48	9,42	9,59	8,43	10,54	8,41	10,48	7,37	6,39	7,32	7,32	7,58	7,15	7,87	8,45	7,43	8,20
G.Musrepova	12,13	11,69	11,00	12,49	12,29	11,89	12,49	13,69	12,64	12,13	12,26	12,65	11,69	11,97	11,72	11,17	10,38	11,12	11,12	11,57	12,06	14,62	11,51	12,11
Urban population																								
North Kazakhstan region	14,26	15,38	16,16	16,63	15,51	16,58	17,27	16,84	15,68	13,65	14,14	14,24	13,98	13,62	12,16	12,05	11,88	11,65	11,59	12,06	14,20	16,00	11,84	10,63
Petropavlovsk	14,50	15,76	16,66	16,79	16,20	16,61	17,27	16,53	15,22	13,51	13,76	13,76	13,33	13,30	11,77	11,63	11,59	11,34	11,18	11,61	13,92	15,49	11,65	10,20
Akzharsky	6,86	7,01	12,81	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
M.Zhumabayeva	18,08	18,76	17,19	20,09	15,17	17,57	17,26	16,25	17,50	15,04	16,42	19,72	18,36	16,07	15,63	16,07	12,88	14,13	15,78	14,75	19,38	22,92	13,01	12,95
Mamlutsky	13,95	15,70	16,55	15,87	18,07	16,09	15,90	20,44	17,39	15,69	14,54	16,27	19,24	14,00	15,38	14,51	12,92	14,99	13,17	16,93	14,45	16,87	13,57	13,30
Shal akyna	13,97	15,58	16,46	19,82	16,44	16,43	17,83	18,80	20,08	15,65	18,36	17,42	18,52	16,83	12,08	13,60	12,85	13,29	12,54	13,33	13,67	18,63	14,22	13,27
Akkayinsky	16,49	18,57	20,95	22,67	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tayynshinsky	12,54	13,09	13,62	14,69	12,85	15,74	17,86	18,54	17,92	12,35	16,01	15,44	16,21	15,29	14,89	14,62	15,39	13,79	15,16	15,24	16,22	18,93	11,99	13,33
Ualikhanovsky	10,74	9,83	8,15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G.Musrepova	12,50	12,15	11,36	12,93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rural population																								
North Kazakhstan region	11,60	11,32	11,53	11,93	12,06	11,96	12,16	12,33	12,82	13,15	13,19	13,47	13,27	12,79	12,07	11,57	11,92	11,95	11,96	12,19	13,37	15,22	11,43	11,57
Petropavlovsk	3,23	5,49	5,64	2,30	2,32	3,49	11,76	8,35	4,34	-	9,00	7,13	8,30	5,20	8,40	2,14	6,54	-	-	-	-	-	-	-

Ayyrtausky	13,25	13,09	12,98	13,65	13,46	13,55	12,90	13,41	13,21	13,96	13,98	12,98	13,88	12,68	12,34	11,13	11,76	12,89	11,56	11,72	13,38	14,75	13,14	12,04
Akzharsky	7,84	8,88	8,30	9,07	10,25	11,21	10,44	11,57	11,00	11,61	9,97	11,94	9,03	8,28	9,21	9,39	8,74	8,63	9,75	8,74	9,67	11,77	7,79	9,23
M.Zhumabayeva	12,87	12,72	13,04	12,65	11,87	11,99	12,15	12,53	12,11	13,86	13,24	13,49	13,99	14,49	12,30	12,58	13,73	12,05	12,47	13,57	14,23	15,63	12,88	12,70
Yesilsky	11,60	12,34	11,51	11,24	12,97	11,94	13,28	12,48	13,59	12,81	15,36	14,70	14,50	14,38	12,44	13,12	14,91	13,66	12,77	13,58	16,20	19,73	14,73	13,16
Zhambylsky	11,82	11,58	11,67	11,38	10,50	11,66	11,35	12,59	13,84	13,76	14,13	14,66	13,34	13,68	14,75	10,71	14,09	13,15	13,67	14,90	16,98	17,89	10,39	10,98
Kyzylzharsky	12,83	11,38	12,78	13,26	12,59	13,24	13,28	12,82	14,01	13,24	13,61	13,41	13,21	13,09	12,85	11,99	11,95	11,55	11,43	12,60	13,29	15,16	10,66	10,34
Mamlutsky	11,94	10,72	12,49	11,76	10,46	12,51	11,96	11,79	11,81	14,36	15,43	13,85	13,03	15,82	10,84	13,60	12,52	12,48	12,06	10,90	12,64	13,97	10,49	12,61
Shal akyna	11,23	11,31	12,48	10,61	9,68	12,25	11,70	12,96	12,55	14,40	14,09	14,89	16,17	12,78	14,30	13,97	13,34	14,40	16,14	14,62	14,32	18,41	13,71	13,54
Akkayinsky	11,64	11,03	13,73	12,97	17,47	14,32	16,80	15,00	17,01	17,02	16,26	17,59	18,72	16,30	15,52	15,59	15,92	16,42	15,92	16,91	18,07	21,13	13,51	13,57
Tayynshinsky	10,02	11,41	10,67	10,71	10,52	10,49	10,69	10,34	11,94	12,60	11,81	12,13	14,04	11,24	11,16	11,00	9,88	11,19	11,93	10,33	12,20	13,18	9,53	11,14
Timiryazevsky	10,91	9,17	8,22	12,25	11,83	10,51	9,46	10,15	10,98	12,00	12,73	14,78	11,53	12,12	10,13	10,74	12,71	11,38	11,38	12,51	13,38	13,77	11,59	11,56
Ualikhanovsky	9,13	5,51	6,56	10,85	9,07	7,93	8,66	8,48	9,42	9,59	8,43	10,54	8,41	10,48	7,37	6,39	7,32	7,32	7,58	7,15	7,87	8,45	7,43	8,20
G.Musrepova	12,04	11,58	10,91	12,38	13,60	11,89	12,49	13,69	12,64	12,13	12,26	12,65	11,69	11,97	11,72	11,17	10,38	11,12	11,12	11,57	12,06	14,62	11,51	12,11

Table L 14 - Infant mortality rate in the North Kazakhstan region, per 1000 births

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
The entire population																								
North Kazakhstan region	15,72	14,85	15,00	13,96	14,82	15,06	10,79	15,22	21,05	13,92	13,84	11,99	11,01	10,83	8,62	7,85	7,11	9,01	10,81	9,43	8,72	10,1	10,06	8,53
Petropavlovsk	15,80	13,90	17,90	18,60	19,80	16,80	13,00	14,80	21,90	14,51	12,25	9,04	11,23	11,96	8,66	7,22	5,14	9,31	10,59	9,88	7,7	15,07	13,48	8,11
Ayyrtausky	26,40	10,20	20,00	17,30	15,50	21,90	3,40	9,00	23,60	8,2	11,74	12,28	17,98	6,79	10,27	7,58	-	9,11	6,74	9,85	6,62	4,41	8,33	2,78
Akzharsky	14,60	12,90	5,80	13,30	15,10	11,10	14,10	18,30	5,70	7,79	12,98	12,52	2,94	6,6	7,1	8,06	4,13	17,65	10,36	10,42	-	-	5,32	10,64
M.Zhumabayeva	12,10	10,50	14,50	13,40	19,90	15,60	12,40	15,70	16,40	18,44	13,91	13,23	16,62	16	4,94	5,15	-	17,75	6,09	9,93	12,94	3,57	6,90	4,12
Yesilsky	14,20	22,60	10,80	7,40	7,40	22,40	9,90	21,40	23,50	12,63	15,55	21,94	14,25	8,56	9,49	3,22	14,87	7,31	14,81	8,2	10,91	8,3	17,97	24,91
Zhambylsky	13,60	6,00	10,70	14,00	4,50	26,90	10,30	5,60	8,20	16,35	8,52	6,97	6,41	11,45	14,88	14,69	10,87	10,99	8,09	-	16,54	4,33	4,88	5,18
Kyzylzharsky	15,80	13,80	17,20	9,40	6,00	4,10	5,90	25,40	20,00	13,16	12,41	12,35	11,79	8,68	11,86	3,35	11	11,3	16,59	15,98	9,56	3,92	2,36	9,09
Mamlutsky	21,90	27,60	17,30	15,60	12,60	26,70	11,00	15,00	9,80	6,56	26,61	6,83	3,57	7,3	11,15	3,72	-	-	4,55	14,08	14,85	4,9	-	17,63
Shal akyna	14,70	10,10	20,30	-	13,40	15,20	29,70	16,90	23,20	19,61	34,32	19,31	3,76	10,75	3,58	10,83	8,89	4,1	12,24	4,07	15,04	12,55	13,27	9,66
Akkayinsky	-	11,70	22,60	3,10	12,20	6,10	6,30	3,10	23,90	12,07	12,23	18,98	9,62	9,68	10,1	3,37	13,91	11,63	8,51	-	14,35	24,39	-	5,88
Tayynshinsky	12,40	21,10	13,90	16,40	10,60	11,10	7,70	15,50	25,00	12,77	6,61	16,8	8,11	9,84	4,81	12,02	7,02	9,12	12,02	9,58	5,61	10,46	2,38	9,64
Timiryazevsky	31,40	11,80	5,80	5,80	17,30	4,40	-	18,40	4,70	14,46	13,82	14,22	5,05	14,63	17,96	24,39	12,9	6,45	12,37	13,35	7,04	8,62	17,24	-
Ualikhanovsky	13,10	23,00	11,60	11,00	10,60	8,10	10,70	12,00	19,60	14,96	10,07	12,78	17,77	7,02	-	7,55	20,65	4,22	8,33	7,75	4,33	4,1	4,63	4,63
G.Musrepova	14,30	15,40	8,80	15,30	22,50	11,30	8,90	18,20	38,00	18,84	20,06	11,25	12,64	14,8	8,62	9,35	13,75	3,66	14,17	8,37	9,09	2,25	16,67	11,63
Urban population																								
North Kazakhstan region	15,06	14,19	17,59	18,73	17,38	17,27	12,18	17,05	21,63	14,81	12,61	10,27	11,24	11,66	8,00	7,73	5,55	8,92	10,38	9,41	8,45	15,82	11,96	8,02
Petropavlovsk	...	...	18,40	18,40	19,82	16,72	12,98	14,65	21,62	14,53	11,96	9,06	11,25	11,68	8,67	7,23	5,15	9,32	10,59	9,88	7,7	15,07	13,48	8,11
M.Zhumabaeva	...	...	9,10	18,30	-	9,62	7,81	37,04	6,99	26,6	18,42	9,62	32,26	24,68	-	8,2	-	8,47	-	-	21,98	10,87	10,10	10,99

