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MINSK2017

LIST OF EXECUTORS

Head of the Feasibility
Studies Department

signature	date	I.D. Franskevich
		full name

Chief Specialist

signature	date	E.G. Rogovaya
		full name

Chief Specialist

signature	date	N.V. Tishuk
		full name

Head of the group

signature	date	A.V. Tsepnikova
		full name

Head of the group

signature	date	M.N. Korseko
		full name

Lead Engineer

signature	date	A.A. Zvozhikov
		full name

Engineer of the I cate-
gory

signature	date	D.V. Shrubikov
		full name

Engineer of the II cate-
gory

signature	date	L.V. Soroko
		full name

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REPORT

Report 301 pages, 36 tables, 51 figures, 32 sources, 4 annexes.

MOTORWAY, ENVIRONMENT, ENVIRONMENTAL IMPACT ASSESSMENT, MEASURES ON IMPACT REDUCTION AND PREVENTION

The study object is the environment of the region of the road reconstruction P-80 Sloboda-Papernya, 0,000 km - 14,770 km.

The subject of the study is the possible changes in the state of the environment during the implementation of the proposed activity.

The aim of the study is to evaluate the baseline state of the environment, estimate the anthropogenic impact on the environment in the area of proposed works, to forecast possible changes in the environment during the implementation of the planned activity.

The EIA report includes:

- the main conclusions about the nature and extent of the possible impact on the environment, alternative options for the implementation of the proposed activities;
- description of the possible consequences in the field of environmental protection and the rational use of natural resources and the associated socio-economic and other consequences of the planned activities for the environment, including public health, flora and fauna, lands (including soils), subsoil, atmospheric air, water resources, climate, landscape, specially protected natural areas, etc.;
- description of measures to prevent and minimize the potential negative impact of the proposed activity on the environment and improve socio-economic conditions;
- the rationale for selecting the priority approach to the implementation of the proposed activity, including cancellation of the implementation (zero alternative), as well as the best available technical and other solutions for the proposed activity;
- conditions for the design of the facility to ensure the environmental safety of the planned activities, considering the possible consequences in the field of environmental protection and rational use of natural resources and associated socio-economic and other consequences of the planned activities for the environment and public health.

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INTRODUCTION

The P-80 Sloboda-Papernya road is a road of the national importance which provides transportation links to nearby settlements in the Minsk region and Minsk city. Intensive long-distance freight and passenger transportations are carried out on this road.

Reconstruction of the P-80 road section will complete the construction of the Second Ring Road around the city of Minsk, including the combined sections of the M-1 / E30 and M-2 roads.

The decision to build the Second Ring Road was based on the fact that the existing Minsk Ring Road has almost reached its capacity limit: currently, in some of its sections, the traffic intensity reaches 100,000 vehicles per day, and taking into account the development prospects of the city, it will further increase. Such a flow of vehicles creates certain difficulties for traffic along the transit road, including the East-West direction.

Also, at present, there is a process of intensive expansion of Minsk urban development outside the existing Minsk Ring Road. The location of the Minsk Ring Road within the city limits negatively affects the city's environment and the comfort of living in the residential areas adjacent to the road. The levels of atmospheric air pollution, noise and other harmful factors on many sections of the route exceed the regulatory parameters.

After the implementation of the master plan for the development of Minsk city till 2030 and the absorption of the existing Minsk Ring Road by urban developments, the second ring road around the city of Minsk will be the main transport corridor for transit traffic bypassing the city, as well as for transport links of the developing suburban satellite zones: industrial cities - Dzerzhinsk, Zhodino, Fanipol; agroindustrial cities - Smolevichi, Stolbtsy, Uzda, Rudensk; tourist-recreational cities - Zaslavl, Logoisk.

Reconstruction of P-80 road Sloboda-Papernya, 0.000 km - 14.770 km, is planned according to the specifications of the I-c technical category.

In accordance with Article 7 of the Law of the Republic of Belarus "On State Environmental Expertise, Strategic Environmental Assessment and Environmental Impact Assessment" No. 399-3 dated July 18, 2016, the reconstructed road is an object for which an environmental impact assessment (EIA) is conducted during the preparation of the pre-design documentation.

Environmental safety of motorways is achieved through the development and application in the construction and reconstruction design documentation of technical solutions that limit negative environmental impacts to acceptable levels, at which there are no harmful effects on public health and there is no irreversible change in the natural environment, deterioration of socio-economic conditions or habitats of people. In the process of implementing the project documentation, the established rules for nature management and environmental protection must be adhered to.

The environmental impact assessment is conducted in order to:

- comprehensively consider possible consequences in the field of environmental protection and rational use of natural resources and associated socio-economic and other consequences of planned activities for the environment, including public health and safety, fauna, flora, land (including soils), subsoil, atmospheric air, water resources, climate, landscape, as well as for historical and cultural value objects and (if available) the interrelations between these consequences prior to making a decision on its implementation;
- search for environmentally and economically sound design solutions that contribute to preventing or minimizing the potential impact of the proposed activity on the environment and public health;
- take effective measures to minimize the harmful effects of the planned activities on the environment and public health;
- determine the possibility (impossibility) of the implementation of the planned activity on a particular land plot.

The EIA is performed for the estimated (least favorable) state of the environment and the combination of the influencing factors for the estimated period of operation of the designed facility and includes the identification of the significant level of all identified impacts and the permissible level of each significant type of impacts for each component of the environment on the road adjacent territory. As a result of the EIA, a conclusion is made about the admissibility (or inadmissibility) of the

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construction, the need for protective measures and the possibility or impossibility of implementing the intended solutions.

The environmental impact assessment of the reconstructed facility was carried out by the specialists of the department of technical, economic and environmental justifications of the “Belgiprodor” State Enterprise.

According to Article 8 of the “Regulation on the Procedure for Conducting Environmental Impact Assessment, Requirements for the Composition of the Environmental Impact Assessment Report, Requirements for Experts Performing Environmental Impact Assessments” (approved by Resolution of the Council of Ministers of the Republic of Belarus No. 47 of 19 January 2017), the impact assessment is carried out for the facility as a whole; it is not allowed to carry out an impact assessment at individual work stages, construction stages, start-up complexes allocated in the project documentation for the facility.

In accordance with the requirements of Article 5 of the Law of the Republic of Belarus "On State Ecological Expertise, Strategic Environmental Assessment and Environmental Impact Assessment" No. 399-3 dated 18 July 2016, pre-project documentation for the reconstruction of the P-80 Sloboda-Papernya road, 0.000 km - 14.770 km, is subject to the state environmental review.

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NON-TECHNICAL SUMMARY

of the report on environmental impact assessment of the reconstruction of the road P-80 Sloboda-Papernya, 0,000 km - 14,770 km

Basic concepts, terms and definitions:

Biota - a historically established set of living organisms, inhabiting a large territory. Biota does not imply an ecological link between species.

Favorable environment - the environment, the quality of which ensures environmental safety, sustainable functioning of natural ecological systems, other natural and natural-anthropogenic objects.

Harmful impact on the environment - any direct or indirect impact on the environment of economic and other activities, the consequences of which lead to negative changes in the environment.

Water protection zone - the area adjacent to surface water bodies, which establishes a regime for the implementation of economic and other activities, ensuring the prevention of their pollution or obstruction.

Hygienic standard - a technical normative legal act that establishes the permissible maximum or minimum quantitative and (or) qualitative value of an indicator characterizing one or another factor of the human environment or products from the standpoint of their safety and harmlessness to humans.

Admissible noise level - a level of noise that does not cause significant anxiety in humans or significant changes in the functional level of systems and analyzers, sensitive to noise.

Environmental pollution – entry of the substance, physical factors (energy, noise, radiation and other factors) or microorganisms into the components of the natural environment or the presence and (or) occurrence in them as a result of harmful effects on the environment, the properties, location or the amount of which lead to negative changes in physical, chemical, biological and other indicators of the state of the environment, including the exceeding of standards in the field of environmental protection.

Pollutant - a substance or a mixture of substances, which causes the contamination of the environment.

Environmental changes - reversible or irreversible changes in the state of the environment that can occur as a result of the impact on it during the implementation of the planned activity.

Clark - the average content of chemical elements in a particular geochemical or geological system.

Hazard class - gradation of chemical substances according to the degree of possible negative impact on the environment and human health.

Components of the natural environment - land (including soils), subsoil, water, atmospheric air, flora and fauna, as well as the ozone layer and near-Earth space, which together provide favorable conditions for the existence of life on Earth.

Environmental monitoring - a system for monitoring the state of the environment, estimating and forecasting changes in the state of the environment under the influence of natural and anthropogenic factors.

Environment - a set of components of the natural environment, natural and natural-anthropogenic objects, as well as anthropogenic objects.

Environmental Impact Assessment – determination at a pre-feasibility (pre-investment) project design stage of likely impacts on the environment during the implementation of the design decisions, anticipated changes in the environment, predicting its future state in order to decide whether the design solutions are feasible or impossible; as well as the determination of the necessary measures for the protection of the environment and rational use of natural resources.

Approximately safe impact level – a temporary hygienic standard of the maximum permissible content of the pollutant in the atmospheric air of populated areas.

Planned economic and other activities - activities for the construction, reconstruction of facilities, their operation, other activities that involve the use of natural resources and (or) may have an impact on the environment.

Coastal strip - part of the water protection zone directly adjacent to the surface water body on which more stringent requirements for economic and other activities than in the rest of the water

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protection zone are established.

Maximum permissible concentration - concentration that does not have a direct or indirect adverse effect on the present or future generations throughout the life of a person and does not diminish the working capacity of the human, and does not worsen their well-being, sanitary and living conditions.

Norms of the permissible anthropogenic impact on the environment - the norms that are established in accordance with the permissible aggregate effect of all sources on the environment and (or) certain components of the natural environment within specific territories and under which the sustainable functioning of natural ecological systems is maintained and biological diversity is preserved.

Best available technical methods - technological processes, methods, order of organization of the production of products and energy, the performance of works or the provision of services, the design, construction and operation of structures and equipment that ensure the reduction and (or) prevention of pollutants into the environment, compared to those used and being the most effective for ensuring environmental quality standards, standards for permissible impact on the environment provided the economic and technical feasibility of their possible use.

Sanitary and epidemiological welfare of the population - state of health of the population, and of the human environment, in which there is no harmful effect on the human body affected by the factors of its habitat, and where favorable conditions for human life are ensured.

Sanitary threshold - distance from an object with a special mode of use that provides an adequate level of public health safety from harmful effects (chemical, biological, physical) at its border and beyond it; it has the SPZ (Sanitary Protection Zone) regime, except for the requirement to develop the SPZ project.

Environmental safety - state of protection of the environment, life and health of citizens against the possible harmful effects of economic and other activities, emergency situations of natural and man-made nature.

An energy equivalent sound level of non-constant noise - sound level of constant broadband noise that has the same average squared sound pressure as this non-constant noise for a given time interval.

Human environment factor - any chemical, physical, social or biological factor of natural or anthropogenic origin, capable of affecting the human body.

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Accepted abbreviations:

EIA - environmental impact assessment;

MPC - maximum permissible concentration;

MPCs.t. – short-term maximum permissible concentration;

APC - approximate permissible concentration;

ASIL - approximately safe impact level;

ESC – environmentally safe concentration;

ESCs.t. – short-term environmentally safe concentration;

PL – permissible level;

ZSS – zone of sanitary security;

SPZ – sanitary protection zone;

SHS – sanitary-hygienic standard.

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1. Conducting the environmental impact assessment

The planned reconstruction of the P-80 road Sloboda-Papernya, 0.000 km - 14.770 km, in accordance with the standards of the I-c category provides for an environmental impact assessment (EIA) in accordance with Article 7 of the Law of the Republic of Belarus "On State Environmental Expert Review, Strategic Environmental Assessment and Assessment Impact on the environment" No 399-3 dated 18 July 2016.

The objectives of the environmental impact assessment are:

- comprehensive consideration of possible consequences in the field of environmental protection and rational use of natural resources and associated social and economic consequences, other consequences of the planned activity for the environment, including public health and safety, fauna, flora, land (including soils), subsoil, atmospheric air, water resources, climate, landscape;
- search for the reasonable, considering the environmental and economic factors, design solutions that contribute to preventing or minimizing the possible impact of the planned activity on the environment and public health;
- taking effective measures to minimize the harmful effects of the planned activity on the environment and public health;
- determination of the possibility / impossibility of the implementation of the planned activity on a particular land plot.

Environmental impact assessment allows to determine the baseline state of the environment, the degree of anthropogenic impact, as well as the immediate and long-term consequences of the effect of potential pollution on natural complexes during the implementation of the planned activity.

The order and procedure for conducting the environmental impact assessment, the requirements to the data and the content of the assessment results report are set out in the Regulation on the procedure for carrying out an environmental impact assessment, the requirements for the composition of the environmental impact assessment report, the requirements for the experts conducting the assessment of the impact on the environment, approved by the Resolution of the Council of Ministers of the Republic of Belarus No. 47 dated 19 January 2017.

According to Article 8 of the "Regulation on the Procedure for Conducting Environmental Impact Assessment", requirements for the content of the environmental impact assessment report and the requirements for specialists carrying out environmental impact assessment, the impact assessment is carried out for the project as a whole; it is not allowed to carry out an impact assessment at individual work stages, construction stages, start-up complexes allocated in the project documentation for the facility.

According to the provisions of the Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters, signed in Aarhus on 25 June 1998, it is compulsory for the EIA to discuss the EIA report with the public whose rights and legitimate interests can be affected when implementing project decisions.

In accordance with the requirements of Art. 5 of the Law of the Republic of Belarus "On State Environmental Expertise, Strategic Environmental Assessment and Environmental Impact Assessment" No. 399-3 dated 18 July 2016, pre-project documentation for the reconstruction of the P-80 Sloboda-Papernya road, 0.000 km - 14.770 km, is subject to the state environmental review.

2. Brief description of the planned activity and facility location

Rationale of reconstruction

The P-80 Sloboda-Papernya road is a road of the national importance which provides transportation links to nearby settlements in the Minsk region and Minsk city. Intensive long-distance freight and passenger transportations are carried out on this road.

Reconstruction of the P-80 road section will complete the construction of the Second Ring Road around the city of Minsk, including the combined sections of the M-1 / E30 and M-2 roads.

The section of the P-80 Sloboda-Papernya road, 0.000 km - 14.770 km, is located in Smolevichi and Minsk districts of the Minsk region and is the connecting link between the M-2 Minsk - National

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Airport Minsk road and the M-3 Minsk-Vitebsk road, it serves for the departure of the residents of adjacent settlements on the aforementioned main roads.

Currently, the reconstructed section of P-80 Sloboda-Papernya road is the road of II category with 2 lanes covered with asphalt concrete. The width of the roadway is on average 15 m. The main defects are individual longitudinal and transverse cracks; the rutting is present in certain areas.

According to the traffic data, the current average annual traffic intensity on the projected section of the P-80 Sloboda-Papernya road, 0.000 km - 14.770 km, is between 4346 and 9256 vehicles per day.

Currently, the section of the P-80 highway under consideration is overloaded due to insufficient capacity, which leads to travel time losses, increased transport costs and an increase in the level of air, soil and vegetation pollution. Due to the large number of freight vehicles and limited overtaking opportunities, the road is characterized by a high number of accidents.

According to the functional purpose and prospective traffic intensity, the projected section of the P-80 Sloboda-Papernya road must comply with the I-c standards, having four lanes, and increase the load-bearing capacity up to the norm of 11.5 tons per one single-loaded axle of a biaxial vehicle.

Modernization of the road will improve its transport and operational parameters, which, in turn, will have a direct impact on the aspects of socio-economic development.

The overall economic effect of the project will be achieved by reducing transportation and repair costs (fuel, lubricants, spare parts and maintenance, depreciation, drivers' salaries, overheads, etc.), as well as non-transportation costs (passenger expenses related to travel duration, reduction of the needs of enterprises (organizations) in working capital associated with cargo transportation, temporary and seasonal breaks in the movement of heavy goods transport, reduction in the number of road transport accidents, creation of new jobs in the field of road maintenance).

Alternative options of the facility location

When developing planned design solutions, the main criterion was the execution of all construction work without the reduction of transit traffic flows. In this regard, two variants of broadening of the carriageway were worked out:

Option 1 - two-way broadening of the roadway while preserving the axis of the existing road;

Option 2 - with the new axis offset of 2.85 m.

When implementing **option 1**, the work will be performed in three stages.

In the first stage, work is carried out to broaden the existing carriageway by 4 meters with the construction of a new pavement with a two-ply asphalt-concrete coating.

In the second stage, the traffic is redirected to the broadened half of the road, and work is performed to equip the base for the asphalt concrete with an equivalent strength to the existing one. The disadvantage of this option is that at the points of the bends it is necessary to disassemble the existing road topping and the roadbed every 30 m to a depth of 1.5 m to install storm drains. All compaction work will be carried out using manual mechanisms, which will require additional costs to achieve the required durability indicators.

In the third stage, the traffic runs on a new road surface, and in the second half of the road the works are being carried out to install cement concrete coating using previously laid asphalt concrete as a base.

The construction of overpasses will be carried out from two halves, which will entail the temporary broadening of the roadbed and the roadway for a width of 4.0 m with a subsequent disassembly.

When implementing **Option 2**, all work is performed in two stages.

In the first stage, the existing coating is used for the organization of temporary traffic, and the work is carried out to broaden the existing roadbed and the construction of new pavement with cement concrete coating, after the construction of the drainage from the separation strip.

In the second stage, the traffic is carried out on the new road surface, and in the second half of the road the works are being carried out to construct a cement concrete cover using the existing asphalt concrete as a base.

Considering better technical design, Option 2 was adopted for further development, with the

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offset of the axis of the carriageway.

Within the framework of the environmental impact assessment, a comparative analysis of two alternatives will be carried out in paragraph 7: "Implementation of the Design Solution for the Reconstruction of the P-80 Sloboda-Papernya road, 0.000 km - 14.770 km " (option 2) and "zero" alternative - "Refusal to Implement the Design Solution for the Reconstruction of the P-80 Sloboda-Papernya road, 0.000 km - 14.770 km".

Design solutions

The reconstruction of the P-80 Sloboda-Papernya road, 0.000 km - 14.770 km, is planned, according to the parameters of the I-c technical category in accordance with the requirements of Standard 45-3.03-19-2006 (02250) "Motorways. Design Standards".

Currently, the road P-80 Sloboda-Papernya in the reconstructed section is the road of the II category with 2 lanes with asphalt concrete. The width of the roadbed is 15 m on the average.

The reconstructed section passes through Okolitsa settlement (for about 1.1 km), as well as near the next residential areas: Ostroshitsky Gorodok, Belye Luzhi, Raubichi, Baguta (including infectious disease clinic "Tavolga"), Sosnovaya, Sloboda. The Republican Center for Olympic Training in Winter Sports "Raubichi" is located near the road.

Due to the close location of the P-80 motorway to the settlements and the sports complex "Raubichi", an intensive movement of public transport (12 to 86 trips per day) is carried out in the area. There are bus stops for passenger services.

The feasibility study for investing in the reconstruction of the P-80 Sloboda-Papernya road, 0.000 km - 14.770 km, was carried out on the basis of the specification approved by RUE "Minskavtodor-Center" dated 4 February 2017 and by the Ministry of Transport and Communications dated 13 February 2017.

In accordance with the specification, two stages are identified:

- I stage: km 0,000 - km 7,600,
- II stage: km 7,600 - km 14,770.

The beginning of the projected section PK0 + 00 corresponds to 0,000 km of the P-80 Sloboda-Papernya road on the border with the four-lane road M-2 (Minsk-National Airport "Minsk").

The end of the projected section PK146 + 22.51 corresponds to 14.770 km of the P-80 Sloboda-Papernya road. At the same time, the existing roundabout interchange at grade level at the intersection with the Borovlyany-Logoysk P-40 highway is preserved without change.

The cross-section profile is designed with the consideration of the snow conditions and ensuring safety and comfort of movement, as well as the maximum use of existing road coating.

The following basic parameters of the cross-section profile were adopted in the investments justifications:

- width of the roadway 4x3.5 m;
- width of the roadside - 3.0 m, including the width of the stopping strips of 2.5 m;
- width of the dividing strip 4.3 m.

The roadbed is designed taking into account the road category, the type of pavement, the natural conditions of the construction area and the features of the engineering and geological conditions of the construction site, the conditions for ensuring the stability of the roadbed slopes, the snow cover of the road and traffic safety. The design of the roadbed is designed according to Technical and Commercial Proposal 200-2009 (02191) "Motorways. Roadbed. Design Regulations".

When the road is reconstructed, the roadbed of the existing road is used as much as possible.

The width of the roadbed is 22.7 m.

In swampy areas, a complete peat removal up to the mineral bottom with backfilling with sandy, dust-free soil is envisaged.

The system of road drainage will consist of a number of structures and individual structural measures designed to prevent overdamping of the roadbed, as well as to intercept and drain water coming from the surface of the road. To ensure the drainage from the roadbed and the passage of small

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watercourses, the installation of culverts is provided.

To ensure drainage on small roadbeds, the construction of a drain is planned. Slopes and bottom are strengthened by sowing grass with plating.

In order to preserve the greenery and reduce the additional drainage of ground in the places where the road passes through the recesses, a cavity cross-sectional profile with a drainage construction under the sandy underlay coating and retaining walls has been adopted. After the diversion of water from the roadway near the river Domelka and the village of Okolitsa, water treatment installations are arranged.

The composition of the pavement was designed in accordance with the requirements of the Technological Regulations, based on the transport-operational requirements established for roads of I-c category, the composition and prospective traffic intensity, climatic and soil-hydrological conditions, the availability of local building materials. The calculated load on the single most loaded axle of a two-axle vehicle is 11.5 tons.

Cement concrete was adopted as a recommended option of the pavement.

Road interchanges

During the reconstruction of the P-80 road in the area of intersection with the roads M-2 (Minsk-National Airport Minsk) and M-3 (Minsk-Vitebsk), it is planned to keep the cloverleaf interchanges in the existing configuration.

The project provides for the construction of 4 new transport interchanges at different grades.

Construction of 9 at-grade adjunctions is included in the design. Construction of speed gaining lanes at at-grade intersections and junctions is planned by the project.

Landscaping of road junctions, slopes of excavations, as well as landscape gardening of the territory of the roadside strip is proposed.

To ensure the safety of pedestrian traffic, underground pedestrian crossings shall be arranged in the following settlements: Sosnovaya (km 2,3); Baguta (km 3,7); Okolitsa (km 10.6); Ostroshitsky Gorodok (km 14.3), as well as in the area of the sports complex "Raubichi" (km 11.8). Internal lighting of underground pedestrian crossings is provided.

In total, when developing a feasibility study for investment in the reconstruction of the P-80 Sloboda-Papernya road, 0.000 km - 14.770 km, the following is envisaged:

- construction of 10 structures;
- reconstruction of 2 structures;
- lengthening of one structure.

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The project will also provide for the installation and re-engineering of utilities (air and cable communication lines, overhead lines with the power of 0.4-10 kV and 35-330 kV, gas pipelines, etc.).

When developing a project for the P-80 road reconstruction investment justification, construction of 17 bus stops is envisaged.

Bus stops are to be equipped with a semi-enclosed pavilion for transport waiting, benches and bins. Speed gaining lanes, landing and stopping areas are designed at the bus stops. Lighting and landscaping of bus stops are planned.

The reconstructed section of the P-80 motorway provides for the location of two small recreational areas:

- building of a new recreation area at 5,35 km on the right side;
- reconstruction of the existing recreation area at km 5.6 on the left side.

The territory of each recreation area is planned to include parking zones for heavy vehicles and cars, a sanitary zone and a recreation area.

In order to organize winter road maintenance, to ensure the proper transport and operational condition of the road, and to provide comfortable and safe transportation of vehicles on it, it is planned to build a salt storage with the capacity of 2500 tons on the territory of the existing LDD-54 (Ostroshitsky Gorodok town) in accordance with the specification for the development of a feasibility study for investment justification.

Currently, the storage of sand and salt mixture is carried out in an open asphalted area. The planned construction of a closed storage of anti-icing materials will prevent their moistening, caking and frosting, and also eliminate the negative impact of salt on the environment.

Traffic safety will be provided by the geometric parameters of the road and by technical means of traffic organization.

3. Brief assessment of the current state of the environment and socio-economic conditions

3.1 Natural conditions and resources of the region of the proposed activity

The designed section of the road P-80 Sloboda-Papernya, 0,000 km - 14,770 km, is located in Smolevichi and Minsk districts of the Minsk region.

The territory of the proposed construction, like the entire territory of the Republic of Belarus, refers to a zone with a temperate continental and unstable wet climate. The area of the road reconstruction is included in the second central road-climatic region of the Republic of Belarus.

The climate is mild, with a sum of degree-days of frost of 387-740, an average annual temperature is 6.2 ° C. The coldest month of the year is January with an average monthly temperature of -5.9°C, the warmest is July with an average monthly temperature of + 17.8°C. The duration of the frost-free period in the air averages to 150-155 days, on the soil - 135-140 days.

The annual amount of precipitation is 650-700 mm, the evaporation potential is about 635 mm per year. The average annual relative humidity is 79%.

The average of the largest decadal snow cover over the winter is 27 cm, the maximum of the largest decadal one - 62 cm, the duration of a stable snow cover is 101 days.

The prevailing wind directions in the area of the projected section of the road in the winter period are southern and western, in the summer period - western and north-western. According to the monitoring carried out on the radiation monitoring network of the Ministry of Natural Resources and Environmental Protection of the Republic of Belarus, the radiation situation on the territory of the Minsk region is characterized as stable, the dose rate (RD) of gamma radiation corresponds to the established long-term values and does not exceed the level of the natural gamma background (up to 0.20 µSv/h).

According to the geomorphologic zoning of the Republic of Belarus, the site for the reconstruction of the P-80 road is located within the Western Belarusian subregion of the Central Belarusian highlands and ridges, and is confined to a single geomorphological region - the Minsk Glacier Upland.

The area, where the object is located, is dominated by a broad-wavy landscape. The constituent ridges, spurs and hills are separated by wide troughs which are connected with the Central Berezinsky plain; lake-like extensions, flat marshy lowlands can also be found. The directly explored area is

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confined to the north-eastern part of the geomorphological region of the Minsk Glacial Upland. It is a stretch of the wilderness plain formed by water ice glacier retreat flows, framed by moraine, hilly ridge, significantly transformed by human activity. Absolute height marks of the survey area measure from 190 to 241 m, rising in the north-west direction. The division of the territory increases on the slopes of the river valley, ancient river valleys, dry valleys.

The degree of manifestation of extreme geomorphological processes is average throughout the entire study area. There are no seismically active zones and karst processes on the territory of the projected facility.

Moraine deposits of the Middle Pleistocene, composed of moraine sandstones and loam (the Sozh glaciation) are widespread in the area of the proposed economic activity. In local depressions and closed basins, the Holocene bog sediments are localized, and alluvial deposits associated with permanent water flows also have a slight spread.

By nature and degree of moistening, the area of reconstruction of the P-80 road refers to the first type of terrain (dry places). Quaternary soils are represented by loess-like sandy loam and clay loam, morainic sands of various granulometric composition, and also moraine sandy loams.

According to the hydrological zoning of the Republic of Belarus, the region of the reconstruction of the P-80 Sloboda-Papernya road belongs to the III - Vilyeyka hydrological district, the basin of the Berezina river. Density of the river network of this region is 0.35 km / km².

The reconstructed section of the road crosses the Domelka River and a non-functional canal, once the source of the Volma River. Also in the area of the P-80 motorway there are reclamation channels that flow into the natural watercourses nearest to the projected road (the Volma River, the Usyazha River, the Domelka River).

There are no fishing grounds on the abovementioned rivers, and these rivers are not used for recreational purposes.

There are no natural lakes on the investigated territory. Water reservoirs existing near the reconstructed section of the R-80 road are of artificial origin. Reservoir Dubrovskoe is located at a distance of about 560 m to the north of the road.

The territory of the existing LDD-54, RMF-5 in the settlement Ostroshitsky Gorodok is located at a distance of ~ 110 m from the Ostroshitskoye reservoir, in the water protection zone of this water body, and also in the sanitary protection zone of the Borovlyany water intake.

In the area of the planned economic activities for the reconstruction of the section of the P-80 highway, passing through the territory of Smolevichi and Minsk districts of Minsk region, the following land users are located: RUE Minskavtodor-Center; Municipal Unitary Enterprise "Minskobldorstroy"; PUE "Ozeritsky Agro"; RUE "Minskenergo"; State Institution "State Memorial Complex" Khatyn "; Department of ideological work, culture and youth affairs of Smolevichy regional executive committee; farm holding Bakumenko Y.V.; GLHU "Smolevichi Forestry"; RUE Beltelecom; Main Directorate of the Commander of Internal Troops of the Ministry of Internal Affairs of the Republic of Belarus; State specialized forestry establishment "Borovlyansky Spetsleskhoz"; Production communal subsidiary unitary enterprise "Minsk Forest Park Economy"; OJSC "1st Minsk Poultry Factory"; Minsk City Specialized Children and Youth School of the Olympic Reserve of Trade Unions for Winter Sports; Establishment of the Republican Center for Olympic Training in Winter Sports "Raubichi"; OJSC "Gazprom Transgaz Belarus".

In accordance with the soil-geographical regionalization of Belarus, the territory of the planned reconstruction of the P-80 Sloboda-Papernya road on 0.000 km - 14.770 km section belongs to the Central (Belarusian) soil province, Central Soil-Climatic Area and Oshmyansko-Minsk agro-soil district.

Soil-forming rocks of the Central District are moraine, water-glacial loams and sandy loams, sometimes there are ancient alluvial redeposited sands and peat deposits of various types of soils.

The division of the territory in this region, both in density and depth of depressions, is the maximum for the republic. On the Minsk Upland, for example, the distance between the depressions does not exceed 0.5 km, with a depth of 75 m in some places.

According to the mechanical composition, the soils of the region are divided into loamy soils (90.5%), sandy loam (5%), sandy soils (1.5) and peat (3%).

The erosion and deflation of the soils of the studied region varies from weak to strong. During

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field investigations, no sites with a high risk of land degradation and dangerously eroded areas were identified.

According to the landscape zoning of the Republic of Belarus, the reconstructed road R-80 is located within the subzone of boreal landscapes, the Belarusian highland of hilly-moraine-erosive and secondary moraine landscapes with broadleaf-spruce and pine forests on sod-podzolic soils. The road is located within the same landscape area: Minsk middle- and large-hilly-ridge hilly-moraine-erosive with spruce-broad-leaved and pine forests, and intersects the following landscapes in the rank of the genus: hilly-moraine-erosive, kame-moraine-erosion and the landscape of undivided complexes of river valleys.

As part of the implementation of the EIA of the proposed economic activity, experts of the state enterprise "Belgidprodor" carried out a full-scale survey of flora and fauna in the area of the route of the P-80 road Sloboda-Papernya, 0.000 km - 14.770 km.

In the immediate vicinity of the projected facility the republican landscape reserve "Prilepsky" is located. The border of the reserve passes along the right-of-way of the P-80 road on the south side in the following sections: km 12.1 - km 13.4, km 11.6 - km 11.9, km 7.9 to the administrative border of Minsk region (km 4,4).

The route of the reconstructed road passes both in the open area, which is currently occupied mainly by agricultural lands, and along the territory of the following forestries: state forestry establishment "Smolevichi Forestry", state specialized forestry establishment "Borovlyansky Spetsleskhoz". The Minsk and Smolevichi districts of the Minsk region have a low level of forest cover: the area of forest land in Minsk region is 55158 hectares (29.0%), in Smolevichi region - 47170 hectares (33.9%).

Vegetation area of the road reconstruction refers to Minsk-Borisov region of the Oshmyansko-Minsk geobotanical district of the subzone of oak and dark coniferous forests.

The vegetation of the investigated territory is represented by forest, coastal-aquatic, marsh, segmental, ruderal and residential vegetation.

There are no large forests in the study area, with the exception of the forest massif of the Prilepsky landscape reserve. Along the reconstructed section of the road, spruce forests that occupy areas of various sizes were most widely spread. The most common spruce forests include mossy, bilberry, as well as snyte, fern and eagle tree spruce forests.

Small-leaved forests of the study area are represented mainly by birch and black alder. Alder gray in the investigated territory does not form separate formations, but it is found scarcely in the admixture to small-leaved young trees, in mixed forests along the slopes of hills and fringes.

Birch forests are represented by drooping birches on the territory of pine, spruce and broad-leaved spruce forests, as well as native fluffy birch forests in the marshes. Derived drooping birch forests belong to the same type of vegetation: drooping birch green-blueberry forests in combination with shrubby-long-moss forests (bilberry and long-moss forests). Fuzzy-birch forests are represented by a typological group – downy-branched birch sedges with willow tiers of forests on lowland marshes.

Black-leaf forests (spirea-leaved, nettle and fern forests) occur in local relief depressions, where lowland swamping processes are developing, and near the P-80 road are represented by a belt section along the stream flow at km 2.9.

Along the P-80 road, there are protective tree plantations in some areas, which, as a rule, perform the functions of protective plantations along highways and field shelterbelts. The species composition of plantations differs significantly on different sections of the road and is represented by the following trees: spruce, birch, pine, linden, aspen, which are planted either in pure single or double rows, or in mixed rows.

The reconstructed section of the P-80 road passes through a territory which is the subject to intensive anthropogenic impact. These are lands under construction and land used in agricultural production. Here, considerable areas are occupied by the synanthropic herbal communities: weed-field, sown grass (meadow agrophytocenosis) and roadside vegetation, which indicates a high degree of development of this territory. At the same time, meadow phytocenoses prevail in the structure of

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grassy vegetation, located at a considerably remote stage of succession. On agricultural lands (active arable land, hayfields on sown meadows, etc.), the segmental vegetation is quite widespread.

Natural meadow vegetation is practically absent, represented by upland meadows, which often do not form a continuous cover, but form small-cereal or small-herbaceous associations. Meadow communities are anthropogenically-natural ecosystems, transformed by human economic activity. Species composition of these meadows includes a significant number of ruderal plant species.

Meadow vegetation is closely adjoined by the herbaceous ruderal vegetation of wastelands, underutilized and unused areas, other disturbed habitats, formed as a result of human activities. The P-80 road passes near the residential development of settlements, where residential vegetation is widespread. Ruderal and residential vegetation has no value for the preservation of the biodiversity.

Marsh vegetation can fragmentarily be encountered on the investigated territory. Grass-type swamps with areas of forest, shrubs can be found here. The projected section of the P-80 highway crosses the Domelka River, where coastal and aquatic vegetation is present.

No species of plants listed in the Red Book of the Republic of Belarus were found on the study area. According to the information from the district inspectorates of natural resources and environmental protection and the State Specialized Forestry Establishment "Borovlyansky Spetsleskhoz" there are no places of growth of wild plants belonging to the species included in the Red Book of the Republic of Belarus on the territory of the planned economic activity.

In accordance with zoogeographical zoning, the section of the reconstructed P-80 road Sloboda-Papernya 0.000 km - 14.770 km, refers to the Transitional Area, and passes both on lands occupied by forest vegetation and on agricultural lands where the territory is characterized by low-value communities with low species wealth.

The entomocomplexes in the study area are represented by widespread species that inhabit the corresponding ecosystems throughout the territory of Belarus. Mesofauna is represented by widespread species, specific not only for the given area, but also for the whole country.

The reconstructed section of the road crosses only one river - the Domelka, which belongs to the watercourses of the third category, the composition of the ichthyofauna of this watercourse is poor and quantitatively small. Fishing grounds on the river Domelka are absent.

The area of the projected object location is inhabited by species of amphibians and reptiles that are widely encountered on the territory of the entire Minsk region.

The batracho- and herpetofauna of the study area is characterized by relative poverty of species composition, which is due to the strong development of the territory, the weak development of the hydrological network with the predominant filling in the spring period, and also during rainy periods during the summer. The mass migrations of amphibians in the area of the P-80 road reconstruction were not noted in full-scale research, which was conducted in April 2017. However, studies were conducted at a very low ambient temperature, which excluded the possibility of reliable identification of amphibian breeding sites and the presence of migration corridors.

Ornithofauna territory near the reconstructed P-80 road is quite diverse. Poultry species that are related to forest and arboreal and shrub ecosystems are prevailed, as well as numerous types of synanthropic ecological complex and types of open landscapes.

There are water bodies, water logs and wetlands in the area of the object, so there are species of coastal-water and wetland ecological complexes, however, in the immediate vicinity of the P-80 road, the birds of the coastal-water and near-water-marsh ecological complexes are not found.

Bird species listed in the Red Book of the Republic of Belarus, as well as those negatively reacting to anthropogenic impact have not been identified in the zone of planned economic activity.

The teriofauna of the investigated territory is quite diverse. The basis of the world of mammals is composed of widespread species, specific for natural forest and open landscapes.

In agricultural lands the most numerous are rodents and representatives of the shrewmouse family. Agricultural land can serve as the fodder ground for the European hare and some predators - foxes, polecats, weasels.

In forest habit biotopes species of the rodents' family are common; forest predators include forest martens, forest hawks, common fox, raccoon dog, ermine, weasel. Also in the forests there are the following representatives of artiodactyls - European roe deer, wild boar, noble deer, moose, representing the main danger for road traffic.

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According to the map of the main migration corridors of ungulates on the territory of Belarus, the projected P-80 road on the section from the village of Okolitsa to the construction boundary in Ostroshitsky Gorodok crosses the migration corridor of ungulates M2-M3-M6-M7, and on the section from the village Okolitsa to the point Sosnovaya it serves as the northeastern border of this migration corridor.

According to the information of the district chapters of the "Belarusian Association of Fishermen and Hunters", there are sites on the P-80 road where there were regular facts of death of wild animals. Road accidents involving wild animals were recorded on the section of km 6 - km 13 of the road, but the largest concentration of road accidents was observed at km 6 - km 7 and km 8.5, while in other areas there were single cases of wild animals crossing the road.

During the field studies in the zone of possible impact of the planned activity, no habitats of animals included in the Red Book of the Republic of Belarus were identified. According to information from the district inspectorates of natural resources and environmental protection and the State Specialized Forestry Establishment "Borovlyansky Spetsleskhoz", there are no animal habitats of the species included in the Red Book of the Republic of Belarus on the territory of the planned economic activity.

3.2 The existing level of anthropogenic impact on the environment in the region of the proposed activity

The existing level of atmospheric air pollution is estimated by the background concentrations of pollutants in the area, which characterize the pollution of the atmosphere, created by existing sources of emissions of existing industrial facilities, traffic on the territory and other factors.

According to the information received from the State Institution "Republican Center for Hydrometeorology, Control of Radioactive Pollution and Environmental Monitoring", background concentrations of pollutants in the atmospheric air of rural settlements of Minsk and Smolevichi districts of the Minsk region exceed the standards of maximum permissible concentrations of pollutants in the air for settlements and places of mass recreation of the population approved by the decree of the Ministry of Healthcare of the Republic of Belarus No 113 dated 08 November 2016.

Background concentrations of pollutants in the atmospheric air on the territory of rural settlements of the Minsk region, including on the territory of the republican landscape reserve "Prilepsky" do not exceed the standards of environmentally safe concentrations of pollutants in the air for specially protected natural areas, individual natural complexes and objects of specially protected natural areas, as well as natural areas which are subject to special protection approved by the decree of the Ministry of Natural Resources and Environmental Protection of the Republic of Belarus No. 5 dated 24 January 2011.

To assess the extent of the existing soil contamination and determine the degree of man-caused soil loads during the implementation of the planned economic activity, the background content, the maximum permissible concentration (MPC) or the estimated permissible concentration (EPC) of the chemical elements in the soil and their clark for the Republic of Belarus were used. The content of technogenic toxicants in the soil cover does not exceed allowable concentrations.

The existing state of the surface waters of the Dnipro basin, including the Domelka River, intersected by the reconstructed section of the P-80 road, which is the fourth order tributary of the Dnepr River (the Domelka → the Usiazha → the Gayna → the Berezina → the Dnepr), was determined according to the National Environmental Monitoring System of the Republic of Belarus. The hydrochemical status for most of the water bodies of the Dnepr basin was estimated as excellent and good, only 8.2% of the basin watercourses were satisfactory.

The average annual concentrations of pollutants (phosphate ion, total phosphorus, ammonium ion, nitrite ion, nitrate ion, common iron, copper, zinc, petroleum products, synthetic surfactants) in the water of the Gayna River, which the Domelka River, crossed by the projected sections of the P-80 road, is the second-order tributary to, correspond to the quality standards.

3.3 Environmental and other restrictions

The republican landscape reserve "Prilepsky" is located in the immediate vicinity of the site of

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reconstruction of the P-80 Sloboda-Papernya road, 0.000 km - 14.770 km. The border of the reserve passes along the right-of-way of the P-80 road on the south side in the following sections: km 12.1 - km 13.4, km 11.6 - km 11.9, km 7.9 to the administrative border of Minsk region (km 4,4). When making technical decisions on the reconstruction of the P-80 road, the presence of this reserve should be taken into account.

In the region of the reconstruction of the P-80 road within a 3-km radius of the projected site there are no monuments of the national and local significance, but there are objects of heritage (immovable historical and cultural values), which has the status of historical and cultural value by Decree of the Council of Ministers of the Republic of Belarus No. 578 dated 14 May 2007. These objects are outside the area of reconstruction work of the 0.000 km - 14.770 km area of the P-80 road and the planned activities will not have an impact on them.

In the roundabout area at the intersection with the P-40 road Borovlyany-Logoysk near Ostroshitsky Gorodok, there is a monument - T-34 tank. Since the existing roundabout interchange remains without reorganization, the planned reconstruction of the P-80 road will not have an impact on this monument.

According to the letter from the State Scientific Institution "Institute of the History of the National Academy of Sciences of Belarus" it approves the design for the P-80 road Sloboda-Papernya, 0.000 km - 14.770 km and reports that there is no information on the availability of archaeological sites on the territory of the planned works. If archaeological artifacts are discovered during excavations, work on the site should be suspended and archaeological experts of the State Scientific Institution "Institute of the History of the National Academy of Sciences of Belarus" should be informed.

The route of the reconstructed P-10 road is partially located within the water protection zones and coastal strips of water bodies (the river Domelka). Since, according to paragraph 2.6 of Art. 46 of the Water Code (No 149-3, dated 30 April 2014), the water discharged from the road to the environment is not classified as the waste water, special measures are not required in the water protection zones of water bodies. The regime of economic and other activities in water protection zones of water bodies is regulated by the requirements of Art. 53 of the Water Code of the Republic of Belarus. However, in accordance with the requirements of paragraph 3 of Article 25, measures should be envisaged in the design of facilities that affect water bodies to ensure protection of water from pollution and contamination, as well as to prevent harmful impacts on water bodies.

In order to prevent pollution of surface water bodies, measures and relevant activities should be envisaged in the project documentation in accordance with the requirements of clause 12.4 ed. No. 4 of the Technical Code of Common Practice 45-3.03-19-2006 (02250).

3.4 Assessment of socio-economic conditions in the region of the proposed activity

The P-80 Sloboda-Papernya road is a road of the national importance and provides transportation links to nearby settlements in the Minsk region and Minsk. Intensive long-distance freight and passenger transportations are carried out on the road.

The projected section of the road P-80 0,000 km - 14,770 km passes through the territory of the Minsk and Smolevichi districts of the Minsk region.

The administrative center of the Minsk region is Minsk (it is not part of the district). Administrative-territorial division of the district is the following: the city of Zaslavl, Machulishchi settlement council and 18 village councils.

The economy of the Minsk district is determined by over 18,000 business entities, including about 10,000 legal entities and over 7,000 individual entrepreneurs. The number of the employed in the economy is 137.7 thousand people.

The industrial potential of Minsk region determines the directions of development of the most important economic activities: metallurgical production and production of finished metal products (24,0) food production (31,6%), production of rubber and plastic products (9,4%), production of vehicles and equipment (12.7%).

Minsk region is known in the republic as the most important agro-industrial complex, which specializes in the production of milk, meat, eggs, grain, potatoes, sugar beets, vegetables. There are 14

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agricultural organizations and 75 farms in the region.

Residential buildings of 4 settlements of the Minsk district are located near the P-80 road: Ostroshitsky Gorodok settlement, Belye Luzhi, Okolitsa village, Raubichi village, belonging to the *Ostroshitsko-Gorodoksky village council*. The center of the village council is Ostroshitsky Gorodok.

State educational institution Ostroshitsko-Gorodokskaya Secondary School, a kindergarten, the Republican Children's Hospital of Medical Rehabilitation, the training and production plant function on the territory of the village council. Local post office, the branch of OJSC "Belarusbank", a pharmacy, a number of food and manufactured goods stores, a library, a rural culture house, a cafe, a bathhouse, a district department of the Ministry for Emergency Situations, a comprehensive reception center and a medical outpatient clinic are at the disposal of the villagers. A number of enterprises of various forms of ownership operate on the territory of the village council.

As of 01 January 2017, there were 2,800 people in Ostroshitsky Gorodok. The social infrastructure of the settlement is well developed.

There are 483 people in Raubichi village, 22 people in the village of Bely Luzhi; the inhabitants of these villages use the social infrastructure of Ostroshitsky Gorodok.

There are 538 people in the village Okolitsa, 819 people in the military barracks. On the territory of the military unit there is a post office; there are shops in the village. The nearest school, a kindergarten and other objects of social welfare for the residents are located in Ostroshitsky Gorodok.