Mamlutsky	...	...	18,20	27,60	10,31	29,70	-	32,97	19,05	-	9,43	10,2	-	-	18,87	-	-	-	-	-	14,29	-	-	14,71
Shal akyna	...	...	17,50	-	10,31	25,00	-	-	34,72	22,56	29,63	27,41	-	18,22	-	7,94	23,26	9,35	9,62	9,17	24,59	25,42	-	-
Akkayinsky	...	...	21,40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tayynshinsky	...	...	21,30	30,00	5,85	15,96	17,96	20,62	18,69	14,22	10,15	22,6	9,43	5,49	-	18,18	12,05	5,59	19,11	11,56	-	-	-	6,71
Ualikhanovsky	...	...	24,90	7,80	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G.Musrepova	...	...	8,60	20,40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rural population																								
North Kazakhstan region	15,97	15,16	13,66	11,23	13,56	13,70	9,97	13,95	20,65	13,28	14,75	13,32	10,81	10,15	9,17	7,96	8,6	9,11	11,2	9,45	8,97	4,75	8,23	9,03
Petropavlovsk	...	...	-	-	-	-	-	-	-	-	111,11	-	-	200	-	-	-	-	-	-	-	-	-	-
Ayyrtausky	...	...	20,20	17,30	15,46	22,22	3,44	9,24	23,59	8,2	11,74	12,28	17,98	6,79	10,27	7,58	-	9,11	6,74	9,85	6,62	4,41	8,33	2,78
Akzharsky	...	...	6,40	13,30	15,06	11,14	14,12	18,52	5,71	7,79	12,98	12,52	2,94	6,6	7,1	8,06	4,13	17,65	10,36	10,42	-	-	5,32	10,64
M.Zhumabayeva	...	...	15,30	5,10	24,27	17,07	14,45	8,90	18,62	15,53	12,51	14,6	8,44	11,55	6,94	3,76	-	22,73	9,11	14,71	9,17	-	5,24	-
Yesilsky	...	...	10,80	7,40	7,39	22,50	9,90	21,39	23,47	12,63	15,55	21,94	14,25	8,56	9,49	3,22	14,87	7,31	14,81	8,2	10,91	8,3	17,97	24,91
Zhambylsky	...	...	10,70	14,00	4,39	27,23	10,28	6,02	7,73	16,35	8,52	6,97	6,41	11,45	14,88	14,69	10,87	10,99	8,09	-	16,54	4,33	4,88	5,18
Kyzylzharsky	...	...	17,20	9,40	5,95	4,10	5,91	25,27	19,83	13,16	12,41	12,35	11,79	8,68	11,86	3,35	11	11,3	16,59	15,98	9,56	3,92	2,36	9,09
Mamlutsky	...	...	16,50	4,60	13,39	25,13	16,13	5,68	4,95	9,57	35,71	5,13	5,43	11,32	6,13	6,13	-	-	7,41	24,0	15,15	-	-	19,60
Shal akyna	...	...	20,60	-	14,29	10,60	44,00	8,30	16,39	17,86	37,15	14,9	6,21	5,85	6,37	13,25	-	-	14,18	-	6,94	-	27,17	18,35
Akkayinsky	...	...	24,60	3,10	12,23	6,06	6,29	3,07	23,19	12,07	12,23	18,98	9,62	9,68	10,1	3,37	13,91	11,63	8,51	-	14,35	24,39	-	5,88
Tayynshinsky	...	...	12,60	9,20	11,80	9,76	5,09	13,77	26,60	12,18	5,38	14,91	7,49	11,56	6,85	8,92	4,87	10,84	8,77	8,6	8,34	3,23	3,48	11,06
Timiryazevsky	...	...	5,80	5,80	17,44	4,37	-	18,52	4,72	14,46	13,82	14,22	5,05	14,63	17,96	24,39	12,9	6,45	12,37	13,35	7,04	8,62	17,24	-
Ualikhanovsky	...	...	4,60	11,00	10,31	8,24	10,67	13,38	19,55	14,96	10,07	12,78	17,77	7,02	-	7,55	20,65	4,22	8,33	7,75	4,33	4,1	4,63	4,63
G.Musrepova	...	...	9,10	15,30	22,46	11,20	8,97	18,36	37,80	18,84	20,06	11,25	12,64	14,8	8,62	9,35	13,75	3,66	14,17	8,37	9,09	2,25	16,67	11,63

Table L 15 - The total coefficient of natural population growth in the North Kazakhstan region, per 1000 people

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
The entire population																								
North Kazakhstan region	-1,29	-1,47	-1,6	-1,47	-1,01	-0,71	-1,38	-1,32	0,6	1,57	1,18	0,99	1,43	1,68	2,21	2,47	1,68	1,33	1,13	0,33	-1,16	-3,57	-0,67	-0,67
Petropavlovsk	-5,6	-6,1	-6,5	-4,8	-4,3	-2,7	-3,6	-1,7	0,7	2,18	1,87	2,56	3,17	2,86	4,23	3,95	3,71	2,9	3,1	1,73	-0,96	-3,21	-0,42	0,17
Ayyrtausky	0,1	-1	-1,1	-1,7	-1	-2	-1,3	-2,4	-1,3	-0,07	-0,42	2,61	0,41	1,69	-0,17	2,7	1,09	-1,25	0,51	-0,65	-0,83	-1,92	-2,24	-0,99
Akzharsky	5	3,5	5,4	6,7	4,1	4,8	5,7	3,3	5,8	8,71	5,44	5,95	9,69	8,67	5,74	4,31	5,85	5,15	2,47	3,6	3,68	1,41	6,03	4,88
M.Zhumabayeva	-1,8	-2	-2,4	-3,6	-1,6	-1,8	-2,7	-3,3	-0,4	-2,56	-1,86	-4,22	-4,55	-3,25	-0,7	-1,28	-1,85	-1,56	-2,75	-3,66	-4,89	-7,66	-2,40	-3,80
Yesilsky	-0,6	0,1	1,2	0,1	-1,6	-0,6	-1,8	-1,7	0	1,16	-1,55	-1,43	-1,42	-1,07	-0,12	-0,64	-3,8	-1,87	-0,92	-2,54	-3,47	-8,3	-4,65	-3,83
Zhambylsky	2,8	1,9	1,6	0,9	2,7	0,2	0,3	-2,5	-0,4	0,63	0,12	-2,81	-0,21	1,98	0,13	1,06	-0,95	-	-1,98	-1,62	-4,11	-4,97	0,82	-0,22
Kyzylzharsky	-2,6	-1,3	-2,2	-2,4	-2,4	-3,5	-3,2	-1,8	-1,1	0,45	-0,9	-0,63	0,2	-0,2	0,49	1,39	0,09	0,41	0,86	-1,38	-1,47	-3,65	-1,53	-0,52
Mamlutsky	-1,4	-0,7	-1,4	-2,1	-1,1	-2,5	-3	-4,4	-1,1	-0,47	-0,81	-0,53	-1,52	-1,8	1,17	0	0,59	-2,06	-0,28	-1,19	-1,68	-3,07	-3,12	-2,47
Shal akyna	0,8	0,1	-0,6	-0,7	1,6	0,8	-0,4	-1,8	0,5	0,74	1,51	-2,79	-4,47	-0,43	0,2	0,1	-1,55	-1,15	-1,6	-0,65	0,84	-4,81	-2,65	-1,80
Akkayinsky	-5	-4,4	-6,4	-4,3	-4,1	-2,7	-5,6	-3,4	-3,2	-2,68	-1,69	-3,39	-4,37	-1,78	-1,38	-1,36	-1,65	-3,88	-4,18	-6,54	-6,73	-9,76	-4,10	-4,11
Tayynshinsky	3,2	1,8	2,8	2,5	3,2	2,1	0,8	1,3	2,3	2,83	2,25	1,53	0,85	2,21	1,26	2,72	0,76	0,55	-1,31	0,59	-0,36	-3,43	0,02	-1,53
Timiryazevsky	-1,5	-0,3	0,9	-2,7	-2,2	2,4	2,9	2	2,2	2,3	3,15	0,75	3,59	3,81	3,09	5,93	0,25	3,08	2,19	0,54	-0,19	-2,68	0,00	-2,25
Ualikhanovsky	5,6	7	7	6,1	7,1	7,4	7,1	4,3	7,1	8,25	8,32	7,2	11,09	5,84	7,08	9,15	6,79	8,65	7,09	8,75	6,56	7,05	8,78	7,59
G.Musrepova	1,3	2	1,8	1,5	0,9	2,3	0,8	-1,6	0,7	1,92	2,13	1,25	2,6	1,87	1,63	0,72	1,77	2,1	0,73	0,22	-1,05	-4,25	0,14	-2,40
Urban population																								
North Kazakhstan region	-4,57	-5,19	-5,58	-4,56	-4,01	-2,76	-3,66	-2,19	0,36	1,96	1,51	1,71	2,41	2,40	3,85	3,71	3,28	2,53	2,55	1,35	-1,13	-3,60	-0,66	-0,16
Petropavlovsk	…	…	…	…	…	…	…	…	…	2,18	1,88	2,57	3,19	2,87	4,28	3,95	3,71	2,9	3,1	1,73	-0,96	-3,21	-0,42	0,17
Ayyrtausky	…	…	…	…	…	…	…	…	…	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Akzharsky	…	…	…	…	…	…	…	…	…	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
M.Zhumabayeva	…	…	…	…	…	…	…	…	…	-2,87	-2,31	-6,9	-2,77	-1,03	-0,39	-0,13	4,16	1,17	-2,85	-2,07	-7,54	-10,80	-1,51	-2,33
Yesilsky	…	…	…	…	…	…	…	…	…	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zhambylsky	…	…	…	…	…	…	…	…	…	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kyzylzharsky	…	…	…	…	…	…	…	…	…	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mamlutsky	…	…	…	…	…	…	…	…	…	-2,82	-0,27	-2,98	-6,14	-0,55	-0,69	-0,28	0,85	-5	-0,87	-4,09	-4,13	-6,27	-5,23	-3,58
Shal akyna	…	…	…	…	…	…	…	…	…	1,69	-0,66	-4,12	-4,33	-1,22	4,48	3,54	-1,22	0,93	1,04	0,91	2,37	-3,04	-0,74	-1,23
Akkayinsky	…	…	…	…	…	…	…	…	…	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tayynshinsky	…	…	…	…	…	…	…	…	…	4,79	0,25	-0,59	1,88	0,43	1,31	4,53	-0,87	1,93	-1,4	-0,09	-0,70	-5,20	-1,76	-1,92
Timiryazevsky	…	…	…	…	…	…	…	…	…	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ualikhanovsky	…	…	…	…	…	…	…	…	…	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
G.Musrepova	…	…	…	…	…	…	…	…	…	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Rural population																							
North Kazakhstan region	0,72	0,80	0,79	0,35	0,63	0,36	-0,17	-0,85	0,73	1,31	0,96	0,5	0,74	1,17	1,01	1,53	0,42	0,36	-0,04	-0,54	-1,18	-3,55	-0,68	-1,16
Petropavlovsk	…	…	…	…	…	…	…	…	…	2,98	-	1,02	-1,04	-	-7,36	4,28	5,45	-	-	-	-	-	-	-
Ayyrtausky	…	…	…	…	…	…	…	…	…	-0,07	-0,42	2,61	0,41	1,69	-0,17	2,7	1,09	-1,25	0,51	-0,65	-0,83	-1,92	-2,24	-0,99
Akzharsky	…	…	…	…	…	…	…	…	…	8,71	5,44	5,95	9,69	8,67	5,74	4,31	5,85	5,15	2,47	3,6	3,68	1,41	6,03	4,88
M.Zhumabayeva	…	…	…	…	…	…	…	…	…	-2,48	-1,73	-3,42	-5,08	-3,91	-0,8	-1,64	-3,81	-2,48	-2,72	-4,22	-3,92	-6,51	-2,80	-4,48
Yesilsky	…	…	…	…	…	…	…	…	…	1,16	-1,55	-1,43	-1,42	-1,07	-0,12	-0,64	-3,8	-1,87	-0,92	-2,54	-3,47	-8,30	-4,65	-3,83
Zhambylsky	…	…	…	…	…	…	…	…	…	0,63	0,12	-2,81	-0,21	1,98	0,13	1,06	-0,95	-	-1,98	-1,62	-4,11	-4,97	0,82	-0,22
Kyzylzharsky	…	…	…	…	…	…	…	…	…	0,45	-0,9	-0,63	0,2	-0,2	0,49	1,39	0,09	0,41	0,86	-1,38	-1,47	-3,65	-1,53	-0,52
Mamlutsky	…	…	…	…	…	…	…	…	…	0,8	-1,11	0,83	1,07	-2,51	2,25	0,17	0,43	-0,27	0,09	0,65	-0,10	-0,98	-1,70	-1,73
Shal akyna	…	…	…	…	…	…	…	…	…	0,26	2,63	-2,09	-4,55	-	-2,23	-1,92	-1,75	-2,51	-3,43	-1,78	-0,29	-6,17	-4,23	-2,27
Akkayinsky	…	…	…	…	…	…	…	…	…	-2,68	-1,69	-3,39	-4,37	-1,78	-1,38	-1,36	-1,65	-3,88	-4,18	-6,54	-6,73	-9,76	-4,10	-4,11
Tayynshinsky	…	…	…	…	…	…	…	…	…	2,2	2,89	2,2	0,52	2,78	1,25	2,12	1,31	0,06	-1,28	0,83	-0,23	-2,76	0,87	-1,34
Timiryazevsky	…	…	…	…	…	…	…	…	…	2,3	3,15	0,75	3,59	3,81	3,09	5,93	0,25	3,08	2,19	0,54	-0,19	-2,68	0,00	-2,25
Ualikhanovsky	…	…	…	…	…	…	…	…	…	8,25	8,32	7,2	11,09	5,84	7,08	9,15	6,79	8,65	7,09	8,75	6,56	7,05	8,78	7,59
G.Musrepova	…	…	…	…	…	…	…	…	…	1,92	2,13	1,25	2,6	1,87	1,63	0,72	1,77	2,1	0,73	0,22	-1,05	-4,25	0,14	-2,40

Table L 16 - The total fertility rate in the North Kazakhstan region, the number of children per 1 woman