The administrative center of Smolevichy district is Smolevichi. On the territory of the district there are 190 settlements, 9 village councils. The regional subordination town of Zhodino and the regional village of Sokol are on the territory of the district, they administratively report to the Oktyabrsky district of Minsk.

Industrial enterprises of the city and the district specialize in the production of building products, food products, peat briquettes and soils, parquet products, construction equipment, etc.

The basis of agricultural production in the region is formed by the grossing farms - PUE "Ozeritsky-Agro", SE "Zhodino AgroPlemElita", JSC "Smolevichi Broiler".

Near the existing P-80 road in Smolevichy district there is a residential development of 3 settlements: Baguta village, Sosnovaya village, and Sloboda village, belonging to the *Ozeritsko-Sloboda village council*. The center of the village council is the agro-town of Sloboda.

Agricultural organizations and small businesses are functioning and are widely represented on the territory of the village.

The trade infrastructure is represented by the shops of Smolevichi regional settlement and private entrepreneurs; outbound trade is organized. There are the complex-reception center of Sloboda settlement, post offices of the agricultural town of Sloboda and Prilepy village, Ozeritsko-Slobodskaya medical outpatient clinic (agricultural town of Sloboda), Prilepy medical outpatient clinic (Prilepy village); State Educational Institution Ozeritsko-Slobodskaya Secondary School, State Educational Institution "Educational and Pedagogical Complex "Prilepsky Kindergarten - Secondary School ", State Educational Institution "Ozeritsko-Sloboda Kindergarten"; Ozeritsko-Sloboda rural library.

The population of the agricultural town of Sloboda amounts to 2882 people; its social infrastructure is well developed - there are shops, a post office, a nursery school, a comprehensive reception center, a medical outpatient clinic, a library.

Baguta village has 53 people, and its socio-economic infrastructure is not developed. The nearest shops, including the school and a kindergarten are located in the agricultural town of Sloboda, which is about 4.5 km away. Medical care for the population is carried out in the Prilepsky medical outpatient clinic (Prilepy village).

308 people are residing in Sosnovaya village. The nearest shops, a school, a kindergarten and the Ozeritsko-Sloboda medical outpatient clinic are located in the agricultural town of Sloboda.

The demographic situation in the Minsk region is fundamentally different from the rest of the country, the region is characterized by an increase in the population (both urban and rural), positive dynamics of natural and migration growth, which is primarily due to the proximity of the capital and the availability of its infrastructure. For the Smolevichi region as a whole, a slightly different picture of demographic processes is observed. Until 2014, the region was characterized by a relatively stable number of the population, with a negative dynamics of natural growth, which was offset by a positive migration. Since 2014, the natural decline in population has stopped, and its growth began. Such

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changes in the demographic situation in the district are largely related to the implementation of various socio-economic programs that provide for the construction of housing and jobs in the administrative units adjacent to Minsk and Minsk region, creation of the so-called "satellite cities" and Minsk conglomeration.

Reconstruction of the section of the P-80 road will complete the construction of the Second Ring Road around the city of Minsk according to the parameters of the I category with a total length of 160 km, including the combined sections of the M-1 / E30 and M-2 roads.

The Second Ring Road around Minsk will be the main transport corridor for traffic transit bypassing the capital, as well as for transport communications of the developing suburban zone with satellite cities: industrial cities such as Dzerzhinsk, Zhodino, Fanipol; agroindustrial cities - Smolevichi, Stolbtsy, Uzda, Rudensk; tourist-recreational cities - Zaslavl, Logoisk.

Modernization of the road will improve its transport and operational parameters, which in turn will have a direct impact on aspects of socio-economic development, such as road sector productivity, business efficiency and living conditions of the population.

With the improvement of transport-operational indicators of the road, the volume of cargo transportation will increase, roadside service will develop, which will lead to an increase in the socio-economic indicators of the region.

Thus, the reconstruction of the section of the P-80 road Sloboda-Papernya, 0,000 km - 14,770 km, on the whole, will have a positive impact on the socio-economic indicators of the region and the living conditions of the population.

4. Brief description of sources and types of impact of the projected facility on the environment

Possible impacts of the projected road on the environment are related to construction works and operational impacts - functioning of the facility as an engineering structure, the operation of mobile sources of influence (road transport).

The impacts associated with construction work are, as a rule, temporary ones. Operational impacts will be manifested during the period of operation of the projected facility.

The main source of the direct impact of the road on human and the environment is the movement of vehicles. The criterion of significance of such impacts is the safety of human life and health, the preservation of natural ecosystems.

Depending on the intensity, composition of traffic and road conditions, the magnitude of harmful impacts can be different, the zone of their distribution varies.

The area in which changes occur due to the construction or operation of a road is called the road impact zone. Single excesses of background contamination of the components of the natural environment are possible in the zone of influence; these excesses do not reach the maximum permissible values. The living or staying of people in this territory is practically safe and does not require restrictions. At the same time, certain changes in the environment affect vegetation, animals, and lead to gradual transformation of the landscape.

In accordance with the Sanitary Norms and Rules "Requirements for the Organization of Sanitary Protection Zones of Enterprises, Structures and Other Objects That are the Objects of Impact on Human Health and the Environment" approved by the Resolution of the Ministry of Health of the Republic of Belarus No. 35 dated 15 May 2014, it is regulated to create sanitary gaps on the republican roads. The size of sanitary gaps is determined in each specific case on the basis of calculations of the dispersion of pollutant emissions in the ambient air and the spread of physical impacts. The sanitary gap shall ensure an adequate level of public health safety from the harmful effects (chemical, physical) at its border and beyond it. The sanitary gap has a sanitary protection zone (SPZ) regime, except for the requirement to develop a SPZ project.

5. Forecast and assessment of possible changes in the state of the environment and socio-economic conditions

The main sources of air pollution during the construction of the road will be the following: operation of road construction equipment and vehicles for excavation and pavement; operation of road

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construction equipment for the transportation of soil, building materials, fuel and lubricants; workers performing construction and installation work; mechanical processing of building materials; minor repairs, painting works, etc.

Most of these types of impacts are insignificant, the problem of impact can be solved during the project implementation period through the implementation of environmental measures to prevent and minimize them.

The main source of air pollution during the operation of roads is the motor vehicles moving along them. The impact of road transport on the atmosphere is mainly associated with emissions of vehicle exhaust and traffic noise.

To assess the impact of the reconstructed section of the P-80 Sloboda-Papernya road, 0.000 km - 14.770 km, on the air of settlements, a calculation of the dispersion of pollutants in the ground layer of the atmosphere was performed, which was based on the calculated emission data and which determined the reached concentrations at a distance from 7 to 200 m from the edge of the roadway of the P-80 road and also on the border of the territory of the republican landscape reserve "Prilepsky".

Calculation of the dispersion was carried out using the software - the unified program for calculation of atmospheric pollution "Ecolog" (version 4, Integral company).

The analysis of the obtained results showed that in MPCs.t. and EFCs.t. is indicated in the atmospheric boundary level according to none of the considered pollutants and summation groups. The contribution of the reconstructed object to the surface concentration of pollutants is no more than 0.61 MPCm.r. (Hydrocarbons are unsaturated aliphatic series). The main contribution to the formation of the surface of the formaldehyde, nitrogen dioxide, ammonia, sulfur dioxide, carbon oxide, particulate matter, benz(a)pyrene introduces the background level of atmospheric air pollution.

The total indicator of atmospheric air pollution "P", determined from the maximum values of the estimated maximum single concentrations of pollutants in the ambient air, corresponds to the permissible degree of atmospheric pollution on the territory of the reconstruction site.

In order to organize the maintenance of the road in winter, ensure the proper transport and operational condition of the road and provide comfortable and safe transportation of vehicles on it, it is planned to build a salt storage with a capacity of 2500 tons on the territory of the existing LDD-54 (Ostroshitsky Gorodok town) in accordance with the specification for the development of the investment feasibility study.

Currently, the sand and salt mixture is openly stored on the asphalted area. The planned construction of a closed storage of anti-icing materials will prevent their moistening, caking and frosting, and also eliminate the negative impact of salt on the environment.

At the subsequent stages of the design, the list of polluting substances, the amount of emissions should be defined in the "Environmental Protection" section of the project documentation. Since residential development is located in the immediate vicinity of the border of the existing LDD-54 base, it is necessary to design a sanitary protection zone to adjust the basic size of the SPZ (50 m) with the justification of the adequacy of the designed (calculated) SPZ boundaries and the assessment of the health risk of the population at the subsequent design stages. The draft sanitary protection zone is subject to sanitary and hygienic examination in accordance with the procedure established by law (clause 10.25 of the "Unified List of Administrative Procedures Carried Out by State Bodies and Other Organizations in Relation to Legal Entities and Individual Entrepreneurs" approved by the decision of the Council of Ministers of the Republic of Belarus No. 156 dated 17 February 2012).

The engines of cars located on rest areas and parking lots may also be the sources of pollutants release into the atmosphere near the reconstructed object. At the subsequent stages of the design, after specifying the configuration of recreational areas and the number of car-places of cars, heavy vehicles and buses, the emission of pollutants will be calculated. As the long-term design experience shows, the annual emission of pollutants in the recreation area does not exceed 0.7 tons / year.

Thus, the designed object will not have a significant impact on atmospheric air pollution; the state of this natural component will not change significantly and will remain within permissible limits.

The EIA also determines the cost parameters of the effects of air pollutant emissions on climate change as well as the impact of the greenhouse gas emissions on this change, and their assessment was made in accordance with Amendments No. 1 and No. 2 to Technical Code of Common Practice 17.08-03-2006 (02120). According to the results of the study, it was revealed that the impact assessment for

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the reconstructed road section was 329 rubles / km, which does not exceed the limit value of the impact assessment for the B-category road of 730 rubles /km, which is the basis for the conclusion on the relative environmental security of the object.

According to the results of acoustic calculations, the existing noise levels in the residential area adjacent to the P-80 road may exceed the permissible levels established by the Sanitary Norms, Regulations and Hygienic Norms "Noise in Workplaces, in Vehicles, in Residential, Public Buildings and on the Territory of Residential Buildings ", approved by the Ministry of Health of the Republic of Belarus No 115 dated 16 November 2011.

Determination of the noise load from the transport stream is carried out by the calculation method using a software package for calculating and normalizing the acoustic impact from industrial sources and transport "Ecolog-Shum".

Based on the forecasted traffic intensity and the expected composition of the traffic flow, a possible increase in the potential noise load on the population residing in the residential areas adjacent to the reconstructed road is expected.

Organization of a sanitary break from the reconstructed facility providing a sufficient level of public health safety from harmful effects will be carried out at the subsequent design stages.

In order to reduce the impact of traffic noise on the adjacent residential area and normalize the acoustic situation, it is necessary to consider the expediency of using the maximum possible set of measures aimed at providing acoustic comfort, taking into account the specific conditions of the existing buildings, technical and economic requirements, the expected dynamics of growth in traffic intensity, changes in the qualitative and quantitative composition of transport traffic for the future.

The choice of noise protection means and determination of the necessity and expediency of their application should be made on the basis of the calculation of the required sound level reduction in the residential area and determination of the required efficiency of the screens.

The main possible impacts of the construction and operation of the projected road on the geological environment, land and soil cover are the following: the reformation of the natural relief during the construction of the roadbed, the change in the structure of land use as a result of land allocation under the roadway, dehumidification and waterlogging of the soil when the groundwater conditions change, dynamic loads on soils, activation of erosion processes, contamination of the soil cover. The project should provide for measures to minimize possible impacts of the construction and operation of the road on the geological environment and terrain.

Pollution of the soil cover in the zone of influence of the road section is mainly associated with emissions of pollutants, determined by the composition and intensity of traffic. The content of gross forms of heavy metals that make up motor transport emissions in the soil of the affected area of the projected facility is expected to be slightly higher than the background indicators, but they will not exceed the allowable concentrations. The content of oil products, sulphates and nitrates in excess of the hygienic standard is also not predicted.

According to Art. 25 of the Water Code of the Republic of Belarus No. 149-3 dated 30 April 2014, when designing facilities that impact water bodies, measures should be envisaged to ensure water protection from pollution and contamination, as well as to prevent harmful effects on water bodies; application of the best available technical methods; prevention of emergency situations; prevention of flooding, waterlogging, salinization of lands, soil erosion.

In most cases the impacts on natural waters during the construction will be temporary and local; during the construction phase they will produce only localized and short-term negative impacts. Such impacts are common for the construction of bridges and roads, and can be controlled by overseeing environmental aspects and the use of proper construction norms and codes.

In accordance with the Water Code of the Republic of Belarus No. 149-3 dated 30 April 2014 (Article 46), the water discharged from the roadway to the environment are not considered wastewater.

In order to minimize the potential adverse effects of the projected object on the surface and underground water a set of measures shall be provided to divert storm water runoff from the reconstructed road outside the coastal strip or clean it in accordance with the requirements of the Water Code of the Republic of Belarus No 149- 3 dated 30 April 2014, and Technical Code of Common Practice 45-3.03-19-2006 (02250) "Motorways. Design Standards" and other technological regulations in the field of environmental protection and ensuring sanitary and epidemiological welfare

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of the population.

Since the territory of the existing LDD-54 is located in a water protection zone of Ostroshitsky reservoir, as well as in the sanitary protection zone Borovlyansky water intake, in order to meet the requirements of current legislation the project documentation must include an appropriate range of activities.

In general, the implementation of the proposed measures in compliance with the basic environmental standards, both by construction organizations and individuals operating this road, should minimize the anthropogenic load on surface and groundwater to the level of the ability of these facilities to self-purify and self-repair.

When building and reconstructing motor roads, natural plant communities are subjected to the greatest changes as a result of direct impact during the performance of preparatory and construction works.

When the road is reconstructed cutting of arboreal and shrubby vegetation with stump rooting will be performed in the bend zone in order to broaden the roadway of the existing motor road. In order to reduce the negative impact on the plant communities in the region, the removal of vegetation is performed at a minimum level.

In order to ensure friendly environment for human life and health, rational (sustainable) use of flora resources, disposal of flora objects should be carried out in accordance with the requirements of the Law of the Republic of Belarus No 205 "On the Flora" dated 14 June 2003.

Forest located in the zone of permanent easement area is quite similar and representative to the plantations along the reconstructed section of the road.

In the immediate vicinity of the projected facility the republican landscape reserve "Prilepsky" is located. The border of the reserve passes along the right-of-way of the P-80 road on the south side in the following sections: km 12.1 - km 13.4, km 11.6 - km 11.9, km 7.9 to the administrative border of Minsk region (km 4,4).

According to preliminary data, the broadening of the roadbed during the reconstruction of the P-80 road is planned, mainly, to the right side.

Protected plant and animal species, as well as rare biotopes and natural landscapes that are of environmental value are absent in the area of the planned works on the reconstruction of the road section, therefore, minimal impact is expected on the reserve territory.

Reconstruction of the P-80 road will not affect the valuable part of the Prilepsky reserve and the planned operations will not entail significant changes in the reserve ecosystem.

The planned work on the reconstruction of the section of the P-80 road as a whole will not affect the rare component of the flora of this region. From the point of view of the impact on the flora of the study area, the reconstruction of the motor road is permissible and does not contradict the preservation of floral diversity.

Animals of the projected works area are relatively trivial, including typically widespread species.

The entomocomplexes are represented mainly by widespread species that inhabit the corresponding ecosystems throughout the territory of Belarus. Reconstruction of the section of the P-80 road will not cause significant damage to the entomofauna of the region.

The reconstructed section of the P-80 road crosses the river Domelka, which belongs to the watercourses of the third category. Since it is not possible to carry out the measures provided for in clauses 2 and 3 of Article 23 of the Law of the Republic of Belarus "On Wildlife" dated July 10, 2007 when carrying out work on the reconstruction of drain facilities, compensation payments should be calculated as a result of damage to fish stocks at the subsequent design stages after specifying the size of drains, the terms of reconstruction etc.

The diversity of amphibians and reptiles in the area of planned economic activity is characterized by a high degree of mediocrity and does not have unique features or diversity of species and abundance. The mass migration activity of amphibians was not observed in the study area, however, in the further development of project documentation, additional studies are needed to identify possible migration corridors, their location and the intensity of their use by amphibians.

Ornithofauna near the reconstructed P-80 road territory is quite diverse. However, there are no species of birds listed in the Red Book of the Republic of Belarus which are negatively reacting to anthropogenic impact along the study site. Reconstruction of the highway will not cause significant

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damage to the nesting and feeding areas of birds.

The basis of the species composition of mammals is formed by massive, widespread species, specific to natural forest and open landscapes.

As a result of the operation of the reconstructed highway, there may be a direct and indirect impact on fauna representatives of the area. Direct impact can be expressed in the death and trauma of animals as a result of possible road accidents with their participation.

According to the map of the main migration corridors of ungulates on the territory of Belarus, developed by the National Scientific Research Center of the National Academy of Sciences of Belarus on the Bioresources, the projected P-80 road on the section from Okolitsa to the border of the reconstruction works in Ostroshitsky Gorodok crosses the migration corridor of ungulates M2- M3-M6-M7, and on the section from the village Okolitsa to the point Sosnovaya is the northeastern border of the mentioned migration corridor. According to the information of the district structures of the Republican State-Public Association "Belarusian Association of Fishermen and Hunters", there are sites on the P-80 road where there were regular facts of the death of wild animals. Road accidents involving wild animals were recorded on a section of km 6 - km 13 of the road, but the largest concentration of road accidents was observed at km 6 - km 7 and km 8.5, while in other areas there were single cases of wild animals entering the road.

To prevent ungulates from entering the roadway and to minimize the likelihood of accidents involving them, the project documentation should envisage a set of measures in the specified sections of the highway, regulated by points 2 and 3 of Art. 23 of the Law of the Republic of Belarus "On the Fauna".

Indirect damage can be caused by the pollution of adjacent territories with exhausted car gases and drainage from rain and meltwater, as well as salinization of territories along the road due to the use of deicing agents to combat winter slipperiness. Salt components (sodium and chlorine ions) of anti-ice reagents, as well as a wide range of substances from emissions of exhaust gases from cars, are able to accumulate in soil and vegetation, and are toxic in high concentrations to all components of biogeocenoses.

Since the P-80 road Sloboda-Papernya is planned to pass along km 0.000 - km 14.770, in the current direction, a relatively low degree of impact on the flora and fauna of the region is expected.

The main sources of waste generation in the construction of a highway are preparatory and construction works.

According to Art. 4 of the Law of the Republic of Belarus "On Waste Management" No. 271-3 (amended on 04.01.2014 No 130-3), the waste management system should be based taking into account the following basic principles:

- Priority use of waste in relation to their disposal or burial, provided that they comply to the requirements of legislation on environmental protection and taking into account economic efficiency;
- Priority of waste recycling compared to its disposal.

Waste management in the course of the project implementation should be carried out in accordance with the requirements of Article 22 "Requirements for Waste Management during the Conduct of Construction Activities" of the Law of the Republic of Belarus "On Waste Management", and Technical Code of Common Practice 17.11-10-2014 (02120) "Environmental Protection and Nature management. Waste. Rules for the Management of Construction Waste. "

Construction waste generated in the course of preparatory and construction works is to be temporarily stored in specially equipped areas for the purpose of subsequent transfer to use or processing. All construction materials (sand-gravel mixture, sand, gravel, soil, etc.) can be fully (100 %) used.

Technical solutions for the reconstruction of the section of the P-80 road Sloboda-Papernya, km 0.000 - km 14.770, will positively affect the social environment and improve road safety, namely:

- separate the traffic flows moving towards each other, increase the number of lanes and decrease the number of conflict points; it will allow to significantly reduce the number of accidents and the severity of their consequences;
- increase in the speed of traffic along the reconstructed section of the road by providing a rational transverse profile of the roadbed, construction of the capital type covering and applying the

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modern Traffic Management Facilities will reduce the amount of pollutant emissions from passing vehicles;

- improvement of transport and operational parameters of the road will affect such aspects of social and economic development as productivity of the road sector, business efficiency, investment attractiveness of the region and the living standards of the population.

With the improvement of transport and operational indicators of the road, the volume of freight traffic will increase, roadside service will be developed (cafes, gas stations, recreation areas, etc.), which will lead to an increase in the socio-economic indicators of the region. Additional jobs will be created for the local population.

The implementation of the planned activities will have a positive effect for the social and economic development of the district.

Thus, the reconstruction of the section of the P-80 Sloboda-Papernya road, km 0.000 - km 14.770, will have a positive effect on the socio-economic indicators of the region and the living conditions of the population.

6. Measures to prevent, minimize, compensate for the harmful effects on the environment

In order to minimize the adverse impact of the proposed activity on the atmospheric air, a number of environmental measures have been proposed: the use of permanent production bases; control of the consistency of the composition and properties of the materials used in the implementation of road construction and installation works to the requirements of existing national technical standards, norms and specifications; increase in the number of road sections with traffic without speed limits; checking of construction equipment and machines with internal combustion engines for toxicity of exhaust gases; fuel quality management.

Additional measures to prevent or reduce potential adverse effects on the atmospheric air for the period of operation of the reconstructed section of the road are not planned, as the expected levels of air pollution by motor vehicle emissions in the nearest residential area will not exceed the established hygienic standards.

Since residential development is located in the immediate vicinity of the border of the existing LDD-54 base, it is necessary to develop a design of a sanitary protection zone in the subsequent design stages to adjust the basic size of the SPZ (50 m) with the justification of the adequacy of the designed (calculated) SPZ boundaries and the assessment of the health risk of the population. The draft sanitary protection zone is subject to sanitary and hygienic examination in accordance with the procedure established by law (clause 10.25 of the "Unified List of Administrative Procedures Carried Out by State Bodies and Other Organizations in Relation to Legal Entities and Individual Entrepreneurs" approved by the decision of the Council of Ministers of the Republic of Belarus No. 156 dated 17 February 2012).

Reduction of the level of traffic noise is achieved through the implementation of the following activities: development of measures to reduce noise by means of traffic management; installation, if necessary, of the noise-shielding screens in the settlements located in the immediate vicinity of the reconstructed highway; conduct of construction and repair work during the daytime; soundproofing of road machinery engines with protective casings, as well as using hoods with multi-layer coatings; placing of inactive installations (compressors) should be made on sound-absorbing platforms or in sound-absorbing tents; during the conduct of road construction works, zones with a sound level above 80 dBA should be marked with safety signs, and the personnel working in this zone should be provided with personal protective equipment; to reduce noise levels at construction sites, noise-proof enclosures should be used to emit noise-intensive aggregates, and if necessary, use portable temporary noise shields/screens.

The mode for carrying out activities within the coastal strips and water protection zones of surface water bodies which are crossed by the projected section of the P-80 road (the river Domelka) should be adopted in accordance with the requirements of the Water Code of the Republic of Belarus No. 149-3 dated 30 April 2014.