	1999	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
The entire population																						
North Kazakhstan region	1,53	1,63	1,62	1,68	1,62	1,61	1,77	1,96	1,97	2,00	2,09	2,07	2,11	2,08	2,02	2,01	2,01	1,98	2,03	1,97	1,87	1,82
Urban population																						
North Kazakhstan region	1,20	1,52	1,43	1,70	1,64	1,74	1,92	1,78	1,78	1,81	1,87	1,84	1,88	1,87	1,83	1,76	1,78	1,74	1,74	1,70	1,72	1,64
Rural population																						
North Kazakhstan region	1,75	1,70	1,73	1,67	1,62	1,54	1,69	2,14	2,18	2,23	2,37	2,41	2,43	2,48	2,46	2,46	2,39	2,52	2,47	2,45	2,02	2,02

Table L 17 - International population migration by ethnic group (arrived), human

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
All ethnic groups	5 868	5 591	4 524	4 976	5 702	6 414	11 783	7 290	23 053	20 703	23 889	16 967	13 818
Kazakhstan	3 062	2 894	2 265	2 532	2 893	3 581	6 392	4 091	12 544	11 653	13 915	9 619	7 542
Russians	2 067	1 880	1 530	1 621	1 918	2 029	3 837	2 243	7 264	6 171	7 005	4 783	4 080
Ukrainians	178	171	136	159	201	205	342	218	852	729	765	675	564
The Germans	160	173	151	150	172	186	354	190	752	645	713	567	474
Tatars	124	129	92	79	129	113	202	119	335	337	332	266	228
Poles	47	49	47	48	53	77	142	77	329	261	305	266	222
Bolero	33	30	33	27	36	37	52	59	191	168	154	156	117
Other ethnic groups	197	265	270	360	300	186	462	293	786	739	700	635	591

Table L 18 - International population migration by ethnic group (dropped out), human

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
All ethnic groups	19 094	17 059	16 975	15 894	15 001	18 599	24 072	23 884	28 516	25 400	29 832	21 354	18 573
Kazakhstan	9 922	9 369	8 739	8 521	7 907	9 867	12 717	13 660	15 176	13 249	16 153	11 879	9 906
Russians	6 452	5 300	5 735	5 182	4 791	5 892	8 020	7 140	9 506	8 569	9 759	6 382	5 697
Ukrainians	815	673	796	642	648	774	906	764	1 029	953	1 000	804	756
The Germans	723	623	648	590	606	767	918	855	1 042	852	981	756	747
Tatars	278	272	258	205	233	248	356	307	408	412	427	324	336
Poles	340	260	297	291	341	500	508	470	497	522	649	445	453
Bolero	193	169	182	146	169	199	166	180	230	215	213	186	154
Other ethnic groups	371	393	320	317	306	352	481	508	628	628	650	578	524

Table L 19 - International migration of population with CIS countries (immigrants), human

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
	1 559	1 383	1 092	945	642	683	853	673	720	598	591	513	486
Petropavlovsk city, North Kazakhstan region	677	587	498	575	451	402	560	444	466	386	384	331	347
Ayyrtau	68	64	47	64	36	55	59	38	55	32	15	11	9
Akzharovo	28	22	7	5	4	7	3	26	2	7	3	2	-
M.Zhumabaevo	140	135	85	30	-	26	41	16	14	19	16	12	19
Yesin	70	25	35	18	4	22	14	23	14	17	17	3	4
Zhambyl	32	27	16	32	10	6	6	8	18	6	5	1	4
Kyzylzhar	143	218	209	137	49	31	57	16	51	45	41	74	28
Mamluts	154	68	48	13	7	11	21	11	7	15	18	6	7
Medalists	16	14	1	1	10	9	13	11	6	8	21	11	20
Akkayyn	46	43	5	2	5	16	12	12	21	6	6	7	2
Tayynsha	51	76	50	31	36	59	35	33	37	22	35	22	32
Timiryazevo	30	19	16	11	2	5	14	3	4	7	7	3	2
Ualikhanovo	28	25	24	13	5	6	2	7	7	1	2	5	2
The city of Musirepovo	76	60	51	13	23	28	16	25	18	27	21	25	10

Table L 20 - International migration of population with CIS countries (emigrants), human

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
North Kazakhstan region	3 843	2 450	3 557	2 766	2 459	3 169	2 748	2 972	3 206	3 550	3 909	2 115	2 055
Petropavlovsk	1 468	943	1 334	1 116	855	1 205	1 477	1 724	1 971	2 048	2 481	1 343	1 231
Ayyrtau	250	148	198	150	151	206	144	161	149	138	166	95	86
Akzhar	63	44	55	26	34	39	24	47	19	23	19	16	9
M.Zhumabaevo	311	231	273	197	148	221	137	135	129	215	136	82	122

Yes	198	84	137	130	83	130	59	82	66	105	89	34	41
Zhambyl	134	86	119	111	85	111	59	78	71	79	83	32	35
Kyzylzhar	316	182	245	207	178	181	165	123	181	216	195	121	109
Mamlutsky	149	114	145	60	74	110	68	70	90	75	69	39	66
Shawl	121	65	124	78	68	47	27	45	13	52	51	33	22
Akkayyn	152	109	141	84	94	76	69	59	74	102	79	61	38
Tayynsha	270	172	320	304	397	585	339	273	285	248	317	118	172
Timiryazevo	92	61	129	63	28	54	55	38	26	61	35	23	23
Ualikhanovo	35	32	31	39	27	22	22	13	10	7	11	3	-
The city of Musirepovo	284	179	306	201	237	182	103	124	122	181	178	115	101

Table L 21 - International migration of the population with the CIS countries (migration balance), human

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
	-2284	-1067	-2465	-1821	-1817	-2456	-1895	-2299	-2486	-2952	-3318	-1602	-1569
Petropavlovsk city, North Kazakhstan region	-791	-356	-836	-541	-404	-803	-917	-1280	-1505	-1662	-2097	-1012	-884
Ayyrtau	-182	-84	-151	-86	-115	-151	-85	-123	-94	-106	-151	-84	-77
Akzharovo	-35	-22	-48	-21	-30	-32	-21	-21	-17	-16	-16	-14	-9
M.Zhumabaevo	-171	-96	-188	-167	-148	-195	-96	-119	-115	-196	-120	-70	-103
Yes	-128	-59	-102	-112	-79	-108	-45	-59	-52	-88	-72	-31	-37
Zhambyl	-102	-59	-103	-79	-75	-105	-53	-70	-53	-73	-78	-31	-31
Kyzylzhar	-173	36	-36	-70	-129	-150	-108	-107	-130	-171	-154	-47	-81
Mamlutsky	5	-46	-97	-47	-67	-99	-47	-59	-83	-60	-51	-33	-59
Shawl	-105	-51	-123	-77	-58	-38	-14	-34	-7	-44	-30	-22	-2
Akkayyn	-106	-66	-136	-82	-89	-60	-57	-47	-53	-96	-73	-54	-36
Tayynsha	-219	-96	-270	-273	-361	-526	-304	-240	-248	-226	-282	-96	-140
Timiryazevo	-62	-42	-113	-52	-26	-49	-41	-35	-22	-54	-28	-20	-21
Ualikhanovo	-7	-7	-7	-26	-22	-16	-20	-6	-3	-6	-9	2	2
The city of Musirepovo	-208	-119	-255	-188	-214	-154	-87	-99	-104	-154	-157	-90	-91

Table L 22 - International migration of population with other countries (immigrants), human

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
	278	236	169	84	79	37	34	70	74	82	64	80	32
Petropavlovsk city, North Kazakhstan region	68	41	34	42	34	14	24	32	36	40	29	28	23
Ayyrtau	31	46	21	12	4	8	3	1	1	5	2	2	-
Akzharovo	28	44	16	-	-	-	-	-	-	-	-	1	-
M.Zhumabaevo	3	1	3	3	-	-	-	1	2	2	2	3	1
Yes	7	-	4	4	1	3	-	7	3	-	-	3	-
Zhambyl	2	1	2	4	-	1	2	-	2	-	2	-	-
Kyzylzhar	19	22	10	1	4	-	-	5	2	1	2	1	3
Mamlutsky	1	3	1	2	-	-	-	1	1	-	2	-	1
Shawl	1	1	-	-	-	-	-	-	-	-	-	-	1
Akkayyn	12	2	1	1	-	-	2	1	1	5	-	1	-
Tayynsha	88	65	74	15	30	8	3	14	25	19	10	24	3
Timiryazevo	16	6	-	-	1	-	-	-	1	-	-	1	-
Ualikhanovo	1	3	-	-	4	1	-	7	-	8	15	16	-
The city of Musirepovo	1	1	3	-	1	2	-	1	-	2	-	-	-

Table L 23 - International migration of population with other countries (emigrants), human

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
	213	142	135	149	214	222	238	304	239	340	406	237	326
Petropavlovsk city, North Kazakhstan region	55	43	32	48	40	67	113	74	71	81	74	87	120
Ayyrtau	6	7	8	14	18	14	11	12	19	15	12	3	7
Akzharovo	2	-	1	1	13	7	-	1	-	2	1	1	2
M.Zhumabaevo	22	11	3	6	10	15	6	-	18	-	3	3	8
Yesil	5	9	12	2	5	6	1	14	5	1	1	-	-
Zhambyl	4	1	2	1	4	1	-	1	1	10	12	2	5
Kyzylzhar	6	4	8	10	13	17	5	14	19	21	14	4	8
Mamlutsky	3	5	3	1	4	8	3	7	5	6	-	1	-
Shawl	1	-	3	-	1	5	5	6	-	-	1	3	-
Akkayyn	14	5	4	1	6	5	2	10	4	9	9	4	2
Tayynsha	77	40	56	59	86	70	81	152	85	176	270	124	153
Timiryazevo	-	2	-	1	-	1	5	1	-	-	-	2	2
Ualikhanovo	1	1	-	-	1	-	1	1	-	-	1	-	-
The city of Musirepovo	17	14	3	5	13	6	5	11	12	19	8	3	19

Table L 24 - Intra-regional migration (migration balance), human

	-5 679	-4 067	-6 231	-4 903	-4 727	-5 383	-3 646	-7 244	-5 463	-4 697	-5 943	-4 387	-4 755
Petropavlovsk city, North Kazakhstan region	663	769	-303	571	1 787	1 184	4 935	-463	753	247	-104	801	330
Ayyrtau	-715	-690	-912	-829	-853	-834	-782	-843	-815	-342	-479	-686	-614
Akzharovo	-368	-257	-475	-503	-387	-425	-643	-657	-504	-224	-343	-473	-268
M.Zhumabaevo	-743	-500	-533	-739	-890	-722	-686	-597	-477	-430	-650	-511	-440
Yesil	-611	-485	-447	-387	-650	-576	-848	-462	-690	-832	-477	-366	-425
Zhambyl	-580	-480	-426	-389	-687	-715	-940	-575	-800	-419	-602	-565	-473
Kyzylzhar	-132	102	84	207	-2	-37	-157	-125	-122	-172	-81	407	3
Mamlutsky	-258	-273	-323	-210	-355	-395	-658	-263	-341	-347	-316	-379	-281
Shawl	-546	-478	-622	-508	-388	-367	-616	-361	-249	-308	-488	-417	-365
Akkayyn	-320	-282	-290	-287	-349	-280	-626	-278	-470	-287	-218	-284	-202
Tayynsha	-955	-625	-816	-874	-856	-955	-882	-1 131	-623	-679	-928	-639	-806
Timiryazevo	-297	-268	-328	-325	-235	-318	-473	-275	-311	-283	-367	-325	-254
Ualikhanovo	-345	-260	-280	-168	-375	-303	-348	-432	-354	-250	-283	-400	-349
The city of Musirepovo	-472	-340	-560	-462	-487	-640	-922	-782	-460	-371	-607	-550	-611

Table L 25 - Population aging index, per 100 children

	2019	2020	2021	2022	2023
The entire population					
North Kazakhstan	59,4	61,3	62,9	56,3	72,9
Urban population					
North Kazakhstan	64,7	65,9	66,5	62,1	78,8
Rural population					
North Kazakhstan	55,2	57,6	59,8	51,1	67,6