In order to minimize the possible adverse impact of the projected facility on surface water bodies, a set of measures should be envisaged in the project documentation to remove stormwater from the projected highway beyond the coastal strip or clean it in accordance with the requirements of the

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Water Code of the Republic of Belarus No. 149-3 dated 30 April 2014, TCCP 45-3.03-19-2006 (02250) «Motorways. Design Standards" and other technological regulations in the field of environmental protection, ensuring sanitary and epidemiological welfare of the population.

The *land allocation* for the roadbed and road structures should be minimal in the project design.

It shall be envisaged that all lands requested for a temporary use permit, upon completion of construction work, should be recultivated into the adjacent agricultural lands and transferred back to land users.

The project documentation should include measures for the conservation of the fertile soil layer during excavations and further measures to restore the fertility of the reclaimed land after the works related to the violation of land, as well as designation of locations for storage of the fertile soil layer and the procedure for re-applying it to recultivated areas.

Land recultivation is carried out in accordance with Directive Document 0219.1.26-2002 "Guidelines for the Recultivation of Lands Being Destroyed in Road Construction".

In order to avoid waterlogging of the territory adjoining the road in all lowered areas, it is necessary to provide for the discharge of surface waters through the installation of drains. To prevent soil erosion, it is recommended to perform log strengthening work at the pipes. To prevent erosion of the roadbed, it is necessary to provide for the reinforcement of slopes and roadsides.

Activities during the conduct of work in the area of the Republican landscape reserve "Prilepsky":

Prior to the beginning of the reconstruction of the road section, it is necessary to obtain the decision (relation) of the Minsk Regional Executive Committee that manages the Prilepsky Reserve, (according to Article 5 of the Regulations on the Reserve) about the terms of the construction works on the territory of the republican landscape reserve "Prilepsky" including the compliance requirements to conduct economic activities within the boundaries of the reserve in accordance with the law.

Recommendations for minimizing the impact on flora objects

In order to ensure friendly environment for human life and health, rational (sustainable) use of flora resources, disposal of flora objects should be carried out in accordance with the requirements of the Law of the Republic of Belarus No 205 "On the Flora" dated 14 June 2003 (amended on 18 Nov 2016).

In case it is necessary to remove trees, bushes that grow in the populated areas, anti-erosion and roadside plantations, the project should determine the size and other conditions for the implementation of compensatory landings or compensation payments for the cost of the removed flora objects in accordance with the requirements of Article 37-1 of the Law of the Republic of Belarus "On the Flora" No 205-3.

The EIA report also suggests measures aimed at minimizing the effect of the impacts on flora objects in the process of reconstruction and operation of the road section, including organizational, technical, forestry and agro-technical ones.

Pure organizational and technical measures include: prohibition of cutting down trees and bushes, prevention of the damage to all elements of plant communities outside the area allocated for construction; prohibition of burning works; prohibition of construction litter and other garbage; arrangement of sites for storing building material, parking lots, etc. outside the established sites for this purpose;

Forest management activities include cleaning of plantings from debris, as well as preventing their littering; prevention of cluttered areas with felling residues at the edge of the forest in order to avoid forest fires from construction and other debris, sand; prevention of dusting the root necks of trees with soil; prevention of mechanical damage to trees by construction equipment; provide for the removal of wood felling residues and wood, located in the right-of-way for broadening the route of the paved road.

Agro-technical measures include the following: mowing and harvesting of mown grass; planting of trees and bushes in roadside strips in spring only.

Recommendations for minimizing the impact on wildlife

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sign 1.25 "Wild Animals";

3. beginning and end of the course of the net guides shall be marked with the warning sign 1.25 "Wild Animals".

In order to inform road users about the possibility of the appearance of wild animals on the carriageway in areas characterized by one-time outcrops of wild animals on the road, it is recommended to install warning signs 1.25 "Wild Animals" and signs of additional information (plates) 7.2.1 that indicate the length of the hazardous area of the road marked with warning signs.

To monitor the impact of the highway on the environment, it is proposed to organize local monitoring.

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Conclusions

The reconstruction of the P-80 Sloboda-Papernya road, km 0,000 - km 14,770 is envisaged according to the parameters of I-c technical category.

Due to the fact that any economic activity represents a potential environmental hazard, an environmental impact assessment of the reconstruction of the P-80 Sloboda-Papernya road, km 0.000 - km 14.770, was carried out.

The impacts associated with the construction work are, as a rule, temporary ones; the operational impacts will be manifested during the whole period of the operation of the facility.

One of the criteria for environmentally safe operation of roads is the quantitative indicators of atmospheric air pollution, determined by sanitary norms, rules, standards, and environmental management conditions.

It is shown that at the border of the residential zone of settlements, near which the projected section of the road passes, there are no exceeding MPC values in the surface layer of the atmosphere for any of the counted pollutants and summation groups.

The estimated maximum values of expected surface concentrations of pollutants at the border of the territory of the republican landscape reserve "Prilepsky", taking into account the background level of air pollution, will not exceed environmentally safe concentrations.

According to the calculation results, the magnitude of the environmental impact assessment (EIA) does not exceed the limit values of this indicator, which is the basis for the conclusion about the relative environmental safety of the facility.

The planned complex of noise-protective measures of passive and active character should ensure a reduction in the levels of traffic noise penetrating the adjacent residential area to acceptable values regulated by sanitary norms, rules and hygienic standards.

The project will provide for measures to minimize possible impacts of the reconstruction and operation of the P-80 Sloboda-Papernya road on the geological environment, terrain, soil cover and land.

In most cases, when reconstructing the existing sections of the road, environmental impacts will be temporary and local, mainly during the construction phase; they will produce only minor, localized and short-term negative impacts.

The complex of technological processes associated with the construction of the roadbed, usually causes the greatest damage to the environment. The preparatory works include the clearing of the road strip from the forest and bushes, the removal of communications. Placement of skidding trails, wood storages and felling waste outside the allocated site/line is not allowed.

The route of the reconstructed road is laid for its long part with the maximum combination of the projected route with the existing road, with partial withdrawal (alienation) of land. Upon strict compliance with the boundaries of the right-of-way for the reconstruction of the road, the damage to the environment will be minimal.

To prevent damage to the soil cover the during road construction, a fertile layer of soil is to be removed in all areas of the facilities and works. The place of removal, thickness, storage location will be determined by the project.

All the components of the road must be carried out taking into account the prevention of erosion processes.

The temporarily destroyed occupied lands are subject to recultivation.

As the project provides for maximum preservation of the existing direction, the impact that will be on the water bodies of the adjacent territories is similar to the current one.

To prevent pollution, littering and depletion of water bodies, the project should provide for a set of measures in accordance with the requirements of the Water Code of the Republic of Belarus No. 149-3 dated 30 April 2014, technological regulations in the field of environmental protection and ensuring the sanitary and epidemiological welfare of the population. The implementation of all design solutions and observance of elementary environmental standards by both construction organizations and individuals operating this road will make it possible to minimize the anthropogenic load on water bodies to the level of their ability to self-purification and self-repair.

As a result of the project implementation, the safety of traffic on the road will be improved due to the regulation of traffic by the measures for its arrangement; the outlook of the reconstructed section

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of the highway will significantly be improved.

Reconstruction of the road will have a positive impact on the socio-economic indicators of the region, will expand the opportunities for the population of the region to realize their entrepreneurial and labor potential. With the creation of the road, there is an effect of improving transport links and developing infrastructure, which will be manifested across the region.

In order to reduce the negative impact on the plant communities of the region, the removal of flora objects should be as minimal as possible.

From the flora and fauna point of view, the upcoming design and construction works on the reconstruction of the highway are completely permissible and do not contradict the conservation of the biodiversity of this territory.

In order to minimize the potential adverse effects of the projected facility on flora and fauna, a set of measures is proposed, including the measures to prevent accidents with wild animals and preserve their migration routes.

If the set of environmental measures stipulated in this EIA is complied with, the impact of the highway reconstruction will not be critical for the current animal populations. The implementation of the proposed recommendations will allow minimizing the negative anthropogenic impact, and the applicable environmental measures will restore the existing biological diversity. Influence on the flora and fauna of the studied region will be insignificant - within the permissible limits, not exceeding the ability of the elements of the vegetable and animal life to self-repair.

Thus, in the reconstruction of the P-80 Sloboda-Papernya road, 0,000 km - 14,770 km, taking into account the implementation of the proposed environmental measures, activities in the field of ensuring the sanitary and epidemiological welfare of the population and strict environmental control, no negative impact on the environment is expected, the state of the natural components will not change significantly and will remain within acceptable limits.

The planned activities for the reconstruction of the P-80 Sloboda-Papernya road, 0.000 km - km 14.770 km, according to the standards of I-c technical category with the construction of artificial structures do not contradict the legislation of the Republic of Belarus in the field of environmental protection, flora and fauna.

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1. LEGAL ASPECTS OF PLANNED ECONOMIC ACTIVITIES

1.1 Requirements in the field of environmental protection

The legislation of the Republic of Belarus in the field of environmental protection is based on the Constitution of the Republic of Belarus and consists of the following legislative acts containing norms regulating relations in the field of environmental protection and nature management:

- Law of the Republic of Belarus No 1982 XII "On Environmental Protection" of November 26, 1992 (amended of July 18, 2016 No. 399-3);
- Law of the Republic of Belarus No. 399-3 "On state ecological expertise, strategic environmental assessment and environmental impact assessment" of July 18, 2016;
- Law of the Republic of Belarus No. 3335-XII "On Specially Protected Natural Territories" of October 20, 1994 (in edition of 28 April 2015 No. 251-3, amended on October 18, 2016 No. 431-3);
- Law of the Republic of Belarus No. 2-3 "On protection of atmospheric air" of December 16, 2008 (in the edition of July 13, 2016 No 397-3);
- Law of the Republic of Belarus No. 340-Z "On Sanitary and Epidemiological Well-Being of the Population" of January 07, 2012 (as amended on June 30, 2016 No. 387-3);
- Law of the Republic of Belarus No 56-3 "On Protection of the Ozone Layer" of November 12, 2001 (as amended on June 16, 2014 No 161-3);
- Law of the Republic of Belarus No. 205-3 "On the Flora" of June 14, 2003 (as amended on July 18, 2016 No. 402-3);
- Law of the Republic of Belarus No. 257-3 "On the Fauna" of July 10, 2007 (as amended on July 18, 2016 No. 399-3);
- Law of the Republic of Belarus No. 271-3 "On the Waste Management" of July 20, 2007 (as amended on July 13, 2016 No. 397-3);
- Water Code of the Republic of Belarus No 149-Z dated April 30, 2014 in the ed. of July, 18, 2016 №399-3;
- Land Code of the Republic of Belarus No 425-3 dated July, 23 2008 (as amended on October 24, 2016 No 73-3, with amend. on October 26, 2012 No 432-3);
- Forest Code of the Republic of Belarus No 332-3 dated December 24, 2015;
- Culture code of the Republic of Belarus No. 413-3 dated July 20, 2016;
- Convention on Biological Diversity and Cartagena Protocol on Biosafety;
- Aarhus Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters;
- Regulations on the procedure for conducting state ecological expertise, including requirements for the composition of documentation submitted for state environmental review, the conclusion of the state environmental review, the procedure for its approval and/or cancellation, special conditions for the implementation of project decisions, as well as requirements for specialists carrying out a state ecological expertise (approved by the decision of the Council of Ministers of the Republic of Belarus No. 47 dated 19 January 2017);
- Regulations on the procedure for environmental impact assessment, requirements for the composition of the environmental impact assessment report, requirements for specialists carrying out environmental impact assessments (approved by the Resolution of the Council of Ministers of the Republic of Belarus No. 47 dated 19 January 2017);
- National Action Plan for the Conservation and Sustainable Use of Biological Diversity for 2016-2020 (approved by Resolution of the Council of Ministers of the Republic of Belarus No. 743 dated 03 September 2015);
- The Red Book of the Republic of Belarus (fauna, year 2005; flora, year 2015) (as amended by Resolution of the Ministry of Natural Resources No. 26 dated 9 June 2014).

Environmental protection is an indispensable condition for ensuring environmental safety, sustainable economic and social development of society.

Control over the observance of environmental norms and requirements in the design of facilities, that can have harmful effects on the environment, is carried out through the state environmental examination.

The state environmental examination is conducted with a view to determine the compliance or

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inconsistency of the project or other documentation for the planned activity with the requirements of the legislation of the Republic of Belarus on environmental protection and rational use of natural resources.

1.2 The procedure for carrying out an environmental impact assessment

The principle of presumption of a potential environmental hazard of any planned economic activity is a fundamental principle when conducting an environmental impact assessment. The environmental impact assessment is a legally established procedure for planned and existing construction projects and their subsequent operation. As a result of this procedure, a study is made of the immediate and long-term consequences of the effects of potential pollution and landscape transformations on natural complexes and, in general, on biota.

The environmental impact assessment is a procedure for taking into account the environmental requirements of the legislation of the Republic of Belarus in the preparation system of economic, including pre-project ones, design and other solutions aimed at identifying and preventing environmental and related social, economic and other consequences of its implementation that are unacceptable for the society .

The procedure for carrying out an environmental impact assessment and the requirements for the composition of the environmental impact assessment report are set out in the “Regulation on the Procedure for Conducting Environmental Impact Assessment, Requirements for the Composition of the Environmental Impact Assessment Report, Requirements for Experts Performing Impact Evaluation on the Environment”, approved by Resolution of the Council of Ministers of the Republic of Belarus No. 47 dated 19 January 2017.

The objectives of the impact assessment are:

- Comprehensive consideration of possible consequences in the field of environmental protection and rational use of natural resources and associated social and economic consequences, other consequences of the planned activity for the environment, including human health and safety, fauna, flora, land (including soils), subsoil, atmospheric air, water resources, climate, landscape, as well as for objects of historical and cultural values and (if available) the interrelations between these consequences before deciding on its implementation;

- search for environmentally and economically sound design solutions that contribute to preventing or minimizing the potential impact of the proposed activity on the environment and human health;

- taking effective measures to minimize the harmful effects of the planned activity on the environment and human health;

- determination of the possibility (impossibility) of the implementation of the planned activity on a particular land plot.

The results of the impact assessment are:

- the main conclusions about the nature and extent of the possible impact on the environment, alternative options for placement and (or) implementation of the proposed activity;

- description of the possible consequences in the field of environmental protection and rational use of natural resources and associated social and economic consequences, other consequences of the planned activity for the environment, including human health and safety, fauna, flora, land (including soils), subsoil, atmospheric air, water resources, climate, landscape, natural areas which are subject to specific and (or) special protection, as well as for objects of historical and cultural values and (if any) interrelations between these consequences and an assessment of their significance;

- description of measures to prevent, minimize or compensate for possible harmful effects of the proposed activity on the environment and improve socio-economic conditions;

- rationale for choosing the priority location of the facility, the best available technical and other solutions for the proposed activity, as well as the refusal to implement it (zero alternative);

- conditions for the design of the facility in order to ensure the environmental safety of the planned activities, taking into account the possible consequences in the field of

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environmental protection and rational use of natural resources and associated social and economic consequences, other consequences of the planned activity for the environment, including human health and safety, fauna, flora, land (including soils), subsoil, atmospheric air, water resources, climate, landscape, natural areas which are subject to specific and (or) special protection, as well as for objects of historical and cultural values and (if any) the interrelations between these consequences.

Local Councils of Deputies, local executive and administrative bodies of administrative and territorial units in the territories of which the planned activities are expected to be implemented and which territories are affected as a result of its implementation, together with the customer and the participating project organization authorized by the customer, conduct public discussions of the EIA report, including a meeting on the discussion of the EIA report, in accordance with the procedure established by the Council of Ministers of the Republic of Belarus.

According to the provisions of the Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters, signed in Aarhus on 25 June 1998, it is compulsory, within the conduct of the EIA, to discuss the EIA report with the public whose rights and legitimate interests can be affected when implementing project decisions.

Public discussions of the EIA report are conducted with the following objectives:

- inform the public about issues related to environmental protection;
- implement the rights of the public to participate in the discussion and adoption of environmentally relevant decisions;
- take account of public comments and proposals on environmental protection in the process of impact assessment and decision-making related to the implementation of the proposed activity;
- search for mutually acceptable solutions for the customer and the public in the prevention or minimization of harmful effects on the environment and public health in the implementation of the proposed activity.

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2. GENERAL CHARACTERISTIC OF THE PLANNED ACTIVITY

2.1 Customer of the proposed activity

The customer of the planned activity for the reconstruction of the P-80 road Sloboda-Papernya, 0.000 km - 14.770 km, is the Republican Unitary Enterprise of Highways "Minskavtodor-Center" (220073 Minsk, Kalvariyskaya Street 9).

2.2 Rationale for reconstruction

The P-80 road Sloboda-Papernya is a road of the national importance which provides transportation links to nearby settlements in the Minsk region and Minsk city. Intensive long-distance freight and passenger transportations are carried out on this road.

Reconstruction of the P-80 road section will complete the construction of the Second Ring Road around the city of Minsk, including the combined sections of the M-1/E30 and M-2 roads.

The decision to build the Second Ring Road was due to the fact that the existing Minsk Ring Road has almost reached the limit of its capacity: currently, in some of its sections, the traffic intensity reaches 100,000 cars per day, and taking into account the development prospects of the city, it will also further increase. Such a flow of vehicles creates certain difficulties for traffic along the transit road, including the East-West direction.

Also, at the present time, there is a process of intensive expansion of urban development of Minsk and its expansion outside the existing Minsk Ring Road. The location of the Minsk Ring Road within the city limits negatively affects the city's ecology and the comfort of living in the residential areas adjacent to the road. The levels of atmospheric air pollution, noise and other harmful factors on many sections of the route exceed the regulatory parameters.

After the implementation of the master plan for the development of Minsk city till 2030 and the absorption of the existing Minsk Ring Road by urban developments, the second ring road around the city of Minsk will be the main transport corridor for transit traffic bypassing the city, as well as for transport links of the developing suburban satellite zones: industrial cities - Dzerzhinsk, Zhodino, Fanipol; agroindustrial cities - Smolevichi, Stolbtsy, Uzda, Rudensk; tourist-recreational cities - Zaslavl, Logoisk, allowing to avoid transit travels through Minsk.

The section of the P-80 Sloboda-Papernya road, 0.000 km - 14.770 km, is located in the Smolevichi and Minsk districts of the Minsk region and is the connecting link between the M-2 Minsk-National Airport Minsk road and the M-3 Minsk-Vitebsk road, it serves for the departure of the residents of adjacent settlements on the aforementioned main roads.

Currently, the P-80 road Sloboda-Papernya on the reconstructed site belongs to the II category road with 2 lanes with asphalt concrete pavement, it is serviced by the Road Maintenance Service-5 of the RUE "Minskavtodor-Center" (Minsk). The width of the roadbed is 15 m on the average.

The main defects are individual longitudinal and transverse cracks, the rutting is present in certain areas.

According to the data on traffic intensity, carried out by the specialists of the State Enterprise "Belgiprodor" in December 2016 and May 2017, the current average annual traffic intensity on the projected section of the P-80 road Sloboda-Papernya, 0.000 km - 14.770 km is between 4346 and 9256 vehicles per day. The composition of the traffic is dominated by passenger transport, which is about 66-80% of the total flow. The traffic of heavy-duty road trains amounts to 8-17%.

Currently, the section of the studied P-80 road is overloaded due to insufficient traffic capacity, which leads to travel time losses, increased transportation costs (fuel, lubricants, consumption of spare parts and maintenance, depreciation costs, drivers' salaries, overhead costs, etc.), as well as an increase in the level of pollution of atmospheric air, soil and vegetation. Due to the large number of freight vehicles and limited overtaking opportunities, the site is characterized by a high number of road accidents.

As a result of the analysis of the transport-operational state of the existing road, the assessment of its capacity, the analysis of environmental measures and the degree of environmental impact, it is established that the current road parameters do not meet their functional requirements.

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According to the functional purpose and prospective of traffic intensity, the P-80 road Sloboda-Papernya must comply with the I-IV standards on the projected section, with four lanes and increased load-bearing capacity to the standard of 11.5 tons per single loaded axle of a biaxial vehicle.

Modernization of the road will improve its transport and operational parameters, which, in turn, will have a direct impact on the aspects of social and economic development, such as productivity of the road sector, business efficiency, investment attractiveness of the region and the living standards of the population. Improving transport conditions will reduce air, soil and vegetation pollution, thereby improving the ecological situation in the region.

The overall state economic effect of the project will be achieved by reducing transportation and repair costs (fuel, lubricants, spare parts and maintenance, depreciation, drivers' salaries, overhead costs, etc.), as well as non-transportation costs (passenger expenses related to travel duration, reduction of the needs of enterprises (organizations) in working capital associated with cargo transportation, temporary and seasonal breaks in the movement of heavy goods transport, a decrease in the number of road accidents, creation of new jobs in the field of road maintenance).

2.3 *Alternative options of the* planned activity implementation

When developing planned design solutions, the main criterion was the execution of all construction work without the reduction of transit traffic flows. In this connection, two variants of broadening of the roadway were worked out:

Option 1 - two-way broadening of the roadway while preserving the axis of the existing road;

Option 2 - with the new axis offset of 2.85 m.

When implementing **option 1**, the work will be performed in three stages.

In the first stage, work is carried out to broaden the existing carriageway by 4 meters with the construction of a new pavement with a two-ply asphalt-concrete coating.

In the second stage, the traffic is redirected to the broadened half of the road, and work is performed to equip the base for the asphalt concrete with an equivalent strength to the existing one, partially used as a base, followed by the laying of cement-concrete coating. The disadvantage of this option is that at the points of the bends it is necessary to disassemble the existing road topping and the roadbed every 30 m to a depth of 1.5 m to install a storm drains. After that, when backfilling the excavation and the foundation, all compaction work will be carried out using manual mechanisms, which will require additional costs to achieve the required durability indicators.

In the third stage, the traffic is organized on a new road surface, and in the second half of the road, works are being carried out on the installation of cement concrete coating using previously laid asphalt concrete as a base.

In addition, the construction of overpasses will be carried out from two halves, which entails the construction of a temporary broadening of the roadbed and the roadway for a width of 4.0 m with subsequent disassembly.

When implementing **option 2**, all work is performed in two stages.

In the first stage, the existing cover is used to organize the temporary movement of transport, and the work is carried out to broaden the existing roadbed and to construct a new pavement with a cement concrete coating on the basis of lean concrete, after the construction of drainage from the dividing strip.

In the second stage, the traffic is carried out on the new road surface, and in the second half of the road the works are being carried out to construct a cement concrete cover using the existing asphalt concrete as a base.

Considering better technical design, Option 2 was adopted for further development, with the offset of the axis of the carriageway.