Table L 26 - Number of workers, thousand human

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
North Kazakhstan region	330,3	329,6	318,9	310,3	311,3	308,3	304,4	301,9	293,3	288,4
Petropavlovsk	23,4	24,1	23,1	109,9	109,2	111,5	114,8	114,5	111,1	105,1
Ayyrtau	9,6	9,3	8,9	22,8	23,8	23,5	21,7	20,9	17,9	17,3
Akzhar	12,9	13,7	14,4	8,6	8,6	8,8	8,7	8,1	7,6	8,5
M.Zhumabaev	15,2	14,6	13,6	19,3	20,5	19,1	19,5	19,0	18,6	17,6
The Wand	12,0	11,5	11,1	13,3	13,0	12,6	11,8	11,8	13,5	13,7
Zhambyl	20,2	19,1	19,3	12,8	12,7	12,0	10,5	10,4	10,2	11,2
Kyzylzhar	26,8	27,3	24,9	24,0	22,6	23,5	23,3	23,5	24,5	26,8
Mamlyutka	11,9	11,6	10,9	10,0	10,4	9,8	10,1	9,4	10,6	10,6
Cry	24,5	24,7	23,3	10,1	11,2	10,6	9,7	9,4	10,0	10,1
Deserve	29,9	30,7	28,6	14,6	12,3	10,3	11,0	11,2	11,5	10,9
Tayynsha	7,9	8,0	8,3	23,6	23,1	23,5	22,3	23,2	22,8	21,7
Timiryazev	8,6	8,7	9,2	8,0	8,0	7,9	7,7	7,2	6,8	6,6
Ualikhanov	11,4	11,4	10,0	9,1	10,6	10,5	9,3	9,3	7,9	8,1
G.Musirepov	115,9	114,9	113,3	24,2	25,3	24,7	24,0	24,1	20,2	20,2

Table L 27 - Number of employed population, thousand people

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
North Kazakhstan region	313,8	312,8	303,1	295,2	296,2	293,4	289,3	287,3	279,1	274,5
Petropavlovsk	110,9	109,9	108,1	105,0	104,4	106,4	109,5	109,5	106,5	100,2
Ayyrtau	22,1	22,9	21,9	21,6	22,6	22,3	20,6	19,8	17,0	16,3
Akzhar	9,0	8,7	8,4	8,1	8,2	8,4	8,2	7,7	7,2	8,1
M.Zhumabaev	19,2	18,1	18,4	18,3	19,4	18,1	18,5	17,9	17,6	16,7
The Wand	14,3	13,8	12,8	12,6	12,3	12,0	11,2	11,2	12,8	13,1
Zhambyl	11,4	10,8	10,5	12,2	12,0	11,4	10,0	9,9	9,7	10,7
Kyzylzhar	25,6	26,0	23,6	22,8	21,6	22,4	22,0	22,4	23,2	25,5
Mamluts	11,3	10,9	10,3	9,5	9,8	9,4	9,6	8,9	10,0	10,1
Cry	10,8	10,7	9,5	9,6	10,7	10,0	9,2	8,9	9,5	9,6
Deserve	12,2	12,9	13,6	13,8	11,7	9,7	10,4	10,6	10,9	10,4
Tayynsha	28,3	29,0	27,1	22,4	21,9	22,3	21,2	22,0	21,5	20,6
Timiryazev	7,5	7,6	7,9	7,6	7,6	7,5	7,3	6,8	6,5	6,3
Ualikhanov	8,0	8,1	8,7	8,6	10,1	9,9	8,8	8,8	7,5	7,7
G.Musirepov	23,3	23,3	22,2	23,0	24,0	23,5	22,7	22,8	19,2	19,2

Table L 28 - Employment rate, %

	2017	2018	2019	2020	2021
North Kazakhstan region	95,1	95,1	95,2	95,0	95,1
Petropavlovsk	95,5	95,6	95,4	95,4	95,6
Ayyrtau	94,9	94,9	95,1	94,9	95,0
Akzhar	94,4	94,7	94,9	94,6	95,0
M.Zhumabaev	94,9	94,9	94,6	95,0	94,5
The Wand	95,1	95,0	94,9	94,8	94,7
Zhambyl	94,9	94,6	95,1	95,0	95,1
Kyzylzhar	95,1	95,2	95,3	94,8	95,1
Mamluts	94,7	94,9	95,1	94,7	94,8
Cry	94,7	94,9	95,0	94,7	94,9
Deserve	94,8	95,0	94,8	94,6	94,7
Tayynsha	94,8	94,9	94,9	94,9	94,8
Timiryazev	95,0	94,8	95,0	94,9	95,0
Ualikhanov	94,7	94,7	95,1	94,9	95,0
G.Musirepov	95,0	95,0	95,2	94,9	94,7

Table L 29 - Number of employees, thousand human

	2010	2011	2012	2013	2014	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
North Kazakhstan region	177,6	170,6	166,7	165,9	163,6	219,2	215,1	211,5	212,8	213,9	214,2	214,1	214,1	208,0	207,5
Petropavlovsk	76,5	75,7	72,1	72,9	73,2	89,3	90,1	89,3	87,5	87,0	88,9	94,6	94,4	92,2	86,9
Ayyrtau	10,8	10,6	10,3	10,2	10,1	11,8	11,2	11,8	13,9	14,1	14,2	12,8	12,8	11,6	11,3
Akzhar	5,4	4,7	5,3	4,5	4,2	5,6	5,7	5,4	5,5	5,6	5,3	4,9	4,9	4,9	5,3
M.Zhumabaev	8,0	7,4	7,5	7,0	6,9	12,0	10,6	10,6	8,7	9,0	7,8	7,7	8,6	8,7	9,1
The Wand	7,1	6,9	7,0	6,8	6,6	8,9	8,0	7,7	8,9	9,3	9,0	8,3	8,1	8,9	8,8
Zhambyl	6,5	6,1	5,4	5,6	5,5	6,9	7,4	7,3	7,8	7,6	7,8	6,7	6,4	6,8	7,4
Kyzylzhar	8,6	7,9	8,2	8,8	8,2	16,2	14,9	14,2	15,3	14,7	15,9	15,0	15,5	15,8	17,2
Mamluts	5,2	5,0	4,6	5,0	5,0	6,7	6,9	6,2	6,1	6,2	5,9	5,7	5,7	6,1	6,9
Cry	6,0	5,9	5,4	5,1	5,0	7,0	7,3	6,6	6,9	7,2	6,6	6,3	6,2	6,8	6,5
Deserve	6,5	6,1	6,1	5,9	5,6	8,1	8,2	8,4	7,6	7,5	7,2	7,5	7,1	6,9	6,9
Tayynsha	14,7	13,0	13,1	12,8	12,1	17,6	16,7	16,6	15,3	15,7	16,3	16,6	16,7	16,0	16,4
Timiryazev	3,9	3,5	4,0	3,7	3,8	5,1	5,5	4,8	5,8	5,5	5,5	5,0	4,6	4,4	4,4
Ualikhanov	4,1	4,2	4,4	4,1	3,9	5,2	5,6	5,9	6,6	7,2	6,1	6,0	5,8	4,8	5,6
G.Musirepov	14,2	13,6	13,3	13,7	13,6	18,8	17,1	16,7	17,0	17,3	17,6	17,1	17,2	14,2	14,6

Table L 30 - Number of self-employed workers, thousand human

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
North Kazakhstan region	94,6	97,7	91,6	82,3	82,3	79,4	75,2	73,1	71,1	67,0
Petropavlovsk	21,6	19,8	18,8	17,5	17,4	17,7	14,9	15,1	14,3	13,3
Ayyrtau	10,3	11,7	10,1	7,8	8,6	8,1	7,8	7,0	5,4	5,0
Akzhar	3,4	3,0	3,0	2,6	2,6	3,1	3,3	2,8	2,3	2,8
M.Zhumabaev	7,1	7,5	7,8	9,7	10,4	10,3	10,8	9,3	8,9	7,6
The Wand	5,5	5,8	5,1	3,7	3,0	3,0	2,9	3,1	3,8	4,3
Zhambyl	4,4	3,4	3,2	4,4	4,4	3,6	3,4	3,5	2,9	3,2
Kyzylzhar	9,4	11,1	9,5	7,5	6,9	6,5	7,1	6,9	7,4	8,3
Mamluts	4,5	4,0	4,2	3,4	3,6	3,4	3,9	3,2	3,9	3,1
Cry	3,8	3,4	2,8	2,7	3,5	3,4	2,9	2,7	2,7	3,1
Deserve	4,1	4,7	5,3	6,3	4,2	2,5	2,9	3,5	4,0	3,5
Tayynsha	10,6	12,3	10,5	7,2	6,2	6,0	4,6	5,3	5,6	4,1
Timiryazev	2,3	2,2	3,1	1,8	2,1	2,0	2,3	2,2	2,1	1,9
Ualikhanov	2,9	2,5	2,8	2,0	2,9	3,8	2,8	3,0	2,7	2,1
G.Musirepov	4,5	6,2	5,4	6,0	6,7	5,9	5,7	5,6	5,0	4,6

Table L 31 - The number of unemployed people,human

(aged 15 years and older)	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
North Kazakhstan region	16470	16802	15839	15155	15116	14908	15078	14686	14249	13833
Petropavlovsk	5066	5006	5158	4921	4854	5099	5309	5028	4573	4936
Ayyrtau	1281	1220	1195	1160	1206	1158	1113	1053	924	936
Akzhar	593	549	494	486	458	448	467	401	414	387
M.Zhumabaev	1032	1008	951	947	1018	1037	971	1048	987	887
The Wand	853	823	759	674	707	644	615	631	776	576
Zhambyl	668	686	567	654	646	586	525	512	545	550
Kyzylzhar	1224	1281	1227	1175	1086	1100	1213	1150	1276	1239
Mamluts	576	672	624	535	524	478	542	491	574	541
Cry	594	735	555	536	570	531	512	480	515	473
Deserve	721	766	727	758	620	536	591	592	578	518
Tayynsha	1686	1674	1500	1222	1180	1199	1133	1201	1247	1096
Timiryazev	445	414	416	402	416	398	390	358	368	285
Ualikhanov	559	592	493	475	559	510	473	464	426	398

Table L 32 - Unemployment rate, %

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
North Kazakhstan region	5,0	5,1	5,0	4,9	4,9	4,8	5,0	4,9	4,9	4,8
Petropavlovsk	4,4	4,4	4,6	4,5	4,4	4,6	4,6	4,4	4,1	4,7
Ayyrtau	5,5	5,1	5,2	5,1	5,1	4,9	5,1	5,0	5,2	5,4

Akzhar	6,2	5,9	5,5	5,6	5,3	5,1	5,4	5,0	5,4	4,5
M.Zhumabaev	5,1	5,3	4,9	4,9	5,0	5,4	5,0	5,5	5,3	5,0
The Wand	5,6	5,6	5,6	5,1	5,4	5,1	5,2	5,3	5,7	4,2
Zhambyl	5,6	6,0	5,1	5,1	5,1	4,9	5,0	4,9	5,3	4,9
Kyzylzhar	4,6	4,7	4,9	4,9	4,8	4,7	5,2	4,9	5,2	4,6
Mamluts	4,9	5,8	5,7	5,3	5,1	4,9	5,3	5,2	5,4	5,1
Cry	5,2	6,4	5,5	5,3	5,1	5,0	5,3	5,1	5,2	4,7
Deserve	5,6	5,6	5,1	5,2	5,0	5,2	5,4	5,3	5,0	4,8
Tayynsha	5,6	5,5	5,2	5,2	5,1	5,1	5,1	5,2	5,5	5,1
Timiryazev	5,6	5,2	5,0	5,0	5,2	5,0	5,1	5,0	5,4	4,3
Ualikhanov	6,5	6,8	5,4	5,3	5,3	4,9	5,1	5,0	5,4	4,9
G.Musirepov	4,8	5,6	5,0	5,0	5,0	4,8	5,1	5,3	5,2	5,0

Table L 33 - Youth unemployment rate (aged 15-28 years), %

	2014	2015	2016	2017	2018	2019	2020	2021	2022
North Kazakhstan region	3,8	3,0	3,0	2,7	3,0	3,0	3,9	2,9	3,6
Petropavlovsk	2,2	1,4	2,6	1,9	2,2	1,6	2,3	1,2	3,9
Ayyrtau	3,3	2,8	3,5	3,3	2,5	5,4	4,1	3,3	3,7
Akzhar	5,3	3,2	2,4	1,5	2,4	3,5	2,6	2,4	1,6
M.Zhumabaev	4,9	5,3	3,3	2,2	2,1	2,5	6,8	10,1	6,7
The Wand	3,0	1,0	1,3	3,1	3,9	3,9	5,8	7,0	1,3
Zhambyl	4,4	7,0	4,0	4,1	4,6	5,0	9,6	4,5	2,6
Kyzylzhar	4,4	6,1	3,7	5,1	4,7	4,8	6,1	7,0	4,3
Mamluts	4,5	3,5	2,6	5,2	5,1	3,2	5,7	7,7	10,7
Cry	5,0	7,1	3,9	4,3	4,2	4,6	4,9	3,4	1,4
Deserve	5,2	1,9	6,1	1,7	3,8	5,2	5,1	0,0	1,3
Tayynsha	5,9	5,1	2,3	2,9	1,9	1,9	2,8	4,0	3,9
Timiryazev	4,3	1,9	3,2	3,3	4,9	5,8	5,2	2,3	0,8
Ualikhanov	4,7	3,7	3,0	1,2	3,0	2,6	6,4	3,5	0,8
G.Musirepov	5,2	4,1	4,2	3,8	5,3	5,3	6,3	2,9	1,8

Table L 34 - The number of economically inactive population (aged 15 years and older),human

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
North Kazakhstan region	130223	126172	133260	136685	130760	131825	130052	128744	135173	140070
Petropavlovsk	55614	56712	62528	64895	65729	64344	60575	61259	66822	72956
Ayyrtau	8436	7396	7339	7281	5522	6206	7564	7334	8816	8779
Akzhar	3532	3640	3298	3351	2967	2578	2441	2897	2791	1818
M.Zhumabaev	6369	7261	6388	5379	3891	5154	3948	4077	3894	4847
The Wand	5313	5417	5839	5695	5487	5075	5149	4859	4037	3573
Zhambyl	5481	5752	5414	3040	2834	2988	3957	3835	4339	3723
Kyzylzhar	9577	9450	10941	12212	13064	12489	12241	13035	12280	10651
Mamluts	3990	3688	4013	4354	4009	4121	3866	3773	3838	3905
Cry	4640	4348	5201	4916	3418	4074	4338	4265	4573	4232
Deserve	3919	3117	1603	1393	3026	4575	3744	3180	3199	3716
Tayynsha	6533	5262	6522	10596	10972	9911	10636	9428	9709	10615
Timiryazev	2066	1850	1270	1638	1119	1012	814	1022	1099	1396
Ualikhanov	3974	3731	3215	2943	1498	1629	2720	2232	1809	1531
G.Musirepov	10779	8548	9689	8992	7224	7669	8059	7548	7967	8328

Table L 35 – Number of employed people by type of economic activity, human

	Agriculture, forestry and fisheries				
	2017	2018	2019	2020	2021
North Kazakhstan region	97818	94616	89020	86087	84381
Petropavlovsk	2036	1908	1540	1817	2565
Ayyrtau	11312	12083	12168	10756	9917
Akzhar	3013	2994	3366	3779	3363
M.Zhumabaev	11886	12069	11431	12353	10558
The Wand	5948	5190	4985	4656	4806

Zhambyl	5843	5741	5099	4735	4619
Kyzylzhar	10542	8132	7976	8245	8787
Mamluts	4421	4825	4586	4875	4081
Cry	4144	4981	4026	3500	3737
Deserve	8758	6520	4181	4536	5114
Tayynsha	12048	11310	11252	9745	9914
Timiryazev	3665	3454	3360	3496	3330
Ualikhanov	2899	3962	4037	3115	3184
G.Musirepov	11303	11447	11013	10479	10406
	Industry and construction				
North Kazakhstan region	31 697	33 294	33 554	35 242	34 956
Petropavlovsk	19 670	20 173	20 454	22 210	22 681
Ayyrtau	1 388	1 214	1 230	1 368	1 165
Akzhar	591	515	541	510	467
M.Zhumabaev	469	639	556	490	808
The Wand	728	898	1 030	930	825
Zhambyl	469	601	565	422	334
Kyzylzhar	2 654	2 811	2 845	2 621	2 411
Mamluts	566	630	625	529	624
Cry	688	844	761	801	622
Deserve	540	502	539	540	378
Tayynsha	1 404	1 528	1 670	1 868	1 860
Timiryazev	254	371	413	445	380
Ualikhanov	702	786	682	781	629
G.Musirepov	1 574	1 782	1 643	1 727	1 772
	The service sector				
North Kazakhstan region	165 642	168 303	170 777	167 964	167 913
Petropavlovsk	83 298	82 274	84 383	85 482	84 230
Ayyrtau	8 944	9 321	8 924	8 452	8 745
Akzhar	4 528	4 657	4 465	3 941	3 857
M.Zhumabaev	5 966	6 724	6 078	5 664	6 546
The Wand	5 893	6 194	5 988	5 640	5 549
Zhambyl	5 863	5 678	5 724	4 867	4 927
Kyzylzhar	9 580	10 608	11 598	11 182	11 188
Mamluts	4 521	4 381	4 151	4 188	4 236
Cry	4 775	4 848	5 256	4 862	4 548
Deserve	4 538	4 669	5 020	5 320	5 113
Tayynsha	8 972	9 049	9 386	9 575	10 234
Timiryazev	3 660	3 773	3 729	3 353	3 102
Ualikhanov	4 971	5 330	5 221	4 908	4 998
G.Musirepov	10 133	10 797	10 854	10 530	10 640

Table L 36 - Average monthly nominal salary of one employee (men), tenge

	2017	2018	2019	2020	2021
North Kazakhstan region	113375	121820	139981	162424	187662
Petropavlovsk	140416	149711	166992	186505	214757
Ayyrtau	87254	88628	110118	137091	149151
Akzhar	83535	87382	114502	139900	160299
M.Zhumabaev	90795	96132	113381	139383	161476
The Wand	96038	103052	120474	144034	162275
Zhambyl	96877	101011	112166	143562	167314
Kyzylzhar	103946	115283	134299	161567	194381
Mamluts	86865	91597	114892	135409	155199
Cry	81985	87366	107275	133175	155179
Deserve	88689	97132	117604	145679	175161
Tayynsha	80023	93171	111290	127724	162319
Timiryazev	103976	114829	118453	135212	158711
Ualikhanov	83945	88540	110339	133033	159788
G.Musirepov	102491	108438	124679	148516	167166

Table L 37 - Average monthly nominal salary of one employee (women), tenge

	2017	2018	2019	2020	2021
North Kazakhstan region	95 726	100 534	121 487	153 064	187 359
Petropavlovsk	111 236	116 403	136 413	166 027	199 885
Ayyrtau	80 179	83 373	106 548	143 936	171 756
Akzhar	81 252	87 054	108 745	144 331	180 705
M.Zhumabaev	88 499	93 061	116 074	152 541	184 658
The Wand	81 764	87 238	116 793	150 730	172 219
Zhambyl	84 502	90 801	101 759	141 357	165 451
Kyzylzhar	91 647	95 940	114 504	146 982	187 349
Mamluts	80 736	84 121	115 647	149 587	186 074
Cry	80 611	85 335	106 367	136 247	163 407
Deserve	85 768	90 524	108 326	143 936	171 261
Tayynsha	83 557	89 261	112 356	141 072	175 025
Timiryazev	79 529	79 896	102 036	129 545	166 183
Ualikhanov	82 453	88 161	103 909	141 422	163 792
G.Musirepov	83 416	86 236	106 344	132 975	192 078

Table L 38 - Average monthly salary, in tenge

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
North Kazakhstan region	9 920	11 823	13 708	15 245	19 166	23 011	27 182	34 522	39 790	45 755	51 689	61 712	68 921	74 853	81 062	84 324	97 344	104 139	110 686	130 233	157 497	187 501	227 021	262 248
Petropavlovsk	12 996	14 897	17 287	18 953	23 935	28 498	33 617	42 360	48 176	54 666	62 873	74 358	82 896	89 548	94 594	98 951	116 298	125 185	132 471	151 098	175 921	206 991	247 784	280 566
Ayyrtausky	7 022	8 102	10 054	11 318	14 533	17 989	21 089	27 270	36 611	37 868	42 297	51 208	55 408	59 738	64 771	68 209	77 301	83 733	85 992	108 286	140 630	160 903	200 515	248 975
Akzharsky	7 711	8 769	11 146	12 502	16 212	18 743	22 290	28 391	30 642	37 196	43 400	52 758	55 582	59 817	63 823	68 214	76 881	82 250	87 194	111 220	142 385	172 095	210 653	248 961
M.Zhumabayeva	7 216	9 379	10 814	11 772	15 189	18 956	21 123	27 860	33 658	39 643	46 184	55 222	59 060	65 193	68 298	72 630	85 518	89 461	94 327	114 941	147 073	175 218	204 394	251 807
Yesilsky	7 618	8 641	11 120	12 154	15 316	18 583	21 999	28 607	31 541	41 029	43 601	53 274	58 981	63 247	66 619	74 986	80 721	88 548	94 685	118 527	147 643	167 584	212 406	242 536
Zhambylsky	8 696	9 424	11 666	12 971	15 550	19 301	21 825	26 405	31 831	39 813	42 487	51 156	58 507	60 678	65 258	71 852	84 381	90 043	95 456	106 669	142 375	166 271	212 286	243 756
Kyzylzharsky	7 765	11 116	12 505	14 447	17 005	21 489	22 989	33 522	35 773	39 923	45 087	53 779	62 788	68 314	81 535	8127 1	94 407	97 409	104 583	123 190	153 249	190 266	233 377	272 238
Mamlutsky	9 515	10 361	12 146	12 414	16 382	19 366	22 611	30 519	33 584	41 261	45 463	55 873	59 997	64 439	67 152	70 170	80 709	83 285	87 199	115 322	143 613	173 161	207 221	244 202
Shal akyna	7 129	8 111	10 548	12 237	16 344	19 752	22 999	30 184	33 496	40 215	46 657	53 287	59 174	63 592	67 377	70 369	78 369	81 292	86 310	106 780	134 835	159 552	198 756	237 005
Akkayinsky	7 297	8 825	10 670	11 490	14 872	17 809	20 726	26 274	29 920	35 356	38 386	47 146	53 779	59 257	67 018	6986 1	82 266	87 068	93 388	112 366	144 716	172 936	222 664	250 942
Tayynshinsky	6 483	7 981	9 875	11 452	13 878	17 108	21 535	26 266	32 159	36 426	39 236	47 732	54 706	61 774	64 158	69 053	79 398	81 889	91 154	111 859	134 860	168 845	209 496	247 680
Timiryazevsky	8 965	10 630	11 591	12 462	16 761	19 316	22 523	30 008	32 408	37 147	41 595	52 788	58 584	60 891	67 342	7238 5	83 439	90 754	95 766	109 520	132 053	162 906	200 738	230 194
Ualikhanovsky	8 310	9 695	12 058	12 619	15 739	17 838	21 246	29 715	33 727	40 911	45 847	51 779	57 480	62 046	63 027	66 903	76 221	83 142	88 334	106 782	137 666	162 002	191 579	228 604
G.Musrepova	8 459	10 677	12 641	14 145	17 345	20 894	25 784	31 626	36 835	41 748	46 589	55 927	64 270	69 264	78 338	80 405	89 235	93 864	98 487	116 250	141 519	178 219	208 340	241 146

APPENDIX M

The project's calendar plan in russian and English

Приложение 1.1
к настоящему договору
№_____ от «_____»_____ 2024 года

КАЛЕНДАРНЫЙ ПЛАН

1. НЕКОММЕРЧЕСКОЕ АКЦИОНЕРНОЕ ОБЩЕСТВО «КАЗАХСКИЙ НАЦИОНАЛЬНЫЙ АГРАРНЫЙ ИССЛЕДОВАТЕЛЬСКИЙ УНИВЕРСИТЕТ»

1.1 По приоритету: Экология, окружающая среда и рациональное природопользование
1.2 По подприоритету: Водные ресурсы
1.3 По теме программы: BR24993222 «Построение системы поддержки принятия решений для природно-хозяйственного обустройства территории Северо-Казахстанской области в контексте устойчивого развития»
1.4 Общая сумма программы: 792 435 450, 00 (Семьсот девяносто два миллиона четыреста тридцать пять тысяч четыреста пятьдесят) тенге 00 тиын, в том числе с разбивкой по годам, для выполнения работ согласно пункту 3:
- на 2024 год - в сумме: 215 867 210,00 (Двести пятнадцать миллионов восемьсот шестьдесят семь тысяч двести десять) тенге 00 тиын;
- на 2025 год - в сумме: 288 473 920, 00 (Двести восемьдесят восемь миллионов четыреста семьдесят три тысячи девятьсот двадцать) тенге 00 тиын;
- на 2026 год - в сумме: 288 094 320,00 (Двести восемьдесят восемь миллионов девяносто четыре тысячи триста двадцать) тенге 00 тиын.