Within the framework of the environmental impact assessment, a comparative analysis of two alternatives will be carried out in paragraph 7: "Implementation of the Design Solution for the Reconstruction of the P-80 Sloboda-Papernya road, 0.000 km - 14.770 km " (option 2) and "zero" alternative - "Refusal to Implement the Design Solution for the Reconstruction of the P-80 Sloboda-Papernya road, 0.000 km - 14.770 km".

2.4 *General project information*

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The P-80 road Sloboda-Papernya is a national road of II-III category, it is serviced by RMS-5 of the RUE "Minskavtodor-Center" (Minsk). The length of the road is 23.38 km.

The road was built in 1934, reconstruction was carried out in 1975. Time of lifecycle maintenance on sites are the following:

- km 0,000 – km 10,330 – year 1987
- km 10,330 – km 14,740 – year 1988
- km 14,740 – km 14,770 – year 1996

The current repair on the section km 1,000 - km 14,560 was carried out in 2008.

A reconstruction of the P-80 road Sloboda-Papernya, km 0.000 - km 14.770 is envisaged, according to the parameters I-c the technical category in accordance with the requirements of TCCP 45-3.03-19-2006 (02250) "Motorways. Design standards".

The projected section of the P-80 road is located in the Smolevichi and Minsk districts of the Minsk region.

Currently, the road P-80 Sloboda-Papernya in the reconstructed section belongs to the road of the II category with 2 lanes with asphalt concrete. The width of the roadbed is 15 m on the average.

The reconstructed section passes through Okolitsa settlement (for about 1.1 km), as well as near the next residential areas: Ostroshitsky Gorodok, Belye Luzhi, Raubichi, Baguta (including infectious disease clinic "Tavolga"), Sosnovaya, Sloboda. The Republican Center for Olympic Training in Winter Sports "Raubichi" is located near the road.

Due to the close location of the P-80 motorway to the settlements and the sports complex "Raubichi", an intensive movement of public transport (from 12 to 86 trips per day) is carried out in the area. There are bus stops for passenger services.

Crossings with the republican roads M-2 Minsk-National Airport Minsk, P-53 Sloboda-Novosady, and M-3 Minsk-Vitebsk are at different grades. Crossing with the republican motorways M-14 (the second ring road around Minsk) and P-40 (Borovlyany-Logoyisk) is through the roundabout. All intersections and junctions with local highways are at grade.

If we have a look at the plan, the area under consideration has 21 turn angles, 8 of them have a value less than 1°. The radius of the remaining angles is less than 3000 m, so the roadway is designed with bends. The minimum radius is 550 m.

The earth surface is in a satisfactory condition, no bulges or erosions are detected, except for PK28+74 on the left - 4 m³. The slopes of the roadbed are lined. The maximum height of the mound is 10 m on the pipe at PK28 + 74, the maximum depth of the notch is 9.2 m on PK25 + 00. The maximum height difference is 47 m.

Drainage from the roadway is carried out due to longitudinal, transverse slopes of the carriageway, as well as with the help of edging and spillway trays.

As main defects, we can note the silt build-up in the outlets of open water-discharge trays. The trays themselves are in good condition.

On the section 0,000 km - 14,770 km of the road P-80 Sloboda-Papernya there are twenty drains. The general state of the surface drainage system can be assessed as satisfactory.

The longitudinal profile is made along the axis of the road. According to field measurements, sections with a longitudinal slope of more than 40 ‰ (II technical grade) - PC54 + 00-PC56 + 00 and PC123 + 00-PC124 + 00 are defined.

The construction of pavement is capital, asphalt concrete. The width of the road cover is 12-12.1 m, not counting the broadening and transitional-velocity lines. The width of the carriageway is 2x3.75 m. The width of the edge stiffening strip from the side of the curb is 0.75 m, the width of the fortified part of the curb is 2.25 m.

The main defects are individual longitudinal and transverse cracks. The rutting was noted on the site of PC103 + 00 - PC107 + 00 on the right side of the roadway.

At km 13.5 of the road P-80 there is an underground pedestrian crossing.

Among the service facilities there are two cafes: near the memorial complex "Mound of Glory" (on the right of PC3 + 40) and at the exist to the sports complex "Raubichi" (right PC118 + 05).

Regular traffic of cars and trucks is carried out along the road. According to the data on traffic intensity, carried out by the specialists of the State Enterprise Belgiprodor in December 2016 and May 2017, on the projected section of the P-80 road Sloboda-Papernya, 0.000 km - 14.770 km, the current

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average annual traffic intensity is between 4346 and 9256 vehicles per day. The composition of the traffic is dominated by passenger transport, which is about 66-80% of the total flow. The movement of heavy-duty road trains is 8-17%.

Transit traffic along the P-80 road Sloboda-Papernya makes up 16% of the traffic (about 930 veh/day), including 10% of the freight transit traffic (about 570 buses / day) and 6% of the light transit traffic (about 360 veh/day).

The estimated traffic intensity for a 20-year perspective along the P-80 road Sloboda-Papernya, 0.000 km - 14.770 km, will be from 8254 veh/day up to 18957 veh/day.

Based on the economic value and the prospective of the traffic intensity on the projected site, it is necessary to upscale the road parameters (plan, longitudinal and transverse profile) to the I-c category.

The rationale for investing in the reconstruction of the P-80 road Sloboda-Papernya, 0.000 km - 14.770 km, was carried out on the basis of a task approved by the RUE "Minskavtodor-Center" on February 4, 2017, by the Ministry of Transport and Communications on February 13, 2017.

In accordance with the terms of reference, two stages were identified:

- I stage: km 0,000 - km 7,600,
- II stage: km 7,600 - km 14,770.

The beginning of the projected section PK0 + 00 corresponds to km 0,000 of the highway R-80 Sloboda-Papernya on the border with a four-lane roadway of the M-2 motorway Minsk-National Airport Minsk.

The end of the projected section PK146 + 22.51 corresponds to km 14.770 of the P-80 Sloboda-Papernya road. At the same time, the existing roundabout interchange at one level at the intersection with the P-40 road Borovlyany-Logoyisk is preserved without reorganization.

The total length of the reconstruction site is 15 km.

The layout of the reconstructed section is shown in Figure 1. In the design documentation the projected road section is completely combined with the existing direction.

The parameters of the plan, longitudinal and transverse profiles of the motor road should ensure safe and uninterrupted passage of vehicles with traffic intensity exceeding 10,000 units/day, the value is calculated for private motor cars.

The road is intended for the admission of vehicles with the following dimensions:

By length: single vehicles up to 12 m; Road trains up to 20 m;

By width: up to 2.5 m;

By height: up to 4,0 m.

The main parameters of the roadbed of the reconstructed road must comply with the standards for roads of I-c category indicated in Table 1.

Table 1.

Name	Requirements TCCP 45-3.03-19-2006
Number of lanes, pcs	4
Lane width, m	3,50
Width of the roadway, m	2x7,0
Width of roadsides, m	3,0
incl. fortified lane	0,5
stopping lane	2,5
Minimal width of the separation lane between different directions, m	2+S (width of the road fence)
Incl. fortified lane	0,5
Width of the roadway	22+ S (width of the road fence)

The traffic of heavy and large vehicles (HLV) by road must be carried out in accordance with the "Recommendations for the Traffic of Heavy Vehicles on Public Roads, Taking into Account the Condition of the Road Coating and Artificial Structures" (Decision of the Committee on Roads No. 79

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dated 10 May 1999).

The cross-section profile is designed with the consideration of the snow conditions and ensuring safety and comfort of movement, as well as the maximum use of existing road coating.

In the areas of use of existing pavement, the base is provided with a transversal alignment and the installation of a coating of cement concrete.

Minimum radii of convex and concave curves are adopted in accordance with the requirements of TCCP 45-3.03-19-2006 for a calculated speed of 100 km/h.

In the feasibility study the following basic parameters of the transverse profile were adopted:

- width of the roadway is 4x3.5 m;
- width of the roadside is 3.0 m, including stopping lanes of 2.5 m;
- the width of the dividing lane is 4.3 m.

The transverse slope of the carriageways is 25 ‰, the slope of the roadside is 40‰.

The roadbed is designed taking into account the road category, the type of pavement, the natural conditions of the construction area and the features of the engineering and geological conditions of the construction site, the conditions for ensuring the stability of the roadbed slopes, the snow cover of the road and traffic safety. The construction of the roadbed is designed in accordance with TCCP 200-2009 (02191) "Motorways. Roadbed. Design Standards".

During the road reconstruction, the roadbed of the existing road is used as much as possible.

The width of the roadbed is 22.7 m.

In swampy areas, a complete peat removal to the mineral bottom with backfilling with sandy, dust-free soil is envisaged.

On roadbeds with a height of up to 3 meters, the steepness of the slopes of the roadbed is accepted - 1: 3, on roadbeds with a height of more than 3 m - 1: 1.5, on sections of bridges approaches - 1: 2.

The system of road drainage will consist of a number of structures and individual structural measures designed to prevent waterlogging of the roadbed, as well as to intercept and drain water coming from the surface of the road. To ensure the drainage from the roadbed and the passage of small watercourses, the installation of culverts is provided.

To ensure drainage on small roadbeds, the construction of drains is planned. Slopes and bottom are strengthened by sowing grasses with plating. The bottom of drains with a longitudinal slope of more than 10 ‰ is strengthened by gravel or concrete.

In order to preserve the greenery and reduce the additional drainage of ground in places where the road passes through the recesses, a cavity cross-sectional profile with a drainage construction under the sand underlay coating and retaining walls has been adopted.

In places of the roadbed construction which is more than three meters, as well as on the concave curves, at bus stops, on the approaches to the bridges through the watercourses and at the exists of the traffic interchanges, water-discharge trays are provided for draining water from the roadway and the construction of rainwater wells.

After the drainage of water from the road near the Domelka river and the village of Okolitsa, water treatment installations are arranged.

The construction of the pavement was designed in accordance with the requirements of the technological regulations, based on the transport-operational requirements established for roads of I-c category, the composition and prospective traffic intensity, climatic and soil-hydrological conditions, the availability of local building materials. The calculated load on the single most loaded axle of a two-axle vehicle is 11.5 tons.

As a result of the comparison of variants of pavement made by experts of the State enterprise "Belgiprodor", the version of the construction of pavement made of cement concrete is considered as the recommended one.

In the investment justification, the following types of pavement are accepted:

New road pavement

It is arranged on the sections of a new roadbed and has the following construction:

- coating: heavy concrete of B35 class in accordance with STB 2221-2011 with a thickness of 0.24 cm;

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- cracks stopping layer - sandy hot asphalt concrete of type G of grade I PGG-I / 2,7 according to STB 1033-2016 with a thickness of 4 cm;
- base: lean concrete of class B7.5 according to STB 2221-2011 with a thickness of 14 cm;
- technological layer of crushed stone-sand mixture C6 according to STB 2318-2013 with a thickness of 15 cm;
- an undercoat layer of 80 cm thick, non-dusty sandy soil laid on a non-woven synthetic material with a surface density of 301-400 g/m² in places where the roadbed consists of clay and silty soils.

Road pavement on the separating lane:

- the top layer of the asphalt-concrete coating of fine-grained hot gravel of type B of class I 20-1 / 2,7 according to STB 1033-2016 with a thickness of 5 cm;
- the bottom layer is made of asphaltic concrete of coarse-grained hot macadam of class I 20-I according to 1033-2016 with a thickness of 7 cm;
- the base is made of crushed stone mix of optimal composition according to Regulating Document 02191.2.058-2012 with a thickness of 8-12 cm;
- the cracks stopping layer is sandy hot asphalt concrete of type G, class I PGG-I / 2,7 according to STB 1033-2016 with a thickness of 4 cm;
- base: lean concrete of class B7.5 according to STB 2221-2011 with a thickness of 14 cm;
- technological layer: crushed stone-sand mixture of type C6 according to STB 2318-2013 with a thickness of 15 cm;
- the undercoat layer: non-dusty sandy soil of 80 cm thick laid on a non-woven synthetic material with a surface density of 301-400 g/m² in places where the roadbed consists of clay and silty soils.

The curbs are strengthened by a 12 cm thick soil-aggregate mixture (40% of crushed stone and 60% of vegetative soil).

Strengthening of the existing pavement

It is arranged on the areas of use of the existing coating as a base. Preliminary on the existing coating a partial milling to the depth of 6 cm is performed.

The road pavement has the following construction:

- coating: heavy concrete of class B35 in accordance with STB 2221-2011 with a thickness of 0.24 cm;
- cracks stopping layer: sandy hot asphalt concrete of type G of the I class PGG-I / 2,7 according to STB 1033-2016 with a thickness of 4 cm;
- leveling layer of asphaltic concrete of crushed coarse-grained hot grade II IIIKIIr40-II according to STB 1033-2016 with a minimum thickness of 7 cm;
- existing road pavement

Road clothes on the roadside cutting areas for the construction of the main carriageway:

- top layer: asphalt-concrete coating of fine-grained hot gravel of type B, I class 20-1 / 2,7 according to STB 1033-2016 with a thickness of 5 cm;
- bottom layer: hot crushed asphalt-concrete covering of class I 20-I according to STB 1033-2016 with a thickness of 7 cm;
- base: crushed stone mix of optimal composition according to Regulating Document 02191.2.058-2012 with a thickness of 37 cm;
- technological layer of crushed stone-sand mixture of type C6 according to STB 2318-2013 with a thickness of 15 cm;
- undercoat layer: non-dusty sandy soil of 80 cm thick laid on a non-woven synthetic material with a surface density of 301-400 g/m² in places where the roadbed consists of clay and silty soils.

Road pavement on the separating lane:

- top layer: asphalt-concrete coating of fine-grained hot gravel of type B, I class 20-1 / 2,7 according to STB 1033-2016 with a thickness of 5 cm;
- bottom layer: hot crushed asphalt-concrete covering of class I 20-I according to STB 1033-2016 with a thickness of 7 cm;

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- the base is made of crushed stone mix of optimal composition according to Regulating Document 02191.2.058-2012 with a thickness of 8-12 cm;
 - the cracks stopping layer is sandy hot asphalt concrete of type G, class I PGG-I / 2,7 according to STB 1033-2016 with a thickness of 4 cm;
 - existing road pavement
- The curbs are strengthened by a 12 cm thick soil-aggregate mixture (40% of crushed stone and 60% of vegetative soil).

Transport interchanges

During the reconstruction of the P-80 road in the area of intersection with the M-2 road Minsk-National Airport Minsk and M-3 road Minsk-Vitebsk, it is planned to keep the cloverleaf interchanges in the existing configuration.

Existing span structures of overpasses allow to pass four lanes of the main road, and to ensure the passage of the transport turning to the left, the assigned SSPs located in spans of 15.5 m are arranged. To do this, under the existing overpasses, a partial disassembly of the cones with the subsequent arrangement of retaining walls is provided. The existing overpasses are not reconstructed (Figure 2).

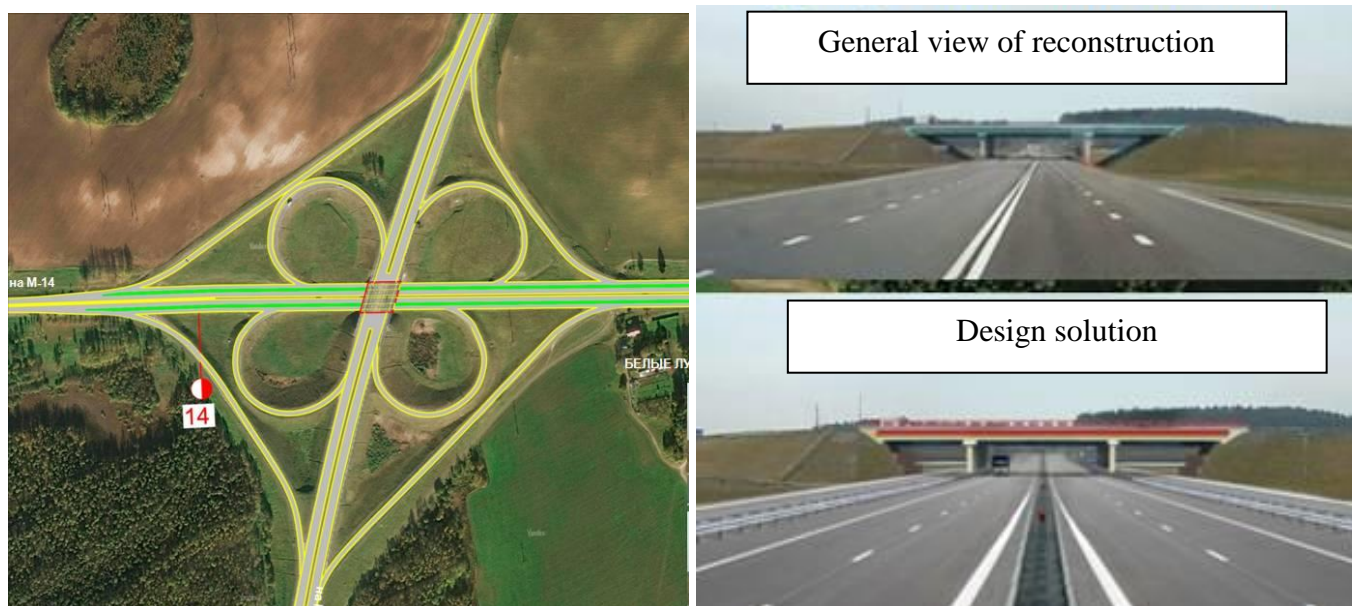


Figure 2.

The project provides for the arrangement of 4 new traffic interchanges at different grades:

- at the crossing point with the route of P-80 road between the settlements Baguta, Sosnovaya, Zadomlya, Baturina and KIZ "Tavolga" construction of local roads and an overpass in the vicinity of the river Domelka is envisaged;
- at the crossing point with the route of P-80 road in the area of intersection with the local road N-9540 Prilepy-Lyady construction of an overpass and the arrangement of passage under it is provided;
- at the crossing point with the route of P-80 road in the Okolitsa district the construction of an overpass and the installation of a passage under it is envisaged;
- at the crossing point with the route of P-80 road in the area of the exit to the sports complex "Raubichi" and the village of Uzborie a local passage and the construction of an overpass is envisaged.

The remaining junctions and intersections with the road P-80 are provided at one level.

At intersections and junctions at the same level, with a calculated intensity of the departing and leaving cars of more than 50 cars / day, a construction of transferring and speeding lanes is envisaged.

In total, 9 one-level contingencies are envisaged in the projected section.

Landscaping of road junctions, slopes of excavations, as well as landscape gardening of the territory of the roadside lane is proposed.

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<p>the river Domanka is envisaged;</p> <p>- at the crossing point with the route of P-80 road in the area of intersection with the local road N-9540 Prilepy-Lyady construction of an overpass and the arrangement of passage under it is provided;</p> <p>- at the crossing point with the route of P-80 road in the Okolitsa district the construction of an overpass and the installation of a passage under it is envisaged;</p> <p>- at the crossing point with the route of P-80 road in the area of the exit to the sports complex "Raubichi" and the village of Uzborie a local passage and the construction of an overpass is envisaged.</p> <p>The remaining junctions and intersections with the road P-80 are provided at one level.</p> <p>At intersections and junctions at the same level, with a calculated intensity of the departing and leaving cars of more than 50 cars / day, a construction of transferring and speeding lanes is envisaged.</p> <p>In total, 9 one-level contiguities are envisaged in the projected section.</p> <p>Landscaping of road junctions, slopes of excavations, as well as landscape gardening of the territory of the roadside lane is proposed.</p>						
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To ensure the safety of pedestrians, underground pedestrian crossings are arranged in the settlements: Sosnovaya (km 2,3); Baguta (km 3,7); Okolitsa (km 10.6); Ostroshitsky Gorodok (km 14.3), as well as in the area of the sports complex "Raubichi" (km 11.8). Internal illumination of underground pedestrian crossings is provided.

In total, when developing a feasibility study for investment in the reconstruction of the P-80 Sloboda-Papernya road, 0.000 km - 14.770 km, the following is envisaged:

- construction of 10 structures;
- reconstruction of 2 structures;
- lengthening of one structure.

The design also provides for the installation of culverts along the main road and at traffic junctions to ensure surface drainage from the offshore strip and to maintain the existing hydrogeological balance and passage of small watercourses.

It is planned to strengthen the channels, slopes of roadbeds near the pipes.

The project will also provide for the installation and re-engineering of utilities (air and cable communication lines, overhead lines with the power of 0.4-10 kV and 35-330 kV, gas pipelines, etc.).

Along the P-80 road there are eight bus stops. In connection with the high traffic intensity of public transport in the development of the project justification of investments in the reconstruction of the P-80 road, a construction of 17 bus stops is envisaged.

Bus stops are proposed to be equipped with the construction of a semi-enclosed pavilion for transport waiting with metal wall fencing with tracery inserts (snowflake), the pavilion roof will be made of metal, the shape of the roof imitates a springboard (which corresponds to the style and direction of the road to the Raubichi sports complex); Benches and bins shall also be installed.

The option of arranging a bus stop is shown in Figure 3.



Figure 3.

Speed-gaining lanes, landing and stopping areas are designed at the bus stops. A pedestrian footpath is provided in the bus stop zone. Stop and footpath's pavement is with small paving tiles. A lawn is envisaged on sites that do not have a cover. The landscaping of bus stops is planned at a moderate level. Lighting of bus stops is envisaged.

The reconstructed section of the P-80 motorway is planned to include two small recreational areas:

- installation of a new recreation area at km 5,35 on the right side;
- reconstruction of the existing recreation area at km 5.6 on the left side.

The territory of each recreation area is planned with the allocation of the following zones:

- parking zone for heavy vehicles for 3-4 cars;
- parking zone for 6 private cars;

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3. EVALUATION OF THE EXISTING STATE OF THE ENVIRONMENT OF THE REGION OF THE PLANNED ACTIVITY

3.1 Nature conditions and resources

3.1.1 Climate

The projected section of the P-80 road Sloboda-Papernya, 0,000 km - 14,770 km, is located in the Smolevichi and Minsk districts of the Minsk region.

The territory of the proposed construction, like the entire territory of the Republic of Belarus, refers to a zone with a temperate continental and an unstable wet climate.

In accordance with the current regulatory documents (Annex A of TCCP 45-3.03-19-2006 (02250), the area of reconstruction of the P-80 road Sloboda-Papernya, 0.000 km - 14.770 km, is included in the second central road and climatic region of the Republic of Belarus.

The climate is mild, with a sum of degree-days of frost of 387-740, an average annual temperature is 6.2 ° C. The coldest month of the year is January with an average monthly temperature of -5.9°C, the warmest is July with an average monthly temperature of + 17.8°C.

The date of transition of the mean daily air temperature passing + 5°C during the temperature rise period is between April 10 and 15, the duration of the period with a temperature above + 5°C is 185-190 days. Transition of the average daily air temperature above + 10°C in the spring period occurs between April 30 and May 5, the duration of the period with a temperature above + 10°C is 140-145 days. The duration of the frost-free period in the air averages 150-155 days, on the soil - 135-140 days. The average number of days with the change of air temperature through 0°C during the day is 70. The average number of days with a thaw in December-February is 36 (the point of observation is Minsk).

The annual amount of precipitation is 650-700 mm, the evaporation potential is about 635 mm per year. The average amount (amount) of precipitation for April-October is 455 mm, for November-March - 228 mm (the point of observation is Minsk). The average annual relative humidity is 79%.

The first autumn frosts are observed on September 25-30, in the vicinity of Minsk the earliest autumn frosts were recorded on September 13, the latest - on November 15. The last spring frosts can be observed on 10-15 May, the latest frosts were observed on 12 June. Steady snow cover is formed on December 10-15 and melts between March 15 and 20 [1].

According to the Change No.1 of the SNB 2.04.02-2000 of Belarus, the average of the largest snow cover for the observation point in Minsk in the decade of the winter is 27 cm, the maximum of the largest decadal snow cover is 62 cm, and the duration of the stable snow cover is 101 days. The greatest decade-long height of the snow cover at 5% of the supply is 55-60 cm. The average of the maximum freezing depths of the soil is 63 cm, the largest of the maximum freezing depths for an open area under a natural snow cover is 137 cm (the point of observation is Minsk).

The normative depth of seasonal freezing of the ground under the open (bare) surface according to the State Hydrometeorological Service of the Republic of Belarus is 102 cm for loam and clay; for sandy loam, fine sand - 123 cm; gravel sand, large and medium size - 132 cm; coarse soil - 150 cm.

The prevailing wind directions in the area of the projected section of the road in the winter period are southern and western, in the summer period - western and north-western.

The average number of days with the wind speed of more than 10 m/s with a negative air temperature is less than 1. The maximum wind speed at 5% of the supply is 25 m/sec. The wind speed, the repeatability of which is 5%, is 6 m / s.

Coefficient, depending on the stratification of the atmosphere, A = 160.

Terrain coefficient: 1.

The average annual wind rose is shown in Table 2.

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Table 2.

	N	N-E	E	S-E	S	S-W	W	N-W	No wind
January	6	4	9	12	20	17	20	12	3
July	14	9	9	6	10	12	20	20	7
Annual	9	8	11	11	16	13	18	14	5

According to the Change No.1 of the SNB 2.04.02-2000 of Belarus, the duration of the frost-free period (with an average daily temperature above 0 ° C) for Minsk is on average 245 days. The duration of the vegetation period with an average daily temperature above + 5 ° is about 200 days.

The geographic location of the road reconstruction region determines the magnitude of the solar radiation and the nature of the atmospheric circulation. The sum of the radiation balance for the year is -1500-1600 MJ/m². The annual sum of the total solar radiation – 3600-3800 MJ / m² [1].

The following unfavorable meteorological conditions can be observed on the studied territory, which at high intensity can worsen the traffic situation and contribute to the rapid deterioration of the roadway [1]:

- average annual number of days with fogs - from 30 to 50 (in Minsk, the average number of days with fogs for a year is 59, the largest is 102);
- average number of days with thunderstorms is 30 or more (in Minsk, the maximum number of days with thunderstorms is 39);
- average annual number of days with ice - 25 or more;
- maximum number of days with strong wind and squalls - 2 (Minsk);
- average number of days with thaws - 30-35;
- average annual number of days with a snowstorm is 20-25 (in Minsk, the maximum number of days with a snowstorm is 29);
- maximum annual number of days with hail - 7 (Minsk).

3.1.2. Radiation situation

According to the monitoring carried out on the radiation monitoring network of the Ministry of Natural Resources and Environmental Protection of the Republic of Belarus, the radiation situation on the territory of the Minsk region is characterized as stable, the dose rate (DR) of gamma radiation corresponds to the established long-term values.

Radiation monitoring is a system of long-term regular observations to assess the state of the radiation situation, as well as the forecast of its future change. Radiation monitoring is an integral part of the National Environmental Monitoring System of the Republic of Belarus (Figure 4). Radiation monitoring is conducted to monitor the natural radiation background; radiation background in areas affected by potential sources of radioactive contamination, including for the assessment of transboundary transport of radioactive substances; radioactive contamination of atmospheric air, soil, surface waters in the territories exposed to radioactive contamination as a result of the Chernobyl disaster. On the territory of the Republic of Belarus there are 55 observation points of radiation monitoring, at the reference points of which daily (including weekends and holidays) measurement of DR gamma radiation (observation network) is performed.

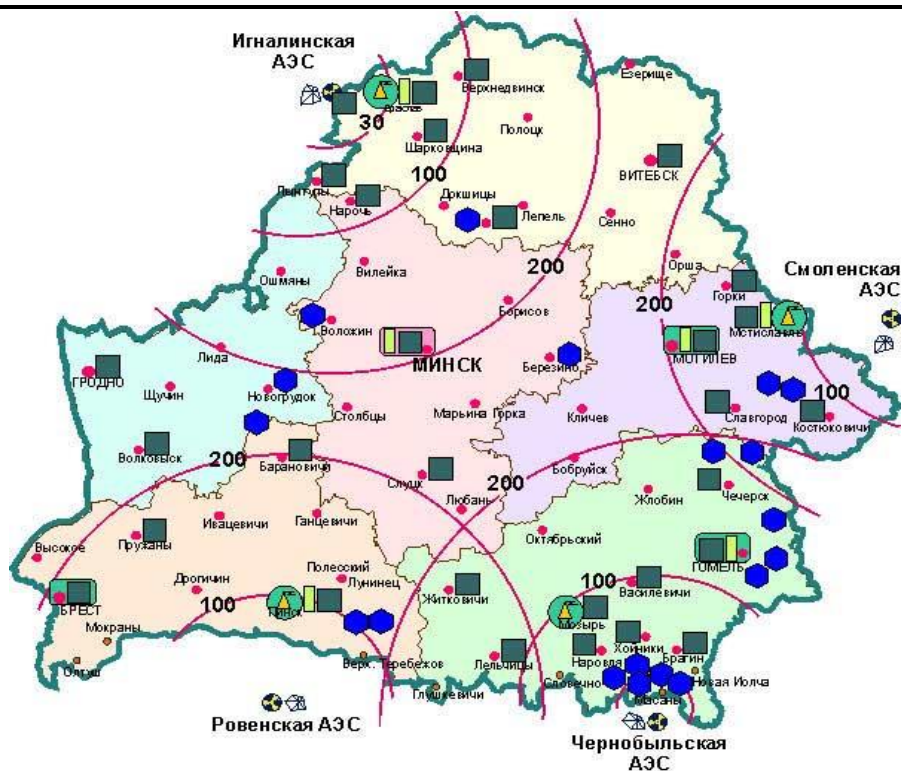


Figure 4.

According to the monitoring carried out on the radiation monitoring network of the Ministry of Natural Resources and Environmental Protection of the Republic of Belarus, the radiation situation on the territory of the Minsk region is characterized as stable, the dose rate (DR) of gamma radiation corresponds to the established long-term values and does not exceed the level of the natural gamma background (up to $0.20 \mu\text{Sv} / \text{h}$). In district cities, the average annual level of DR of gamma radiation is in the range from 0.10 to $0.12 \mu\text{Sv} / \text{h}$. [2].

In 2015, during the state sanitary inspection by the Sanitary and Epidemiological Service of the Minsk Region, 13,329 samples of food products from the food production and personal farms were examined for radionuclides.

In the main food products produced in the manufacturing sector (milk and dairy products, meat and meat products, bread and bakery products, potatoes, vegetables, berries and fruits, fish, etc.), exceeding of existing standards of cesium-137 and strontium-90 was not registered.

Exceedances of the permissible levels of cesium-137 were registered in the forest wild products: 3.5% of the forest berries (Berezinsky, Borisovsky, Vileysky, Volozhinsky, Logoysky, Slutsky districts), mushrooms - 7.7% (Vileysky, Logoysky, Molodechnenskiy, Slutsky districts), medicinal raw materials - 2.2% (Stolbtsovsky, Borisovsky districts), which were obtained from individuals.

In 2015, territorial centers of hygiene and epidemiology examined 3228 samples of food products produced in personal farms for the content of cesium-137. The products from 381 settlements of the Minsk region were studied. In the production of personal farms, the excess of the standards for the content of cesium-137 was not registered.

As part of the state sanitary supervision, 1037 drinking water samples were tested for total alpha- and beta activity, as well as radionuclides of cesium-137 and strontium-90. Exceedances of the permissible levels were not found.

Sources of ionizing radiation (hereinafter - SIRs) on the territory of the Minsk region are used by medical and preventive organizations, industrial enterprises.

In 2015, 324 radiation facilities were functioning, including 7 objects with open radiation sources and 24 objects with closed radiation sources where works are performed; 291 objects generate SIRs, of which 274 are medical X-ray rooms.

In 2015, only 1188 people worked with the SIRs, classified as "personnel" in the established order. 100% of the personnel are covered by the individual dosimetry control. No exceedances of the permissible exposure doses to personnel were registered.

Individual annual doses to personnel working in medical organizations did not exceed 7.19

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mSv/year; of personnel working in industrial enterprises - 5.12 mSv / year (permissible dose level for personnel - 20 mSv / year) [3].

3.1.3. Terrain and geomorphological features of the studied territory. Engineering and geological conditions

According to the geomorphologic zoning of the Republic of Belarus, the site for the reconstruction of 0.000 km - 14.770 km of the P-80 road is located within the Western Belorussian subregion of the Central Belarusian Upland area and ridges [1].

The geomorphological region extends from the west to the east (from the Grodno upland to the eastern border of the republic) by 540 km. The distance from the north to the south (from the north of the Minsk Upland to the boundary of the Sozh glacier) is 230 km. The most prominent orographic feature is the system of elevations of the Belarusian ridge, arched out from the south-west to the northeast. Among these elevations the highest elevations of the Republic of Belarus are located, exceeding 300 m above sea level. Here there are sections of the Black Sea-Baltic watershed of the East European Plain. The total area of the hills, bounded by a structure contour of 200 m, occupies the main territory of the geomorphological region.

The elevations in the central part of the republic are distinguished by the typical ridge-hilly and large-hilly-ridged landscape of the marginal (frontal) formations, composed of loamy and stony moraine material, which alternates with sandy loamy and sandy varieties.

The terrain of the central part of the republic is characterized not only by relative antiquity, but also by its external features. These features are expressed in a number of signs of denudation, erosion dismemberment, flattening of the surface. Their combinations give the heights a monolithic character with settled peaks, steep slopes, dissected river valleys. The signs of denudation are violated at the sites of the esker-kame relief, usually located on a moraine base, forming domed hills like bald peaks. Relative exceedances here reach several tens of meters.

A distinctive feature of the region should be considered as the absence of "living" glacial lakes. Numerous cavities are occupied by residual basins, filled with sapropel and peat. Karst and suffusion lakes are found in areas of the nearby location of carbonate rocks.


The river valleys, on the other hand, are well developed and terraced. They divide up the elevations into morphological areas - nodes, especially in the places of numerous through valleys and close contact of the upper reaches of the rivers of different basins. The valleys of rivers which are draining the plains are characterized by a considerable width of floodplains and terraces creating elongated strips of alluvial deposits.

The projected road section is confined to one geomorphological area (Figure 5) - Minsk Glacial Upland (24).



Figure 5.

This geomorphological region extends from north to south from the upper reaches of the

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<p>Figure 5.</p> <p>This geomorphological region extends from north to south from the upper reaches of the</p>										
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Berezina (Dniepr) to the upper reaches of the Neman at a distance of more than 150 km. The morphological and genetic connection of the Minsk Upland with the Oshmyany ridges in the west is expressed in the amphitheater of the glacial complexes forming an arc of 250 km long. Borders of the region serve as plains and lowlands: Narochanskaya, Verkhnerberzinskaya, Tsentralneberezinskaya, Stolbtsovskaya.

The geomorphology of the region reveals a definite connection with tectonic structures. Its base is the arch of Belarusian anticline - the Vilyeyka burial ledge. The south-eastern part of the elevation is located within the Volozhin graben bordered by the Oshmyany and Naliboki faults. Large faults are extended along the line Dzerzhinsk-Minsk-Logoisk-Borisov (Vyzhevsko-Minsky) and in the interfluvium of the Berezina and the Viliya. Absolute foundation marks increase from the center to the periphery. In the vicinity of Dzerzhinsk it is located 100-200 m below sea level, in Minsk it falls to a depth of 300 m and further to the east by 500 m. The thickness of the sedimentary cover ranges from 300 to 700 m. It is represented by clays and marl; in the center of a significant area there are deposits of the Cretaceous system - marl, chalk, sands. The anthropogenic system is represented by morainic and water-glacial deposits of the Berezinsky, Dniepr, and Sozh age. Their capacity on the territory of the republic, on average, is about 200 m, and the maximum capacity, which is 325 m, is in the region of Logoisk. The anthropogen's bed is heavily dismembered. Absolute heights are at Zaslavl - 142 m, in Logoisk - up to 105 m. The surface is diversified by local elevations (Volozhinskaya, Olehnovichskoe, Ostroshitsky, Yanushkovichskoe) and depressions, the most significant of which is Logoisk depression (depth of - 105 meters), which has a meteoric origin. The most significant troughs of glacial plowing and erosion are Verkhneberezinskaya (branch of the Dvinsko-Dniepr megalobin) and Berezinskaya north of Volozhin.

The glacial integuments of the Dniepr glaciation play a major role in the structure of the elevation, which make up about half the volume of the anthropogenous strata. Moraine deposits are represented by sandy loams, less often loams, which are heavily overgrown. In the geological sense, this is a complex conglomerate of marginal formations that form powerful nodes, formed mainly as a result of phases and oscillations during the Dniepr and Sozh times. Externally, Ivenetsky, Minsk, Radoshkovichi and Logoysk nodes are distinguished. They represent the angular massifs - Ivenetsko-Minsky, Ilyansky, Logoysky, etc. The highest elevations are located here: Dzerzhinskaya (346 m), Lysaya (342 m), Mayak (335 m). In the structure of the moraine and water-glacial strata, the Dniepr, Minsk, Oshmyanka stages are distinguished. They form the upper and lower uneven-aged complexes. The lower complex is represented by the main moraine, decorated in the form of angular arrays. Accumulation of deposits is associated with the transgressive stage of the development of the ice sheet. The upper complex, relief-forming, is represented by moraines of the head inconsistently overlapping with the lower complex superimposed on it during the epoch of the regressive stage of the glacier's activity. The upper complex is represented by a typical finely moraine hilly terrain with manifestations of glaciotectionogenesis (thrusts, scales), as well as by the forms of fixed ice and thermokarst. Volozhin-Zaslavsko-Dokshitsky belt of the marginal formations belongs to the marginal frontal ridges, formed in different stages of the glacier edge movement. It includes Volozhinsky, Radoshkovichi, Logoyskie, Pleschenitskie ridges. Among them, second-order ridges are distinguished, arranged in stages of oscillatory movements (Dainovskaya, Molodechnenskaya, Zembinskaya, etc.). The main stages have connections with the Kopylskaya ridge, the Novogrudskaya Upland.

Geology and geomorphology of the Minsk Upland in the final stage are the results of the Sozh glaciation, which repeatedly imposed on the Dniepr base.

The complexity of the structure, the large absolute and relative heights within the Minsk Upland create signs of vertical geomorphological differentiation (longline). The upper tier (250-300 m) form the nodes and angular massifs: Logoysky, Radoshkovichi, Ivenetsko-Minsk. They differ in large-scale and ridge terrain with relative heights up to 80 m above the level of the Central Berezinsky plain. The hills are dome-shaped, giving the landscape the appearance of the comparative shallow waters. Significant (up to 30 °) slopes contribute to the movement of soil along the slopes and the formation of skeletal soils. The tops are mostly covered with forest, pine-tree lichen pine forests predominate on sandy loam with juniper in undergrowth. In places where loamy moraines are spread, a spruce appears in the forest and the undergrowth is more rich.

The middle tier occupies heights of 250-220 m. It is represented by a medium-hilly, rugged

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terrain with relative elevations of 40-50 m above the surface of the plains. Boulder loam and sandy loam predominate in moraines. The tops are often crowned with dome-shaped kames, folded by layered sand deposits. Slope processes and the formation of deluvium are actively developing. Vegetation is represented by dry lands and mixed pine small-leaved forests with an admixture of spruce. Sloping inter-hill slides are plowed up. The lower tier at absolute altitudes of 220-180 m is represented by the water-glacial and moraine plains. The highest areas are allocated as kames and esker ridges. The gentle southern and south-western slopes of the elevation are often covered with a layer of loess-like rocks. Their presence has a leveling effect on moraine terrain. At the same time loess-like rocks stimulate the development of erosion forms: ravines, beams, ruts. The lower tier is mostly plowed. Forest areas, except pine, include spruce, oak and a rich variety of underbrush. The lowest level with heights of less than 180 m is occupied by river valleys, lowered lakes, bottom of erosion cuts.

Loess-like rocks bring a characteristic feature to the terrain. They are widespread on the southern, southwestern, southeastern slopes, where they form a raincoat with a thickness of up to 2-4 m at altitudes of 180-220 m. Loess-like loams and sandy loam lie directly on morainic and water-glacial sediments and date back to the late Lake or Early Late Glacial. Due to significant plowing, these areas are distinguished by intense ancient and modern erosion. On the slopes of the beams and river valleys, young erosion ruts are formed, and on the placers are the suffusive depressions. A significant role in the appearance of the elevation is played by man-made forms, represented by quarries, excavations for peat extraction, etc.

The Black Sea-Baltic watershed passes through the highest parts of the Minsk Upland. The sources of the rivers of the Dniepr and the Neman basins begin at the highest points of the terrain, close to each other with their upper reaches (Isloch-Ptich, Svisloch-Usha, Iliya-Gaina). The basin of the Neman includes the tributaries of the Berezina (Neman), the Usha, the Nemanets, the Losha; the basin of the Viliya - the Dvina, the Iliya. The Dniepr system includes the tributaries of the Berezina (Dniepr), the Svisloch, the Plisa, the Gaina. The rivers are small, but the depth of the roadbed reaches 15-20 m. The floodplain and the floodplain terrace are well developed.

The rivers within the Minsk Upland have been largely transformed by man-made impact. In Svisloch there are the following reservoirs: Zaslavskoe, Krinitza, Drozdy, Chizhovskoye, Komsomolskoye Lake, Osipovich. A significant part of the river is channeled and enters the Vileyka-Minsk water system. The length of the connecting channel of the system is 70 km from the mouth of the Iliya to the Svisloch. The ascent through the watershed in the Radoshkovichi region is 75 km. The Vilyeyka Reservoir, which was created, is the largest artificial reservoir in the republic, with an area of 64.6 km² [4].

In general, in the area where the object is located, a broad-wavy terrain dominates. The constituent ridges, steep slopes and hills are separated by wide openings to the Central Berezinsky plain by troughs, lake-like extensions, flat marshy lowlands. The area under investigation is confined to the north-eastern part of the geomorphological region of the Minsk Glacial Upland. It is a stretch of the frontal plain formed by water ice glacier retreat flows, framed by moraine hilly ridge and significantly transformed by human activity.

Absolute marks of the surface of the survey area are measured from 190 to 241 m, rising in the north-west direction.

The dismemberment of the territory increases on the slopes of the river valley, the old river valleys, dry valleys (Figure 6).



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Figure 6.

The intensity of the technogenic load on the terrain of the study area is 30-40 thousand m³/km². The stability of the terrain to technogenic loads is 99-100%.

The degree of manifestation of extreme geomorphological processes is average throughout the entire study area.

There are no seismically active zones and karst processes on the territory of the projected facility.

Geologically, the Quaternary deposits that are most susceptible to man-made impact play a special role in shaping the ecological situation. They are represented by a complex stratum of all horizons of the Pleistocene and Holocene, characterized by great variegation of the structure of the section, lithological composition and hydrogeological conditions. The most significant value in the section is the deposits of the middle and upper link, occurring from the surface, as well as Holocene (modern) sediments.

The map of the quaternary deposits of the region of the proposed activity is shown in Figure 7.



- bIV* - Swamp sediments of the Holocene
- gIIIsz* - Moraine deposits of Middle Pleistocene
- laIIIpz* – Lacustrine-alluvial deposits of the Upper Pleistocene
- fIIIsz*^s - Fluvioglacial supernumerary deposits (Sozh subhorizon) of the Middle Pleistocene
- Terminal moraine formations
- Kame terraces and elevations

Figure 7.

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bIV - Swamp sediments of the Holocene

gIIIsz - Moraine deposits of Middle Pleistocene

laIIIpz – Lacustrine-alluvial deposits of the Upper Pleistocene

fIIIsz - Fluvioglacial supernumerary deposits (Sozh subhorizon) of the Middle Pleistocene

Terminal moraine formations

Kame terraces and elevations

Figure 7.

The moraine deposits of the Middle Pleistocene, composed of moraine sandstones and loam (the Sozh glaciation), are widespread in the area of the proposed economic activity. In local depressions and closed basins, the Holocene bog sediments are localized, and alluvial deposits associated with permanent water flows also have a slight spread.

By nature and degree of moistening, the area of reconstruction of the P-80 road refers to the first type of terrain (dry places). Quaternary soils are represented by loess-like sandy loam and loam, morainic sands of various granulometric composition, and also moraine sandy loams.

Complicating factors in the development of the project for the reconstruction of the section of the P-80 road are:

- presence in the upper part of the section of a series of loose soils having a heterogeneous composition and different degree of compaction;
- the ability of clay morainic soils to thixotropic softening under dynamic action (transition to fluid and fluid state, deterioration of physical and mechanical properties during soaking, freezing, damage by mechanisms);
- occurrence of loess-like deposits in the upper part of the section, having the ability to significantly (in 1,5-2 and more times) deteriorate the physicommechanical properties during soaking, freezing, damage by mechanisms and thixotropic softening under vibrations and other dynamic influences;
- abundance in the freezing of loess-like sandy loam and sandy loamy moraine, as well as silty sand;
- the possibility of meeting sporadically watered sands in sandy loamy rocks from the first centimeters to 20-30 cm;
- the possibility of appearance in water periods of the "perched water" in the near-surface zone in silty-clay soils.

Loam and loess-like sandy clay – excessively swollen (V group - relative frost heaving > 10%), gravel sand, medium and small, slightly swollen (group II - relative frost heaving of 1-4%), moraine sandy loamy (III group - relative frost heaving of 4-7%), silty sulphate sands (group IV - relative frost heaving of 7-10%).