2. Характеристика научно-технической продукции по квалификационным признакам и экономические показатели

2.1 Направление работы: Прикладные исследования в области управления земельными ресурсами.
2.2 Область применения: Развитие территории Северо-Казахстанской области.
2.3 Конечный результат:
- за 2024 год:
Будут разработаны концептуальные основы обустройства Северо-Казахстанской области на принципах устойчивого роста, в частности:
- будет составлен обзор мировой научной литературы за последние не менее 5 лет с указанием мировых практик разработки концептуальных основ обустройства территории;
- будет составлена база пространственных данных, где будут сконцентрированы материалы и данные о природно-климатических и социально-экономических показателях Северо-Казахстанской области;
- будет разработан веб-сайт, на котором указаны краткая информация о программе: актуальность, цель, ожидаемые и достигнутые результаты, имена и фамилии членов исследовательской группы с их идентификаторами и ссылками на соответствующие профили, список публикаций (со ссылками на них) и патентов, информация для потенциальных пользователей, а также другая информация.
- за 2025 год:
Будут проанализированы мировые практики по эффективному освоению территорий на основе пространственно-ландшафтного обустройства земель;



Будут оценены природно-климатические и социально-экономические факторы Северо-Казахстанской области, в частности:

- будут оценены климатические, водные и земельные составляющие освоения территории;
- будут оценены трудовые ресурсы, как основа социально-экономического развития;
- будут оценены транспортно-коммуникационные возможности и доступность услуг;
- будут оценена экономическая эффективность устойчивого развития исследуемых территорий;

Будут разработаны концептуальные основы обустройства Северо-Казахстанской области на принципах устойчивого роста;

Будет создана серия цифровых карт по землепользованию и землеустройству для эффективного пространственно-ландшафтного обустройства территории;

Будут разработаны несколько вариантов пространственно-ландшафтного планирования территории с учетом трудовых и земельных ресурсов.

Будет опубликована 1 (одна) публикация входящая в 1 (первый), 2 (второй) и (или) 3 (третий) квартиль по импакт-фактору в базе данных Web of Science и (или) имеющих процентиль по CiteScore в базе данных Scopus не менее 50 (пятидесяти) и не менее 8 (восьми) публикации в изданиях рекомендованных КОКНВО.

- за 2026 год:

Будет проведен сравнительный анализ. Будет определен вариант пространственно-ландшафтного планирования территории с учетом трудовых и земельных ресурсов, экономического потенциала области. По результатам будет составлен отчет.

Будет разработан комплекс мер для устойчивого роста Северо-Казахстанской области на основе привязки существующего или нового каркаса населенных пунктов к земельным и водным ресурсам, с определением необходимых социально-экономических условий.

Будет разработан комплекс мероприятий пространственно-ландшафтного обустройства Северо-Казахстанской области с научно-обоснованными мероприятиями в контексте устойчивого развития:

- будут разработаны проекты методик и инструкции в области планирования и обустройства территории;
- будут разработаны предложения/рекомендации по внесению дополнении в Программу развития территории Северо-Казахстанской области;

Будут опубликованы и распространены результаты реализации программы:

- будут обновлены учебные планы не менее 10 дисциплин имеющихся образовательных программ вуза;
- будут разработаны учебные планы 3 новых дисциплин;
- будет разработана рабочая учебная программа не менее 1 новой образовательной программы;
- будут опубликованы 8 (восемь) публикаций входящих в 1 (первый), 2 (второй) и (или) 3 (третий) квартиль по импакт-фактору в базе данных Web of Science и (или) имеющих процентиль по CiteScore в базе данных Scopus не менее 50 (пятидесяти) и 2 (две) публикации в изданиях рекомендованных КОКНВО;
- будет издана 1 (одна) монография с углублённым изучением проблем обустройства территории содержащее полное и всестороннее исследование данной проблемы;
- будет проведен семинар где будут доведены до общества полученные результаты исследований;
- будут получены не менее 2 (двух) патентов в зарубежных патентных бюро (европейском, американском, японском) или не менее 2 (двух) зарубежных или международных патентов, включенных в базу данных Derwent Innovations Index (Web of Science, Clarivate Analytics) либо не менее 5 (пяти) объектов интеллектуальной собственности

(патент; для заявок в области информационных технологий - авторское свидетельство), зарегистрированных в Национальном Институте интеллектуальной собственности Республики Казахстан;

- будет зарегистрирована не менее 1 (одного) результата в качестве РННТД;

- будет обновлен веб-сайт научно-технической программы с достигнутыми результатами.

2.4 Патентоспособность: Патентоспособен.

2.5 Научно-технический уровень (новизна):

В 2024 году несколько областей Казахстана сильно пострадали от наводнения, включая Северо-Казахстанскую область. В этой связи, иссследования в рамках настоящей программы будут направлены на обеспечение устойчивого развития региона, в том числе путем предотвращения наводнений. Наработки членов команды в этом направлении имеются. В настоящей программе они будут масштабированы по всей территории области. Тем самым значимость программы находится на высоком национальном уровне.

Для решения задач программы планируется применение наиболее современных технологии включая ГИС и ДЗЗ, многокритериальное аналитическое моделирование, методы кластерного анализа. Планируется построение системы поддержки принятия решений (DSS) для регионального планирования и обустройства территории. Работы по разработке вариантов планирования территории, комплекса мер для устойчивого роста Северо-Казахстанской области, комплекса мероприятий пространственно-ландшафтного обустройства территории области планируется выполнить на основе рекомендации DSS. Тем самым будет обеспечено внедрение системы поддержки принятия решений для регионального планирования и обустройства территории на примере одной области, которая может масштабироваться по всей территории Казахстана.

На сегодняшний день, нет детального регионального причинно-следственного анализа основных демографических показателей и трудовых ресурсов Северо-Казахстанской области. Для эффективного управления трудовыми ресурсами планируется сделать прогноз демографических показателей и трудовых ресурсов, что позволит выявлять и решать возникающие проблемы области.

Планируется многокритериальная оценка в которой будут определены рабочие нагрузки фермеров как основную проблему, вызывающую беспокойство, одновременно продемонстрировав ожидаемые преимущества ICLS одновременно по экономическим, агрономическим, экологическим и социальным критериям. Метод энтропийных весов будет использован для определения комплексных весов для оценки уровня экономического и социального развития региона.

2.6 Использование научно-технической продукции осуществляется:

- для развития регионов. Будут разработаны предложении по внесению дополнении в Программу развития территории Северо-Казахстанской области. Для других регионов, результаты программы будут зарегистрированы в качестве РННТД и выведены на коммерциализацию. Это позволит оказывать услуги по обустройству территории и разработке мер для устойчивого роста регионов;

- для совершенствования нормативного регулирования отрасли землеустрйоства. Для этого будут разработаны усовершенствованные правила и инструкции в области планирования территории и предложены в уполномоченный государственный орган;

- для совершенствования процесса подготовки кадров. Для этого будут обновлены учебные планы не менее 10 дисциплин имеющихся образовательных программ, разработаны учебные планы 3 новых дисциплин, внедрена не менее 1 новой образовательной программы, издана монография.

2.7 Вид использования результата научной и (или) научно-технической деятельности:

- в рамках данной программы РННТД будут использованы для разработки рекомендации;

- в последующем РННТД будут использованы для их коммерциализации.

3. Наименование работ, сроки их реализации и результаты

Шифр задания, этапа	Наименование работ по Договору и основные этапы его выполнения*	Срок выполнения		Ожидаемый результат*
		Начало	Окончание	
2024 год				
1.	Разработка концептуальных основ обустройства Северо-Казахстанской области на принципах устойчивого роста	Сентябрь 2024 г.	до 1 декабря 2024 г.	Будут проведен обзор литературы и собраны данные. Будет составлен обзор мировой научной литературы за последние не менее 5 лет с указанием мировых практик разработки концептуальных основ обустройства территории и составлена база пространственных данных, где будут сконцентрированы материалы и данные о природно-климатических и социально-экономических показателях Северо-Казахстанской области.
1.1	Веб сайт - разработка	Сентябрь 2024 г.	до 1 декабря 2024 г.	Веб сайт. Будет разработан веб-сайт, на котором указаны краткая информация о программе: актуальность, цель, ожидаемые и достигнутые результаты, имена и фамилии членов исследовательской группы с их идентификаторами и ссылками на соответствующие профили, список публикаций (со ссылками на них) и патентов, информация для потенциальных пользователей, а также другая информация.
1.2	Обзор лучших мировых практик для разработки концептуальных основ	Сентябрь 2024 г.	до 1 декабря 2024 г.	Обзор. Будет составлен обзор мировой научной литературы

	обустройства Северо-Казахстанской области на принципах устойчивого роста			за последние не менее 5 лет с указанием мировых практик разработки концептуальных основ обустройства территории.
1.3	Сбор данных: • по климатическим, воднымм и земельнымм ресурсам • по экологическому состоянию • трудовых ресурсов • транспортно-коммуникационных • Социально-экономические показатели Картографические материалы	Сентябрь 2024 г.	до 1 декабря 2024 г.	Данные и материалы. Будет составлена база пространственных данных, где будут сконцентрированы материалы и данные о природно-климатических и социально-экономических показателях Северо-Казахстанской области.
1.4	Масштабирование технологии обустройства территории создающих условия для развития орошаемого земледелия с использованием талых вод в Северо-Казахстанской области	Сентябрь 2024 г.	до 1 декабря 2024 г.	Данные и материалы. Будет составлена база пространственных данных, где будут сконцентрированы материалы и данные о природно-климатических показателях Северо-Казахстанской области.
1.5	Веб сайт - обновление	Ноябрь 2024 г.	до 1 декабря 2024 г.	Обновленный веб сайт. Будут обновлены данные по достигнутым результатам, а также другая информация.
2025 год				
2	Провести анализ мировых практик по эффективному освоению территорий на основе пространственно-ландшафтного обустройства земель	Январь 2025 г.	Июнь 2025 г.	Отчет. Будут проанализированы мировые практики по эффективному освоению территорий на основе пространственно-ландшафтного обустройства земель.
3.	Оценка природно-климатических и социально-экономических факторов	Январь 2025 г.	до 1 ноября 2025 г.	Отчеты по оценке. Будут оценены природно-климатические и социально-экономические факторы Северо-Казахстанской области.

3.1	Оценка климатических, водных и земельных составляющих освоения территории	Январь 2025 г.	до 1 ноября 2025 г.	Будут оценены климатические, водные и земельные составляющие освоения территории.
3.2	Оценка трудовых ресурсов, как основы социально-экономического развития	Январь 2025 г.	до 1 ноября 2025 г.	Будут оценены трудовые ресурсы, как основа социально-экономического развития.
3.3	Оценка транспортно-коммуникационных возможностей и доступности услуг	Январь 2025 г.	до 1 ноября 2025 г.	Будут оценены транспортно-коммуникационные возможности и доступность услуг.
3.4	Оценка экономической эффективности устойчивого развития исследуемых территорий	Январь 2025 г.	до 1 ноября 2025 г.	Будут оценена экономическая эффективность устойчивого развития исследуемых территорий.
3.5	Публикация 6 (шесть) статьей в КОКНВО	Сентябрь 2025 г.	до 1 ноября 2025 г.	Опубликованные статьи. Будут опубликованы 6 (шесть) публикации в изданиях рекомендованных КОКНВО.
3.6	Веб сайт - обновление	Январь 2025 г.	Январь 2025 г.	Обновленный веб сайт. Будут обновлены данные по планируемым на текущий год исследованиям, а также другая информация.
4	Разработка концептуальных основ обустройства Северо-Казахстанской области на принципах устойчивого роста	Июль 2025 г.	до 1 ноября 2025 г.	Рекомендации. Будут разработаны концептуальные основы обустройства Северо-Казахстанской области на принципах устойчивого роста.
4.1	Публикация 1 (одной) статьи в КОКНВО	Сентябрь 2025 г.	до 1 ноября 2025 г.	Опубликованные статьи. Будет опубликована 1 (одна) публикация в изданиях рекомендованных КОКНВО.
4.2	Масштабирование технологии обустройства территории создающих условия для развития орошаемого земледелия с использованием талых вод в Северо-Казахстанской области	Январь 2025 г.	до 1 ноября 2025 г.	Карта размещение малых водоемов. Будет разработана Карта размещение малых водоемов с использованием технологий орошаемого земледелия с использованием талых вод в Северо-Казахстанской области.

5	Создание серии цифровых карт по землепользованию и землеустройству для эффективного пространственно-ландшафтного обустройства территории	Январь 2025 г.	до 1 ноября 2025 г.	Цифровые карты. Будет создана серия цифровых карт по землепользованию и землеустройству.
6	Определение варианта пространственно-ландшафтного планирования территории с учетом трудовых и земельных ресурсов, экономического потенциала области	Июнь 2025 г.	до 1 ноября 2025 г.	Будут разработаны несколько вариантов пространственно-ландшафтного планирования территории с учетом трудовых и земельных ресурсов. Будут опубликованы статьи. Будет обновлен веб сайт.
6.1	Разработка нескольких вариантов пространственно-ландшафтного планирования территории с учетом трудовых и земельных ресурсов, экономического и экологического потенциала области	Июнь 2025 г.	до 1 ноября 2025 г.	Цифровые карты. Будут разработаны несколько вариантов пространственно-ландшафтного планирования территории с учетом трудовых и земельных ресурсов.
6.2	Публикация 1 (одной) статьи в международных изданиях (Web of Science/Scopus) и 1 (одной) статьи в КОКНВО	Сентябрь 2025 г.	до 1 ноября 2025 г.	Опубликованные статьи. Будет опубликована 1 (одна) публикация входящая в 1 (первый), 2 (второй) и (или) 3 (третий) квартиль по импакт-фактору в базе данных Web of Science и (или) имеющих процентиль по CiteScore в базе данных Scopus не менее 50 (пятидесяти) и 1 (одна) публикация в изданиях рекомендованных КОКНВО.
6.3	Веб сайт - обновление	Октябрь 2025 г.	до 1 ноября 2025 г.	Обновленный веб сайт. Будут обновлены данные по достигнутым результатам, а также другая информация.
2026 год				
7	Определение варианта пространственно-ландшафтного планирования территории с учетом трудовых и	Январь 2026 г.	до 1 ноября 2026 г.	Разработанные комплексы мер и мероприятий.

	земельных ресурсов, экономического потенциала области			
7.1	Веб сайт - обновление	Январь 2026 г.	Январь 2026 г.	Обновленный веб сайт. Будут обновлены данные по планируемым на текущий год исследованиям, а также другая информация.
7.2	Сравнительный анализ и определение основного варианта пространственно-ландшафтного планирования территории с учетом трудовых и земельных ресурсов, экономического потенциала области	Январь 2026 г.	до 1 ноября 2026 г	Отчет. Будет проведен сравнительный анализ. Будет определен вариант пространственно-ландшафтного планирования территории с учетом трудовых и земельных ресурсов, экономического потенциала области. По результатам будет составлен отчет.
7.3	Масштабирование технологии обустройства территории создающих условия для развития орошаемого земледелия с использованием талых вод в Северо-Казахстанской области	Январь 2026 г.	до 1 ноября 2026 г.	Данные и материалы и карта размещение малых водоемов. Будет доработана карта размещения малых водоемов с использованием технологий орошаемого земледелия с использованием талых вод в Северо-Казахстанской области.
7.4	Публикация 1 (одной) статьи в КОКНВО	Июль 2026 г.	до 1 ноября 2026 г.	Опубликованные статьи. Будет опубликована 1 (одна) публикация в изданиях рекомендованных КОКНВО.
8	Разработка комплекса мер для устойчивого роста Северо-Казахстанской области на основе привязки существующего или нового каркаса населенных пунктов к земельным и водным ресурсам, с определением необходимых социально-экономических условий	Июль 2026 г.	до 1 ноября 2026 г.	Рекомендации. Будет разработан комплекс мер для устойчивого роста Северо-Казахстанской области на основе привязки существующего или нового каркаса населенных пунктов к земельным и водным ресурсам, с определением необходимых социально-экономических условий
8.1	Веб сайт - обновление	Ноябрь 2026 г.	до 1 ноября	Обновленный веб сайт.

			2026 г.	Будут обновлены данные по достигнутым результатам, а также другая информация.
9	Разработка комплекса мероприятий пространственно-ландшафтного обустройства Северо-Казахстанской области с научно-обоснованными мероприятиями в контексте устойчивого развития	Июль 2026 г.	до 1 ноября 2026 г.	Рекомендации. Будет разработан комплекс мероприятий пространственно-ландшафтного обустройства Северо-Казахстанской области с научно-обоснованными мероприятиями в контексте устойчивого развития.
9.1	Разработка проектов методик и инструкции в области планирования и обустройства территории	Июль 2026 г.	до 1 ноября 2026 г.	Проекты нормативных документов. Будут разработаны проекты методик и инструкции в области планирования и обустройства территории.
9.2	Разработка предложении по внесению дополнении в Программу развития территории Северо-Казахстанской области	Июль 2026г.	до 1 ноября 2026 г.	Предложения. Будут разработаны предложения/рекомендации по внесению дополнении в Программу развития территории Северо-Казахстанской области.
10	Оформление и распространение результатов реализации программы	Июнь 2026 г.	до 1 ноября 2026 г.	Будут опубликованы и распространены результаты реализации программы.
10.1	Обновление учебных планов не менее 10 дисциплин имеющихся образовательных программ вуза	Июль 2026 г.	до 1 ноября 2026 г.	Обновленные силлабусы. Будут обновлены учебные планы (силлабусы) не менее 10 дисциплин имеющихся образовательных программ вуза.
10.2	Внедрение 3 новых дисциплин	Июль 2026 г.	до 1 ноября 2026 г.	Новый модуль образовательной программы. Будут разработаны учебные планы 3 новых дисциплин.
10.3	Создание 1 новой образовательной программы	Июль 2026 г.	до 1 ноября 2026 г.	Новая образовательная программа. Будет разработана рабочая учебная программа не менее 1 новой образовательной программы.

10.4	Публикация 8 (восемь) статьей в международных изданиях (Web of Science/Scopus) и 1 (одной) статьи в КОКНВО	Сентябрь 2026 г.	до 1 ноября 2026 г.	Опубликованные статьи. Будут опубликованы 8 (восьми) публикаций входящих в 1 (первый), 2 (второй) и (или) 3 (третий) квартиль по импакт-фактору в базе данных Web of Science и (или) имеющих процентиль по CiteScore в базе данных Scopus не менее 50 (пятидесяти) и 1 (одна) публикация в изданиях рекомендованных КОКНВО.
10.5	Монография 1	Июнь 2026 г.	до 1 ноября 2026 г.	Изданная монография. Будет издана 1 (одна) монография с углублённым изучением проблем обустройства территории содержащее полное и всестороннее исследование данной проблемы.
10.6	Семинар	Сентябрь 2026 г.	до 1 ноября 2026 г.	Проведенный семинар. Будет проведен семинар где будут доведены до общества полученные результаты исследований.
10.7	Получение патентов	Сентябрь 2026 г.	до 1 ноября 2026 г.	Полученные патенты. Будут получены не менее 2 (двух) патентов в зарубежных патентных бюро (европейском, американском, японском) или не менее 2 (двух) зарубежных или международных патентов, включенных в базу данных Derwent Innovations Index (Web of Science, Clarivate Analytics) либо не менее 5 (пяти) объектов интеллектуальной собственности (патент; для заявок в области информационных технологий - авторское свидетельство), зарегистрированных в Национальном Институте интеллектуальной

				собственности Республики Казахстан.
10.8	Регистрация РННТД	Ноябрь 2026 г.	до 1 ноября 2026 г.	Номер регистрации и сертификат. Будет зарегистрирована не менее 1 (одного) результата в качестве РННТД.
10.9	Веб сайт - обновление	Октябрь 2026 г.	до 1 ноября 2026 г.	Обновленный веб сайт. Будут обновлены данные по достигнутым результатам, а также другая информация.

От Заказчика:
Председатель
ГУ «Комитет науки Министерства науки и высшего образования РК»

Жанкуатов Г.Ж.

м.п.

От Исполнителя:
Финансовый директор
Некоммерческое акционерное общество «Казахский национальный аграрный исследовательский университет»

_____ **Сыдыков А.Ш.**

м.п.

Ознакомлен:
Научный руководитель программы

_____ Молжигитова Д.К.
(подпись)

THE CALENDAR PLAN
NON-PROFIT JOINT STOCK COMPANY
1. KAZAKH NATIONAL AGRARIAN RESEARCH UNIVERSITY

1.1 By priority: Ecology, environment and environmental management

1.2 By sub-priority: Water resources

1.3 On the topic of the program: BR24993222 "Building a decision support system for the natural and economic development of the territory of the North Kazakhstan region in the context of sustainable development"

1.4 The total amount of the program: 792,435,450. 00 (Seven hundred ninety-two million four hundred thirty-five thousand four hundred fifty) tenge 00 tiyn, including by year, for the performance of work according to paragraph 3:

- for 2024 - in the amount of: 215 867 210.00 (Two hundred fifteen million eight hundred sixty seven thousand two hundred ten) tenge 00 tiyn;
- for 2025 - in total: 288,473,920. 00 (Two hundred eighty-eight million four hundred seventy-three thousand nine hundred twenty) tenge 00 tiyn;
- for 2026 - in the amount of: 288,094,320.00 (Two hundred eighty-eight million ninety-four thousand three hundred and twenty) tenge 00 tiyn.

2. Characteristics of scientific and technical products according to qualification criteria and economic indicators

2.1 Field of work: Applied research in the field of land management.

2.2 Scope of application: Development of the territory of the North Kazakhstan region.

2.3 The final result:

- for the year 2024:

Conceptual foundations for the development of the North Kazakhstan region based on the principles of sustainable growth will be developed, in particular:

- a review of the world scientific literature for the last at least 5 years will be compiled, indicating world practices in developing conceptual foundations for the development of the territory;
- a spatial database will be compiled, where materials and data on natural, climatic and socio-economic indicators of the North Kazakhstan region will be concentrated;
- a website will be developed that provides brief information about the program: relevance, purpose, expected and achieved results, names and surnames of members of the research group with their identifiers and links to relevant profiles, a list of publications (with links to them) and patents, information for potential users, as well as other information.

- for the year 2025:

The world practices on the effective development of territories based on spatial and landscape land development will be analyzed;

The natural and climatic and socio-economic factors of the North Kazakhstan region will be assessed, in particular:

- the climatic, water and land components of the territory development will be assessed;
- labor resources will be evaluated as the basis of socio-economic development;
- transport and communication capabilities and accessibility of services will be assessed;
- the economic efficiency of the sustainable development of the studied territories will be assessed;

Conceptual foundations for the development of the North Kazakhstan region based on the principles of sustainable growth will be developed;

A series of digital maps on land use and land management will be created for effective spatial and landscape arrangement of the territory;

Several options for spatial and landscape planning of the territory will be developed, taking into account labor and land resources.

There will be 1 (one) publication included in the 1st (first), 2nd (second) and (or) 3rd (third)

quartile of the impact factor in the Web of Science database and (or) having a CiteScore percentile in the Scopus database of at least 50 (fifty) and at least 8 (eight) publications in publications recommended by the COKNVO.

- for the year 2026:

A comparative analysis will be carried out. A variant of spatial and landscape planning of the territory will be determined, taking into account labor and land resources, and the economic potential of the region. A report will be compiled based on the results.

A set of measures will be developed for the sustainable growth of the North Kazakhstan region based on linking the existing or new framework of settlements to land and water resources, with the definition of the necessary socio-economic conditions.

A set of measures for spatial and landscape development of the North Kazakhstan region with scientifically based measures in the context of sustainable development will be developed:

- draft methodologies and instructions in the field of planning and development of the territory will be developed;

- proposals/recommendations on making additions to the Development Program of the territory of the North Kazakhstan region will be developed;

The results of the program implementation will be published and distributed:

- the curricula of at least 10 disciplines of the university's existing educational programs will be updated;

- curricula of 3 new disciplines will be developed;

- a working curriculum of at least 1 new educational program will be developed;

- 8 (eight) publications will be published that are included in the 1st (first), 2nd (second) and (or) 3rd (third) quartile by impact factor in the Web of Science database and (or) have a CiteScore percentile in the Scopus database of at least 50 (fifty) and 2 (two) publications in publications recommended by the COKNVO;

- one (1) monograph will be published with an in-depth study of the problems of territory development containing a complete and comprehensive study of this problem;

- a seminar will be held where the results of the research will be brought to the public;

- at least 2 (two) patents will be obtained from foreign patent offices (European, American, Japanese) or at least 2 (two) foreign or international patents included in the Derwent Innovations Index database (Web of Science, Clarivate Analytics) or at least 5 (five) intellectual property objects (patent; for applications in the field of information technology - an author's certificate) registered with the National Institute of Intellectual Property of the Republic of Kazakhstan;

- at least 1 (one) result will be registered as an RNTD;

- The website of the scientific and technical program will be updated with the results achieved.