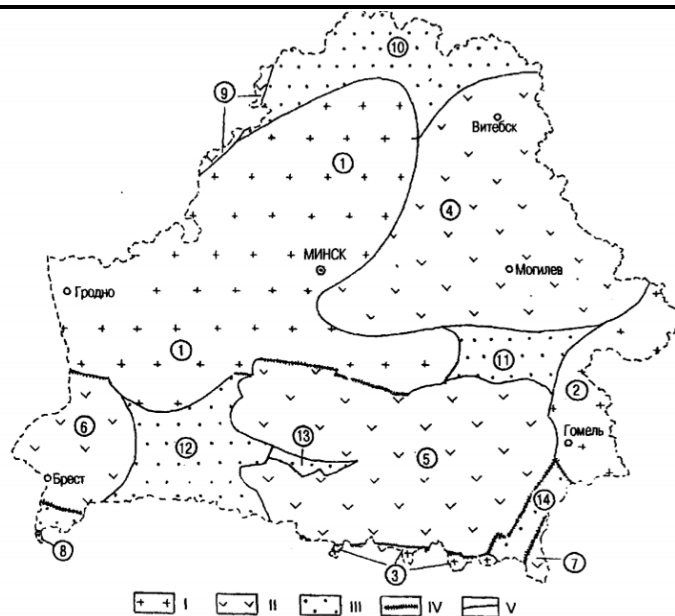
Hydrogeological conditions

The combination of geological and hydrogeological features of the country is based on the hydrogeological zoning of the territory of Belarus. The basic units of regionalization are: hydrogeological basin, hydrogeological massif, hydrogeological region.

More than 60 aquifers and complexes are distinguished on the territory of Belarus in the thickness of sedimentary rocks and in the fissured zone of the crystalline basement, differing in stratigraphic volumes, lithological content, spatial structure, water saturation and water permeability, and the chemical composition of groundwater.

The studied territory of the planned location of the facility belongs to the Belarusian hydrogeological massif, which is located in the central and northwestern parts of Belarus (Figure 8). It is a large reservoir of fresh and mineralized groundwater, contained in rocks of the crystalline basement and in deposits of the sedimentary cover. The thickness of the water bearing rocks of the platform cover varies from 80 to 500 meters, and sometimes up to 1,000 meters [5].

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Scheme of hydrogeological zoning of the Territory of Belarus

Hydrogeological structures: I-massifs; 1-Belarusian, 2-Voronezhsky, 3-Ukrainian; II-basins: 4-Orshansky, 5-Prityatsky, 6-Brestsky, 7-Dnieper-Donetsky, 8-Volynsky, 9-Baltic; III-districts: 10-Latvian, 11-Zhlobinsky, 12-Polesky, 13-Mikashkevichi-Zhitkovichsky, 14-Bragin-Loevsky.

Structure borders: IV-marked on super-regional and regional faults; V-marked along the boundaries of tectonic structures

Figure 8.

In the hydrogeological section of the massif there are up to 20 or more aquifers and aquifers, stratigraphically confined to sediments of the Quaternary strata, chalk, Jurassic, Devonian, Silurian, Ordovician, Cambrian and Upper Proterozoic. The lack of regionally consistent water supports in the section contributes to a good hydraulic relationship between the water-bearing horizons, which are fed by the infiltration of water from the upper horizons to the lower horizons. The river valleys are areas of groundwater discharge.

In the section of the Belarusian hydrogeological massif, 2 hydrodynamic zones are distinguished: active and delayed water exchange. The zone of active water exchange covers the upper part of the hydrogeological section to the clay and alleuvrolite deposits of the Narevo horizon of the Middle Devonian, the horizon of the "blue clays" of the Lower Cambrian, the Kotlin suite of the Upper Proterozoic, which separate hydrochemical regions of fresh and mineralized waters. The thickness of this zone varies from 100 m to 200-4500 m on the Minsk and Oshmyany Uplands. Its aquifers contain fresh hydro carbonate magnesium-calcium waters with mineralization and good organoleptic indices. In the central part of the massif in the rocks of the crystalline basement fresh groundwaters containing the biologically active radon component are found. They are used for medicinal purposes in the sanatoriums "Radon", "Sosnovy Bor" and serve as the main source of household and drinking water supply to large cities and rural settlements.

The zone of delayed water exchange includes the aquifers of the Ordovician, Silurian, Lower Cambrian, Upper Proterozoic and the fractured zone of rocks of the crystalline basement of the Archaean-Lower Proterozoic age. It contains mineral waters of predominantly chloride and sulfate-chloride sodium, less often calcium-sodium composition with mineralization; often contains elevated concentrations of biologically active components of bromine and fluorine. It is used in balneological practice of numerous sanatoria and health resorts and preventive institutions; the waters are used for medical purposes – for drinking and bottling.

The first from the surface aquifers and complexes are confined to quaternary deposits, the thickness of which reaches 180 m. The number of aquifers is determined by the number of uneven-aged moraines dividing the watered stratum into a number of independent aquifer complexes which are hydraulically connected.

Regional distribution on the territory of the region has inter-moraine Dniepr-Sozh and Lower Pleistocene Dniepr water-bearing complexes, the operation of groundwater is based mainly on the centralized water supply of large cities and towns. The main source of water supply for small

Original inv.No.	Signature and date	Repl. Inv. No	<p>Cambrian, Upper Proterozoic and the fractured zone of rocks of the crystalline basement of the Archaean-Lower Proterozoic age. It contains mineral waters of predominantly chloride and sulfate-chloride sodium, less often calcium-sodium composition with mineralization; often contains elevated concentrations of biologically active components of bromine and fluorine. It is used in balneological practice of numerous sanatoria and health resorts and preventive institutions; the waters are used for medical purposes – for drinking and bottling.</p> <p>The first from the surface aquifers and complexes are confined to quaternary deposits, the thickness of which reaches 180 m. The number of aquifers is determined by the number of uneven-aged moraines dividing the watered stratum into a number of independent aquifer complexes which are hydraulically connected.</p> <p>Regional distribution on the territory of the region has inter-moraine Dniepr-Sozh and Lower Pleistocene Dniepr water-bearing complexes, the operation of groundwater is based mainly on the centralized water supply of large cities and towns. The main source of water supply for small</p>

consumers, as well as rural settlements, are groundwaters of in-moraine and overmoist deposits of the Sozh horizon.

The least protected from industrial pollution is groundwater. It is widespread almost everywhere and is confined to various genetic types of Quaternary sediments: to marsh sediments, alluvial deposits of floodplains and terraces, fluvio-glacial overmoist deposits of the time of the ice glacier descent, and to lacustrine-alluvial sediments. It lies at a depth, mainly up to 5 m, less often up to 10 m. Almost everywhere the groundwater table is the Sozh moraine up to the boundary of the Sozh glaciation; to the south - the Dniepr moraine. Therefore, the thickness of the groundwater table is determined by the depth of occurrence of moraine deposits.

The main indicators that determine the natural protection of groundwater are the capacity of the aeration zone, its lithological composition and the filtration properties of its constituent rocks. An important condition for assessing the degree of protection is the presence in the aeration zone of weakly permeable interlayers of loam and clay that are capable of preventing the penetration of pollutants into groundwater.

The supply of groundwater is mainly due to infiltration of atmospheric precipitation during the autumn-winter period and in spring during the melting of snow and flooding of rivers. To a lesser extent - in the summer, during the periods of floods caused by heavy rains.

The first relative water bodies in the area under consideration include Sozh moraine deposits. They are represented mainly by sandy loam sediments, which are replaced in several sections by multimeter strata (up to 20 m) of sandy, sandy-gravel and gravel-pebble rocks, often watered. On large areas (river valleys, valleys of glacial erosion), they are generally absent [5].

During the field work in March-April 2017, the wells opened groundwater at a depth of 2.2-8.0 m from the surface. They are confined to the sands of the moraine deposits of the Sozh horizon. Also, the waters of sporadic distribution in sand interlayers in clayey rocks of moraine genesis are opened.

During periods of intense infiltration of atmospheric precipitation (intense snowmelt, heavy rains, etc.), an increase in the groundwater table by 0.5-0.7 m from the level recorded during the study period is possible.

3.1.4 Hydrological features of the study area

According to the hydrological zoning of the Republic of Belarus, the region of reconstruction of the P-80 road Sloboda-Papernya, 0.000 km - 14.770 km, refers to the III^d - Vilyeyka hydrological district, the basin of the Berezina river. Density of the river network of this region is 0.35 km / km² [1].

The reconstructed section of the road crosses the Domelka River and a non-functional canal, once the source of the Volma River. Also in the area of the P-80 road there are reclamation channels that flow into the natural watercourses nearest to the projected road (the Volma River, the Usyazha River, the Domelka River).

The Domelka is a river in the Minsk region, Smolevichi region, right tributary of the Usyazha river (Figure 9). The Domelka takes its source in the south-eastern outskirts of Baguta village, its length is 11 km, the catchment area is 51 km², the average slope of the water surface is 2.1 ‰, it flows along the Minsk Upland. The mouth is 1 km to the north of Isbitskoe village. The canal was channeled in 1972 over 5.9 km from Zadoml village to the mouth. Between the villages of Bagut and Zadoml there are 2 ponds [6].

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Figure 9.

The Volma is a river in the Minsk region of Belarus, the left tributary of the river Svisloch (Dnipro basin). The length is 103 km, the catchment area is 1150 km². The average annual water discharge in the mouth is 6.7 m³ / s. The total fall of the river is 54.1 m, the average slope of the water surface is 0.5 ‰.

Earlier the river originated from the melioration channel near the northeastern outskirts of the settlement of Korolyov Stan of the Minsk region (5 km south-west of the P-80 road); at present the source of the river is south of the settlement of Dubrovka, 10 km south of the reconstructed road.

The Volma flows along the Minsk Upland and the Central Berezinsky Plain through the Smolevichi, Cherven and Pukhovichi districts. The mouth is 1 km to the east of the village of Svetly Bor, Pukhovichsky district.

The terrain is mostly flat, in the upper part small-hulled, composed of sandy and sandy loam soils, which are plowed up (35%). The forest (41%) is mixed. The valley is trapezoidal, 0.4-0.6 km wide, in some places (near the village of Petrovinka) up to 3 km. The slopes are gentle and moderately steep. The floodplain is drained and plowed for a long time. The river is regulated by 4 dams, incl. Dam of the Petrovichsky reservoir. The riverbed in the middle reach is straightened and deepened, the width of the river in the upper is 3-4 m, in the lower - 8-10 m, in the mouth part up to 40 m. The shores are steep and bluff, with a height of 0.4 to 2 m. It feeds ponds of the fish processing plant "Volma" in the village Ozerny of the Chervensky district (such fish species as carp, crucian carp, pike are grown there), some of the water is thrown into the Svisloch through the system. The river is used as a water intake of reclamation systems.

The Volma is characterized by an intense flood. 37% of the annual runoff is accounted for the spring period. The highest flood level in the lower reaches at the end of March, the average height above the low level is 1.4-2.2 m, the largest is 2.9 m. It freezes in early December, the melting starts at the end of March. Spring ice drift lasts for 3-4 days.

The main tributaries are: the Vozha, the Gat, the Chervenka (left), the Sloust (right). The density of the river network is 0.33 km / km².

On the river there are the town of Smilovichi, the Petrovichsky reservoir, the recreation zones of local importance - Mirror ponds and the Red Beach, the health-improving center "Volma" (Chervensky district). In the upper reaches of the catchment area there are biological reserves of Yukhnovsky and Volmyansky [6].

The Usyazha is a river in the Minsk and Smolevichi districts of the Minsk region, the right tributary of the Gaina River (Dnipro basin). The length is 45 km, the catchment area is 473 km². The average annual water discharge in the estuary is 3.2 m³/s, the average slope of the water surface is 1.1‰.

The river flows from the eastern extremity of the Ostroshitskoye reservoir in Ostroshitsky Gorodok settlement (until 1978 the source was considered to be the river Vesnyanka), the mouth for 3 km to the northeast from the village of Yuryevo of Smolevichy district. The general direction of the current is the northeast. The current of the river passes through the Smolevichi district, in the middle reach the Usyazha forms its border with the Logoisk District.

The main tributaries are: the Dubrovka, the Dyarazanka (left) and the Domelka (right). It flows in the upper reaches along the southeastern slopes of the Minsk Upland, in the lower reaches

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The valley in the upper reaches is trapezoidal (the width is 0,5-2 km), in the lower reaches - inexpressive. The floodplain in the upper and middle reaches is high, with meadows, and occasionally under arable land (width 0.2-1 km), in the lower reaches it is almost completely drained and peaty (width from 1.5 km to 5 km). The riverbed from the village of Prilepa of the Smolevichi district is channeled down 6.1 km downstream, the rest is moderately winding; the width is 4-7 m, in the lower reaches (the width is 10-25 m) it meanders. The banks are steep (the height is 1.5-2 m), sometimes precipitous (the height is 3-5 m). In the middle and lower reaches the river takes a runoff from reclamation channels.

The valley of the river is quite densely populated, especially in the upper reaches. The largest settlements and villages on the banks of the river are Prilepy, Kudrishchino, Anoshki, Pristromy, Usyazha, Rudnya, Trubichino, Khotenovo, Mgle, Prudishchi, Yuryevo [6].

The development of projects for water protection zones and coastal strips is regulated for surface water bodies (with the exception of streams, springs and canals), which are coordinated with the regional and interregional inspections of flora and fauna of the State Inspectorate for the Protection of Fauna and Flora under the President of the Republic of Belarus, the land management services of local executive and regulatory bodies, organizations of the Ministry of Forestry of the Republic of Belarus and the conclusion of state ecological examination.

In accordance with the Republican integrated scheme for the allocation of fishing grounds, approved by the Ministry of Agriculture and Food of the Republic of Belarus No. 29 dated 18 June 2014, there are no fishing grounds at the abovementioned rivers.

Also, the Domelka, the Volma and the Usyazha rivers are not used for recreational purposes, there are no recreational zones (adjoining the water body areas of the territory which is directly used for recreational purposes and issued in accordance with the procedure established by the legislation of the Republic of Belarus - according to Sanitary Rules and Regulations (SanPiN) "Hygienic Requirements for the Maintenance and Operation of Water Objects When Using Them for Recreational Purposes" (Decree of the Ministry of Health of the Republic of Belarus No. 238 dated 30 December 2008)).

The rivers Volma and Usyazha are located at a considerable distance from the reconstructed road: the source of the Volma is located 10 km to the south of the road, the source of the Usyazha river is 1.5 km away from the projected site. Works on the reconstruction of the section of the P-80 road, 0.000 km - 14.770 km, will not affect these watercourses.

There are no natural lakes on the investigated territory. The reservoirs existing near the reconstructed section of the P-80 road are of artificial origin, the nearest one is at a distance of about 70 m (on the left, near Okolitsa) from the existing road. The Dubrovskoye reservoir is located at a distance of about 560 m to the north of the road and the reconstruction of the road section will not affect it.

The territory of the existing LDD-54 RMS-5 in the settlement Ostroshitsky Gorodok is located at a distance of ~ 110 m from the Ostroshitskoye reservoir, in the water protection zone of this water body, and also in the sanitary protection zone of the Borovlyany water intake.

According to the state land cadaster of the Republic of Belarus, as of January 1, 2016, the total land area of the Republic of Belarus is 20,760.0 thousand hectares, including 8,581.9 thousand hectares of agricultural land, of which 5,677.4 thousand hectares are arable lands.

Agricultural development (the share of agricultural land) in the territory of Belarus is quite high: agricultural lands occupy 41.3% of the total area of the country (Figure 10).

Original inv.No.	Signature and date	Repl. Inv. No	reconstructed section of the 1-33 road are of artificial origin, the nearest one is at a distance of about 70 m (on the left, near Okolitsa) from the existing road. The Dubrovskoye reservoir is located at a distance of about 560 m to the north of the road and the reconstruction of the road section will not affect it.						
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			3.1.5 Land reserves and soil covering According to the state land cadaster of the Republic of Belarus, as of January 1, 2016, the total land area of the Republic of Belarus is 20,760.0 thousand hectares, including 8,581.9 thousand hectares of agricultural land, of which 5,677.4 thousand hectares are arable lands. Agricultural development (the share of agricultural land) in the territory of Belarus is quite high: agricultural lands occupy 41.3% of the total area of the country (Figure 10).						
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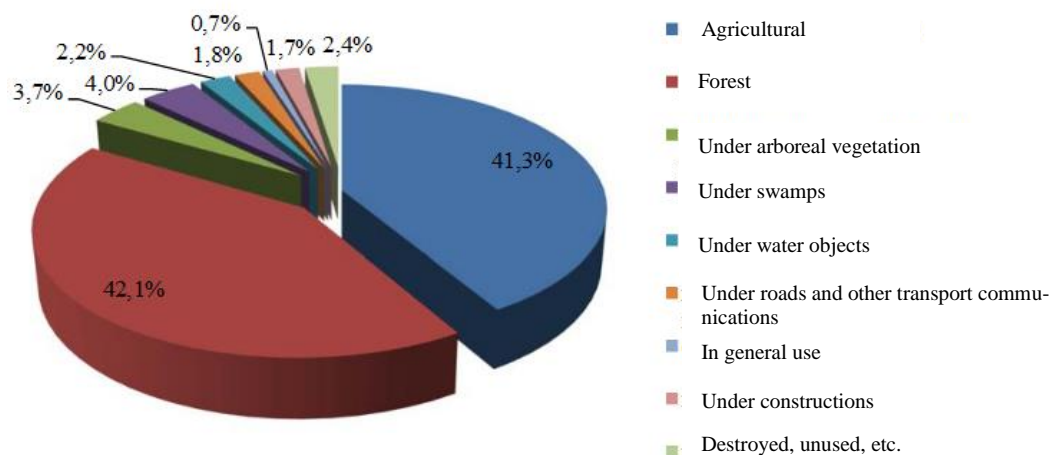


Figure 10.

The plowing (effective weight of arable land) of agricultural land is 66.2%, 1.3% is under permanent crops, 32.4% of the total agricultural land is occupied by meadow lands. Among meadow lands, 69.4% are reclaimed ones. Hard lands account for 7.7 thousand hectares or 0.1% of the country's territory. The distribution of agricultural land in the context of the regions of the republic is shown in Figure 11 [7].

The share of forest land and lands under arboreal and shrubby vegetation in the total land area is 45.8%, the share of land under marshes is 4.0%, under water objects is 2.2%, under roads and other transport communications and lands of common use and lands under construction - 4.2%. A significant part of the total area of the country (2.4%) is occupied by unused, disturbed and other lands.

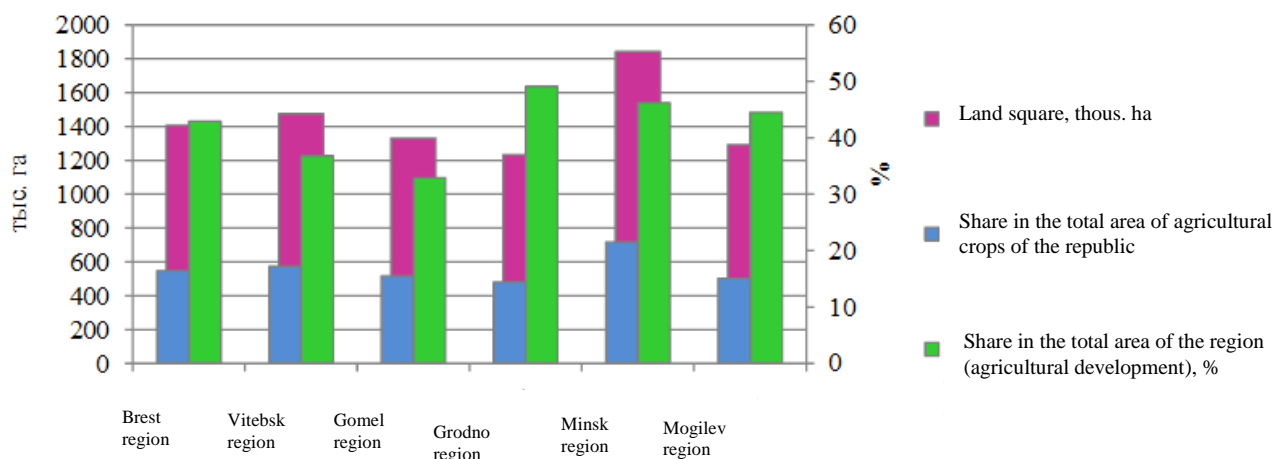


Figure 11.

The main land users in our country are agricultural organizations (8894.6 thousand hectares or 42.8% of the total land area) and forestry organizations (8554.7 thousand ha or 41.2%). Figure 12 shows the structure of the land fund of the Republic of Belarus (in %) by categories of land users in the context of oblasts. The agricultural development of the territory of the Minsk region is 44.8%, the Grodno region - 49.3%.

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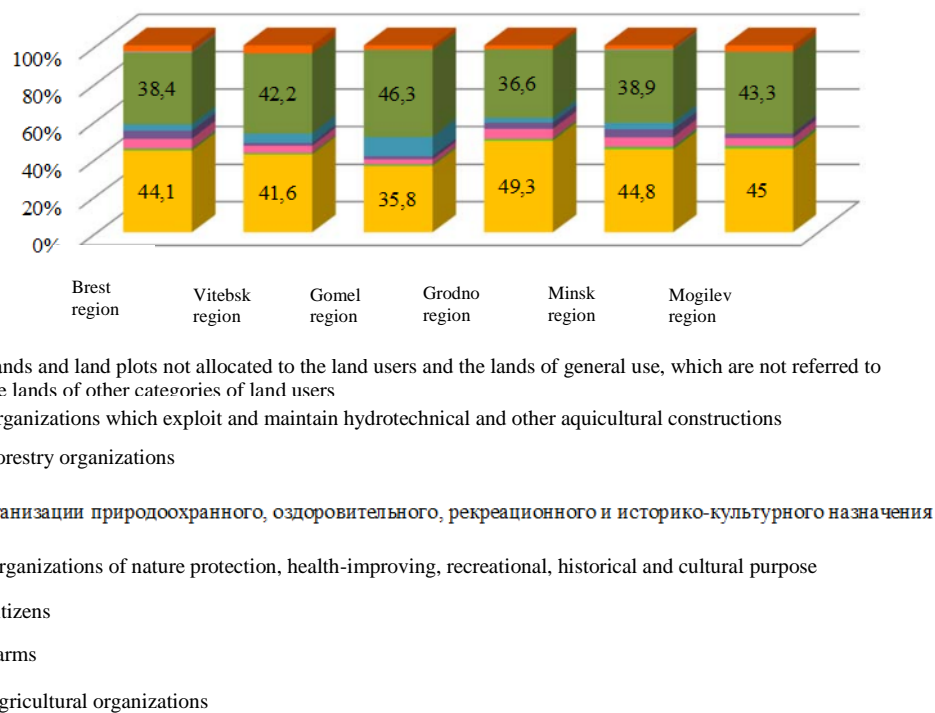


Figure 12.

Table 3 presents data on the availability and distribution of land (ha) in the Minsk region, incl. in the Minsk and Smolevichi districts [8], on the territory of which the reconstructed section 0,000 km - 14,770 km of the P-80 road passes.

Table 3.