2.4 Patentability: Patentable.

2.5 Scientific and technical level (novelty):

In 2024, several regions of Kazakhstan were severely affected by flooding, including the North Kazakhstan region. In this regard, the research under this program will be aimed at ensuring the sustainable development of the region, including through flood prevention. The achievements of the team members in this direction are available. In this program, they will be scaled throughout the region. Thus, the significance of the program is at a high national level.

To solve the tasks of the program, it is planned to use the most modern technologies, including GIS and remote sensing, multi-criteria analytical modeling, and cluster analysis methods. It is planned to build a decision support system (DSS) for regional planning and territory development. Work on the development of options for planning the territory, a set of measures for sustainable growth of the North Kazakhstan region, a set of measures for spatial and landscape development of the territory of the region is planned to be carried out on the basis of the DSS recommendation. This will ensure the implementation of a decision support system for regional planning and territorial development using the example of one area that can be scaled throughout Kazakhstan.

To date, there is no detailed regional causal analysis of the main demographic indicators and labor resources of the North Kazakhstan region. For effective human resource management, it is planned to make a forecast of demographic indicators and labor resources, which will allow identifying and solving emerging problems in the region.

A multi-criteria assessment is planned, which will identify the workloads of farmers as the main problem of concern, while demonstrating the expected benefits of ICLS simultaneously on economic, agronomic, environmental and social criteria. The entropy weights method will be used to determine complex weights to assess the level of economic and social development of the region.

2.6 The use of scientific and technical products is carried out:

- for the development of the regions. Proposals will be developed to make additions to the Program of development of the territory of the North Kazakhstan region. For other regions, the results of the program will be registered as RNTD and commercialized. This will make it possible to provide services for the development of the territory and the development of measures for the sustainable growth of the regions;

- to improve the regulatory regulation of the land industry. To do this, improved rules and instructions in the field of territory planning will be developed and proposed to the authorized state body;

- to improve the training process. To do this, the curricula of at least 10 disciplines of the existing educational programs will be updated, curricula of 3 new disciplines have been developed, at least 1 new educational program has been introduced, and a monograph has been published.

2.7 Type of use of the result of scientific and (or) scientific and technical activities:

- within the framework of this program, RNNTDS will be used to develop recommendations;

- in the future, RNNTDS will be used for their commercialization.

3. The name of the work, the timing of its implementation and the results

Task, stage code	Name of works under the Contract and main stages of its fulfilment*	Due date		Expected Result*
		Commencement	Ends	
2024 year				
1.	Development of the conceptual framework for the development of the North-Kazakhstan region on the principles of sustainable growth	September 2024 y.	up to 1 December 2024 y.	A literature review and data collection will be undertaken. A review of the world scientific literature for the last at least 5 years will be made, indicating the world practices of development of conceptual bases of territory development and a spatial database will be compiled, where materials and data on natural-climatic and socio-economic indicators of the North-Kazakhstan region will be concentrated.
1.1	Web site - development	September 2024 y.	up to 1 December 2024 y.	Web site. A website will be developed that provides a summary of the programme: relevance, objective, expected and achieved results, names of research team members with their identifiers and links to relevant profiles, list of publications (with links to them) and patents, information for potential users, and other information.

1.2	Review of the best global practices for the development of the conceptual framework for the development of the North-Kazakhstan region on the principles of sustainable growth	September 2024 y.	up to 1 December 2024 y.	Review. A review of the world scientific literature for the last at least 5 years will be compiled, indicating the world practices in developing conceptual frameworks for land development.
1.3	Data collection: - on climatic, water and land resources - environmental status - labour resources - transport and communication - Socio-economic indicators Cartographic materials	September 2024 y.	up to 1 December 2024 y.	Data and materials. A spatial database will be compiled, where materials and data on natural-climatic and socio-economic indicators of the North-Kazakhstan region will be concentrated.
1.4	Scaling of land development technology creating conditions for the development of irrigated agriculture with the use of melt water in the North-Kazakhstan region	September 2024 y.	up to 1 December 2024 y.	Data and materials. A spatial database will be compiled, where materials and data on natural and climatic indicators of the North-Kazakhstan region will be concentrated.
1.5	Веб сайт - обновление	November 2024 y.	up to 1 December 2024 y.	Updated website. Results achieved and other information will be updated.
2025 year				
2	To analyse global practices for effective land development based on spatial and landscape land management	January 2025 y.	June 2025 y.	Report. World practices for effective land development based on spatial and landscape land management will be analysed.
3.	Assessment of natural, climatic and socio-economic factors	January 2025 y.	up to 1 November 2025 y.	Assessment Reports. Natural-climatic and socio-economic factors of the North-Kazakhstan region will be assessed.
3.1	Assessment of climatic, water and land components of territory development	January 2025 y.	up to 1 November 2025 y.	The climatic, water and land development components of the area will be assessed.
3.2	Assessment of labour resources as a basis for socio-economic development	January 2025 y.	up to 1 November 2025 y.	Labour resources as the basis for socio-economic development will be assessed.

3.3	Assessment of transport and communications capacity and accessibility of services	January 2025 y.	up to 1 November 2025 y.	Transport and communications capacity and accessibility of the service will be assessed.
3.4	Assessment of economic efficiency of sustainable development of the territories under study	January 2025 y.	up to 1 November 2025 y.	The economic efficiency of sustainable development of the studied territories will be assessed.
3.5	Publication of six (6) articles in KOCNVO	September 2025 y.	up to 1 November 2025 y.	Published articles. Six (6) publications will be published in the editions recommended by KOCNVO.
3.6	Web site - update	January 2025 y.	January 2025 y.	Updated website. There will be updated data on studies planned for the current year, as well as other information.
4	Development of the conceptual framework for the development of the North-Kazakhstan region on the principles of sustainable growth	July 2025 y.	up to 1 November 2025 y.	Recommendations. A conceptual framework for the development of North Kazakhstan Oblast on the principles of sustainable growth will be developed.
4.1	Publication of 1 (one) article in KOCNVO	September 2025 y.	up to 1 November 2025 y.	Published articles. There will be published 1 (one) publication in the editions recommended by KOCNVO.
4.2	Scaling of land development technology creating conditions for the development of irrigated agriculture with the use of melt water in the North-Kazakhstan region	January 2025 y.	up to 1 November 2025 y.	Map of small reservoirs location. Map of small reservoirs location using irrigated farming technologies with use of melt water in North-Kazakhstan oblast will be developed.
5	Creation of a series of digital maps on land use and land management for effective spatial and landscape management of the territory	January 2025 y.	up to 1 November 2025 y.	Digital maps. A series of digital maps on land use and land management will be created.
6	Determination of a spatial and landscape planning option for the territory, taking into account labour and land resources and the economic potential of the region	June 2025 y.	up to 1 November 2025 y.	Several options for spatial and landscape planning of the territory, taking into account labour and land resources, will be developed. Articles will be published. The website will be updated.

6.1	Development of several options for spatial and landscape planning of the territory, taking into account labour and land resources, economic and environmental potential of the region	June 2025 y.	up to 1 November 2025 y.	Digital maps. Several options for spatial and landscape planning of the territory will be developed, taking into account labour and land resources.
6.2	Publication of 1 (one) article in international editions (Web of Science/Scopus) and 1 (one) article in KOCNVO.	September 2025 y.	up to 1 November 2025 y.	Published articles. There will be published 1 (one) publication included in the 1st (first), 2nd (second) and (or) 3rd (third) quartile by impact factor in Web of Science database and (or) having CiteScore percentile in Scopus database not less than 50 (fifty) and 1 (one) publication in the editions recommended by KOCNVO.
6.3	Web site - update	October 2025 y.	up to 1 November 2025 y.	Updated website. Results achieved and other information will be updated.
2026 year				
7	Determination of the option of spatial and landscape planning of the territory taking into account labour and land resources, economic potential of the region	January 2026 y.	up to 1 November 2026 y.	Developed sets of measures and activities.
7.1	Web site - update	January 2026 y.	January 2026 y.	Updated website. The data on the studies planned for the current year, as well as other information will be updated.
7.2	Comparative analysis and determination of the main variant of spatial-landscape planning of the territory taking into account labour and land resources, economic potential of the region	January 2026 y.	up to 1 November 2026 y.	Report. A comparative analysis will be carried out. A variant of spatial and landscape planning of the territory will be determined, taking into account labour and land resources, economic potential of the region. A report will be prepared based on the results.
7.3	Scaling up the technology of land development creating conditions for the development of irrigated farming with the use of melt water in the North-Kazakhstan region	January 2026 y.	up to 1 November 2026 y.	Data and materials and map of small reservoirs location. The map of small reservoirs location using irrigated agriculture technologies with use of melt water in North-Kazakhstan oblast will be finalised.

7.4	Publication of 1 (one) article in KOCNVO	July 2026 y.	up to 1 November 2026 y.	Published articles. There will be published 1 (one) publication in the editions recommended by KOCNVO.
8	Development of a set of measures for sustainable growth of North-Kazakhstan oblast on the basis of linking the existing or new framework of settlements to land and water resources, with determination of necessary socio-economic conditions	July 2026 y.	up to 1 November 2026 y.	Recommendations. A set of measures will be developed for sustainable growth of the North Kazakhstan Oblast based on linking the existing or new settlement framework to land and water resources, identifying the necessary socio-economic conditions
8.1	Web site - update	November 2026 y.	up to 1 November 2026 y.	Updated website. Results achieved and other information will be updated.
9	Development of a set of measures of spatial-landscape arrangement of the North-Kazakhstan region with science-based measures in the context of sustainable development	July 2026 y.	up to 1 November 2026 y.	Recommendations. A set of measures of spatial-landscape arrangement of the North-Kazakhstan region will be developed with science-based measures in the context of sustainable development.
9.1	Development of draft methodologies and instructions in the field of spatial planning and landscaping	July 2026 y.	up to 1 November 2026 y.	Draft regulatory documents. Draft methodologies and instructions will be developed in the field of territory planning and development.
9.2	Development of proposals on making additions to the Programme of development of the territory of the North-Kazakhstan region	July 2026 y.	up to 1 November 2026 y.	Proposals. Proposals/recommendations on making additions to the Programme of territory development of the North-Kazakhstan region will be developed.
10	Formalisation and dissemination of the results of the programme implementation	June 2026 y.	up to 1 November 2026 y.	The results of the programme will be published and disseminated.
10.1	Updating the curricula of at least 10 disciplines of the existing educational programmes of the university	July 2026 y.	up to 1 November 2026 y.	Updated syllabuses. Curricula (syllabuses) of at least 10 disciplines of the existing educational programmes of the university will be updated.
10.2	Introduction of 3 new disciplines	July 2026 y.	up to 1 November	New module of the educational programme. Curricula of 3 new disciplines will be developed.

			2026 y.	
10.3	Creation of 1 new educational programme	July 2026 y.	up to 1 November 2026 y.	New educational programme. A working curriculum of at least 1 new educational programme will be developed.
10.4	Publication of 8 (eight) articles in international editions (Web of Science/Scopus) and 1 (one) article in COCNVO	September 2026 y.	up to 1 November 2026 y.	Published articles. There will be 8 (eight) publications included in the 1st (first), 2nd (second) and (or) 3rd (third) quartile by impact factor in Web of Science database and (or) having CiteScore percentile in Scopus database not less than 50 (fifty) and 1 (one) publication in the editions recommended by KOCNVO.
10.5	Monograph 1	June 2026 y.	up to 1 November 2026 y.	Published monograph. There will be published 1 (one) monograph with in-depth study of the problems of territory development containing a full and comprehensive study of the problem.
10.6	Seminar	September 2026 y.	up to 1 November 2026 y.	Seminar to be held. A workshop will be held to communicate the research findings to the community.
10.7	Obtaining patents	September 2026 y.	up to 1 November 2026 y.	Patents obtained. At least 2 (two) patents in foreign patent offices (European, American, Japanese) or at least 2 (two) foreign or international patents included in the Derwent Innovations Index database (Web of Science, Clarivate Analytics) or at least 5 (five) intellectual property objects (patent; for applications in the field of information technologies - copyright certificate) registered in the National Institute of Intellectual Property of the Republic of Kazakhstan will be obtained.
10.8	Registration of RNSTDs	November 2026 y.	up to 1 November 2026 y.	Registration number and certificate. At least 1 (one) result will be registered as RNSTD.
10.9	Web site - update	October 2026 y.	up to 1 November 2026 y.	Updated website. Results achieved and other information will be updated.