Name of regions and districts	Total land square	Including									
		Arable	Used for permanent crops	Meadows, total	re-claimed lands	agricultural lands, total	Forest lands	Lands covered with arboreal and shrubby vegetation	Under marshes	Under water objects	Under transport communications
Minsk region	3985380	1311051	31223	499997	368081	1842271	1604893	94667	72722	90603	82430
Minsk district	190266	64425	5528	18669	11544	88622	55158	9267	1170	5013	5585
Smolevichi district	139258	56319	595	12907	9654	69821	47170	2889	1010	2523	3631

As can be seen from the data presented in the table, the areas of the Minsk region as a whole have a similar land use structure, with a relatively low level of forest cover (Minsk district - 55158 ha (29.0%) and Smolevichi district - 47170 ha (33.9%), which is lower than the average republican level); and high agricultural development (about 50% of the territory).

In the Minsk region, the area of drained land is 707.9 thousand hectares, irrigated lands - 1.9 thousand hectares. In the Minsk region, the area of irrigated land is 775 hectares (including arable land - 686, meadows - 89), and the area of drained land is 12,998 ha (including arable lands - 5501 ha, meadows - 6755 ha). In Smolevichi region there are no irrigated lands, and the area of drained lands is 22391 ha (including arable lands - 9144 ha, meadows - 6654 ha) [8].

The cadastral assessment of land and soil fertility in the country, in the Minsk region, including Minsk and Smolevichi regions, is presented in Table 4 [1].

Table 4.

Territories	Mark of the cadastral land assessment	Mark of the soil fertility
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Republic of Belarus	<u>31,2*</u> 28,9**	<u>31,2</u> 28,9
Minsk region	<u>33,2</u> 30,7	<u>32,8</u> 30,4
Minsk district	<u>36,0</u> 34,5	<u>35,3</u> 33,8
Smolevichi district	<u>32,8</u> 31,3	<u>32,2</u> 30,7

* arable lands

** agricultural lands

In the area of the planned economic activity for the reconstruction of the section of the P-80 highway passing through the territory of Smolevichi and Minsk districts of the Minsk region, the lands of the following land users are located:

- RUE "Minskavtodor-Center"
- Municipal Unitary Enterprise "Minskobldorstroy"
- PUE "Ozeritsky Agro"
- RUE "Minskenergo"
- State Institution "State Memorial Complex "Khatyn"
- Department of ideological work, culture and youth affairs of Smolevichy regional executive committee
- PF Bakumenko Yu. V.
- State Forest Management Service "Smolevichi Forestry"
- RUE Beltelecom
- General Directorate of the Commander of the Internal Troops of the Ministry of Internal Affairs of the Republic of Belarus
- State specialized forestry establishment "Borovlyansky Spetsleskhoz"
- Manufacturing communal subsidiary unitary enterprise "Minsk Forest Park Economy"
- OJSC "1st Minsk Poultry Factory"
- Institution "Specialized School for Children and Youth of the Olympic Reserve of Trade Unions for Winter Sports of the Minsk City"
- Establishment of the Republican Center for Olympic Training in Winter Sports "Raubichi"
- OJSC "Gazprom Transgaz Belarus"

In accordance with the soil-geographical regionalization of Belarus, the territory of the planned reconstruction of the P-80 road Sloboda-Papernya on the 0.000 km - 14.770 km section belongs to the Central (Belarusian) soil province, Central Soil-Climatic Area and Oshmyansko-Minsk agro-soil district [1, 9].

Soil-forming rocks are of the Central District moraine and water-glacial loam and sandy loam, in some places there are redeposited ancient alluvial sands and peat deposits of various types of soil.

The dismemberment of the territory in this region, both in density and depth of depressions, is the maximal one in the republic. On the Minsk Upland, for example, the distance between the depressions does not exceed 0.5 km, with a depth of 75 m in some places.

Oshmyany-Minsk area of sod-podzolic soils developed on morainic loam covers Oshmyansky and Minsk hills and is located within the three districts of the Grodno region and seven districts of the Minsk region. Here is the highest point of Belarus - Dzerzhinskaya mountain. Relative heights here are also significant and reach 150 m. The Minsk Upland is divided into three tiers according to the features of the terrain. The uppermost of them is represented by sections of large-hulled terrain with considerable depth and density of dismemberment. Relative hills, overgrown with wood, are in the form of hills. Such features of the surface are specific for Logoyskoye, Radoshkovichi and Pleschenitsky elevations.

The second tier occupies the middle-hilly areas. Their apical surface is gently-rolling, flat-rolling and even flat with the presence of suffusion forms which are the characteristic of the loess-like deposits. The slopes of this tier are dissected by gullies and ravines (Volozhinsky, Dzerzhinsk sites).

The third tier consists of flat surfaces of water-glacial lowlands, intersected by river valleys and complicated by bottom-bumpy terrain forms.

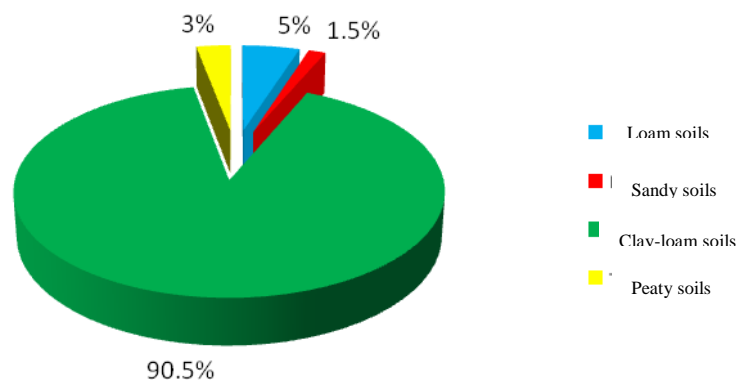
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The Oshmyany Upland consists of high ridges, where features of a young glacial relief (rocks, hills), high flat watersheds are still preserved.

The soil cover of the area is very complex and depends on the absolute altitude of the terrain. So, on the elevated (in the upper parts) upland the sod-podzolic, strongly- and medium-podzolic, strongly eroded soils are widespread, which are developed on lightly lagged moraine loams and cartilaginous gravel sandy loams underlain by moraine loams.

The lower sections (the second tier) are predominantly occupied by sod-podzolic strongly- and medium-podzolic soils, sometimes medium and strongly eroded, which are developed on light loess-like loams underlain by morainic loams, sometimes by sands. These soils are the most fertile in the area. In the areas of water-glacial lowlands, sod-podzolic medium-podzolic slightly eroded soils are formed on water-glacial light weakly-buffered loam, in places of sandy loam.

According to the mechanical composition, the soils of the region are divided into loamy, sandy loamy, sandy and peaty (Figure 13).



Drawing 13.

In inter-morainal depressions and on leveled, albeit elevated areas, due to poor permeability of soil-forming rocks of loamy composition, both atmospheric and soil-groundwater stagnates, which leads to the development of bogging processes. So, in the Minsk region, hydromorphic soils occupy 28.5%, and agricultural development of the territory is about 60%, but only 47% of soils are plowed. Moreover, arable soils here are mainly acidic (82.8%), are poor in mobile forms of phosphorus (9.0 mg) and potassium (10.8 mg), and are poorly supplied with these elements.

Land degradation is one of the most pressing environmental problems in Belarus. Of all the types of land degradation characteristic of Belarus, water and wind erosion on agricultural lands is the most acute, which is due to a significant plowing and economic development of farmland [1,9].

The erosion and deflation of the soils of the region under study varies from weak to strong. During field investigations, no sites with a high risk of land degradation and dangerously eroded areas were identified.

3.1.6 Landscape characteristics

According to the landscape zoning of the Republic of Belarus, the reconstructed P-80 road is located within the subzone of boreal landscapes, the Belarusian highland of hilly-moraine-erosion and secondary moraine landscapes with broad-leaved spruce and pine forests on sod-podzolic soils [10].

The route of the road runs within one landscape area: the Minsk middle- and large-hilly-ridge hilly-moraine-erosive with spruce-broad-leaved and pine forests (25) (Figure 14).

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Figure 14.

The route of the road crosses the following landscapes in the rank of the genus: hilly-morainic-erosive, kame-moraine-erosive and landscape of undivided complexes of river valleys (Figure 15).

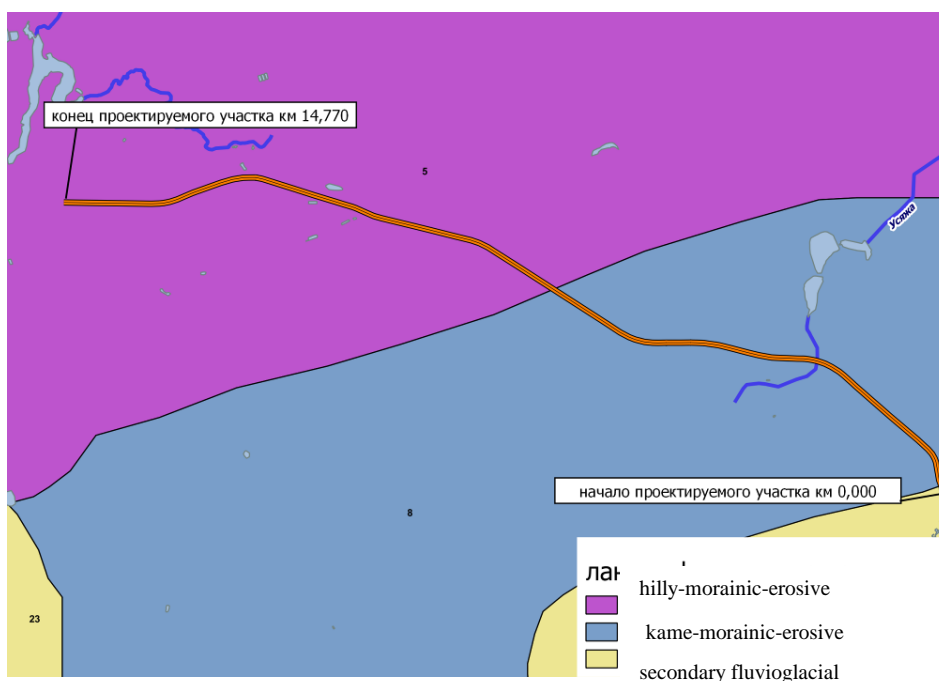


Figure 15.

Hilly-morainic-erosive drained landscapes with broadleaf-spruce forests on sod-podzolic, less sod-paleo-podzolic soils are widespread within the final moraines of the zone of the Sozh and Dniepr glaciations and are represented by almost 50% of the area of the described group. The absolute marks are 200-250 m, more rarely - 320 m, and on the Minsk upland - up to 346 m.

The relief is predominantly shallow and middle-hilly (fluctuations of relative heights are 10-20 m), less often large-hulled (> 20 m) and plateau-like. Its peculiarity is a considerable transformation by erosion processes, as a result of which a rugged terrain type is often formed. Denudation processes also appear in landscapes, leading to a smoothing of the terrain and the transfer of the products of the destruction of the constituent rocks. As a result, the hills have a rounded shape, smooth outlines, the steep of their slopes reaches 5-10 °, rarely - 15-20 °. Typical forms of the terrain are hills and ridges or, drain gullies, valleys of small rivers and streams, less often ravines and gullies.

The territory is composed of boulder moraine material - loamy, sandy loam and sandy one. Quaternary deposits have, as a rule, a two-membered addition - moraine material is blocked by water-

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glacial sandy loam with a thickness of 0.5-0.7 m or loess-like loam (0.5-2 m). On such soil-forming rocks, fertile sod-podzolic and sod-pale-podzolic sandy-loam soils were formed, which caused a high degree of agricultural development of landscapes. The share of agricultural land reaches 67%. As a result, there is a widespread development of planar, less often deep erosion. Manifestations of the latter in the form of a gully-gullies network are more often confined to areas where loess-like loams predominate in the cover deposits.

The natural vegetative cover is represented by small areas of broadleaf-spruce, pine, less often oak and spruce forests. The wooded landscapes are not large (22%). Exhausted meadows are developed along the valleys of the drain, the bottom of the gullies, the valleys of the streams [10].

Kame-morainic-erosive drained landscapes with pine forests on sod-podzolic soils are represented by small areas in the marginal parts of the Minsk, Oshmyany Uplands and occupy 8.3% of the group area. Within the landscapes, in approximately equal proportions, there are kame and moraine hills. The territory is composed of morainic and water-glacial material, mostly covered with sandy loam. Kame deposits often have a moraine cover. Absolute marks are 200-260 m, fluctuations in relative heights - 10-20 m. Characteristic forms of the terrain are wide, well-developed droughts of the drain with flat bottoms.

The area is dominated by sod-podzolic sandy, less frequently sandy-loam soils, selectively plowed up. The share of agricultural land is the lowest (40%), and the proportion of forests (45%) is the highest in the group described. Forests are pine or birch ones. Soddy swampy soils with out-flood meadows were formed along the troughs of the drain.

The above genera of landscapes are represented by a number of landscape tracts, which are separated by mesoforms of the terrain and closely related features and character of soil and vegetation cover. An important role in the formation of tracts is also played by their altitude position.

The highest hypsometric level in the landscape adjacent to the site is occupied by the tracts of separate kame and moraine hills. They rise above the general broadwave surface by 5-7 m, are more often scattered throughout the territory and are composed of different lithologically different rocks: kame hills - of sorted water-ice sands, morainic hills – mostly of boulder sandy loam, less often of gravelly-arenose material.

On the surface morainic rocks can often be blocked by a thin cover of water-ice deposits. The soddy-podzolic sandy and sandy loam soils developed on these rocks are characterized by a combination of favorable properties (good aeration, high heat capacity) on the one hand, and unsatisfactory (unstable water regime, limited supply of various nutrients) on the other. They are occupied by pine trees, re less often – by mossy spruces.

The tracts of the broad-wavy water-ice terrain form the general landscape background of the reserve area. Long sloping and very gentle slopes constructing its relief are composed of moraine loam and sandy loam. On top they are usually covered by a shield of different thicknesses of water-ice deposits (loams, sandy loams, less often sands) and to a lesser extent - loess-like loams. The various parts of the slopes and, in particular, the different nature of the structure of the soil-bearing and underlying rocks, their different genesis and granulometric composition, determined the development of a wide range of sod-podzolic and, to a lesser extent, of sod-podzolic wetlands and sod-pale-podzolic soils. The range of different indicators of their water-physical, chemical properties, level of productivity can be very significant. As a result, conditions are created for the growth of various types of forests - pine forests and spruce forests, less often birch and aspen.

The tract of the wide-wavy water-ice terrain with its specific long, gentle and very gentle slopes is replaced in the near-valley areas by the terrain of sloping (5-7 °) and steep (more than 7 °) slopes. Folded by morainic rocks, they, however, have a very thin layer of water-ice deposits due to denudation process. When developing them for arable land, erosion develops, as evidenced by small areas of low-washed soils that are fixed in this tract. The most common soils here are zonal sod-podzolic sandy loamy soils developing under the canopy of mossy and eagle pine forests of and less often birch forests, which derived from them. In the composition of their stand and undergrowth, spruce often appears. There are islands of dry cereal meadows.

The tracts of shallow troughs and ravines form a distinct and widely ramified tree network that divides the territory into a multitude of smoothed minor, usually mutually reinforcing ravings. The troughs and dells that separate them are shallow and filled with water-ice rocks, denudation and

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erosion products. Fir groves prevail here, however, there are pine, oak, less often maple and linden. In some places lowland, rarely dry meadows appear.

The tracts of deep valleys with low meadows have a limited distribution on the territory under consideration. The valleys which are deeply embedded in the thickness of water-ice and moraine deposits cause unloading of groundwater enriched with many nutritious elements. As a result, conditions are created for intensive bogging and formation of peat-bog soils of low-lying type with a peat thickness of 0.2-1.0 m. They are occupied mainly by lowland meadows.

An inalienable and very prominent feature of the landscape adjoining to the object are the tracts of closed hollows with *Ledum* pine forests and cotton grass-sphagnum. The basins have different sizes (from 100 to 1500 m in diameter), often deeply embedded (up to 3-5 m). They receive poor mineral nutrition at the expense of atmospheric and infiltrating waters, which results in the formation of upland, less often transitional peatbog soils of different thickness.

Thus, the number of the allocated landscape tracts is quite low. However, they are characterized by a large degree of differences between themselves, contrast and frequent changes in each other in space, which creates a mosaic pattern, a fairly colorful picture of the landscape structure of the territory [10].

3.1.7 Flora and fauna

As part of the implementation of the EIA of the proposed economic activity, experts of the State Enterprise "Belgidprodor" conducted a full-scale survey of flora and fauna in the area of the P-80 road Sloboda-Papernya, 0.000 km - 14.770 km.

Flora

In the immediate vicinity of the projected facility the republican landscape reserve "Prilepsky" is located.

The border of the reserve passes along the right-of-way of the P-80 road on the south side in the following sections: km 12.1 - km 13.4, km 11.6 - km 11.9, km 7.9 to the administrative border of Minsk region (km 4, 4).

The republican landscape reserve "Prilepsky" was established by the Decree of the Council of Ministers of the Republic of Belarus No. 1451 "On the Formation of the Prilepsky Republican Landscape Reserve" (Annex 1) dated 20 September 2000 in order to preserve the unique landscape complex characterized by the spread of natural softwood forests as well as rare and endangered species of plants and animals listed in the Red Book of the Republic of Belarus.

In accordance with the Regulations on the republican landscape reserve "Prilepsky" (as amended by the resolutions of Council of Ministers No 1697 dated 12 November 2008, No 611 dated 30 June 2012, No 884 dated 21 October 2015, No 793 dated 30 September 2016) the following is prohibited on the territory of the republican landscape reserve "Prilepsky" (except in cases when this is stipulated by the management plan of this reserve):

- carrying out works related to the change in the natural landscape and the existing hydrological regime;
- setting of tourist camps, lighting of fires, parking in places not intended for this purpose; movement of mechanized transport outside roads, except for machines that carry out agricultural and forestry operations, as well as the state nature protection institution that manages the reserve (a group of reserves) in the event of its creation;
- burning dry vegetation (grassland fire); burning of logging residues of harvested wood during logging operations and other works to remove woody and shrubby vegetation; grazing;
- erection of construction projects, except construction of engineering and transport communications, construction of parking structures for motor vehicles, buildings and structures for the purpose of forest management, hunter's and (or) fishermen's houses, eco-information centers, tourist camps, ecological trails and (or) landscaping and recreation areas; Destruction, removal and (or) damage to tree and shrub vegetation, living ground cover and forest litter, removal (destruction) of the fertile soil layer, except for cases when it is related to agricultural and forestry activities, as well as other activities not prohibited by this Regulation .

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The management of the republican landscape reserve "Prilepsky" is carried out by the Minsk regional executive committee.

The landscape reserve "Prilepsky" was created in accordance with the scheme of rational distribution of the specially protected natural areas of the Republic of Belarus in the Minsk district of the Minsk region, mainly on the lands of the Minsk forestry department (now Ostroshitsky Gorodok forestry of the State Forestry Management Service "Borovyansky Spetsleskhoz"). The area of the reserve is 3242 ha, of which 100% are forests. The purpose of the reserve is to preserve a unique natural complex, which has a great ecological, scientific, educational and recreational importance.

The route of the reconstructed P-80 road Sloboda-Papernya, 0,000 km - 14,770 km passes both in the open area, which is currently occupied mainly by agricultural lands, and along the territory of the following forest management services: State Forestry Management Service "Smolevichi Leskhoz", State Forestry Management Service "Borovyansky Spetsleskhoz".

Vegetation area of the reconstruction area of the P-80 road refers to the Minsk-Borisov region of the Oshmyany-Minsk geobotanical district of the subzone of oak and dark coniferous forests [1,11,12].

According to the data from State Property Committee of the Republic of Belarus, the Minsk and Smolevichi districts of the Minsk region have a low level of the forest area on the territory (Figure 16).



Figure 16.

As it comes from the data presented in Table 4, the area of forest land in the Minsk region is 55158 hectares (29.0%), in the Smolevichi region - 47170 hectares (33.9%).

The territory under consideration is dominated by forests of natural origin, occupying about 82% of the total area, while forest-cultivated plantations represent only 14% of the territory, which is lower than the national average. In the pedigree structure of forests dominate indigenous woods of coniferous species, whereas birch groves and, more rarely, aspen represent only on 9% of the territory.

The forests in Minsk and Borisov area, located in the southeastern part of the Minsk Upland, to near which the P-80 road is running, do not form significant forest masses. There are fairly uniformly scattered small areas of forest (with the areas of 200-500 hectares), but in some places there are larger areas, reaching 1500-2000 hectares. Often, they are represented by only one formation or one type of

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forest - the remnants of a forest phytocenoses complex. The vegetative world of the investigated territory is represented by forest, coastal-aquatic, marsh, segmental, ruderal and residential vegetation.

Forest vegetation. There are no large forests except for the forest massif of the landscape reserve "Prilepsky" in the study area.

The species composition of forests on the territory of the "Prilepsky" reserve is quite representative and diverse. Here one can find not only all the main forest species, typical for the Oshmyany-Minsk forest area, but also a number of exotic species - such as larch, Labrador pine. In the composition of forests, along with the above-mentioned exotic species of artificial origin, there are species which are common to leaf forests: ash, maple, linden. In a small admixture, the oak is also occasionally present in the wood structure. One of the essential features of the composition of forests is the complete absence of sites with a dominant alder on its territory. However, in the spruce forests, a small part of alder is sometimes observed, and in the composition of pine stands - gray alder (the southern boundary of the spread in its natural form). At the same time, it should be noted that the share of major foresters is significantly different from the forest and geobotanical areas. And if pine forest formations predominate in the geobotanical region (46%) and spruce forests are much less common (15%), then in the reserve area pine forests and spruce forests are almost equal in proportion to 91% of the forest area, i.e. the presence of spruce in the forest is much wider. This feature of the forest composition of the reserve is due to the wide spread of soils with morainic bedding and a rather high specific gravity of fractions of large dust in the upper horizons of soils.

The age structure of the reserve forest is also quite diverse, since here there are stands of 1 to 7 age classes. However, middle-aged forests of age class 3 predominate; less often - 4th class of age. The average age of the pine stands is 56 years, spruce - 70 years, birches - 42 years, i.e. according to the age structure the forests are represented by stands that are most fully produced, as a rule, that are stable and have passed the period of formation. If to take into account the productivity, here we can basically find high-productive woods (I-Ia classes). However, there are areas of the II-III and even occasionally IV class.

On the territory of the "Prilepsky" nature reserve three soil-forest-typological complexes are distinguished:

1. Mossy-brake pine forests in combination with areas of spruce forests, rarely brake birches on sod-podzolic automorphic soils, sometimes with a moraine underlay deeper than 1 meter.
2. Sorrel-brake spruce forests in combination with areas of pine forests and birch forests, on sandy and loamy, sometimes silty sod-podzolic soils with a moraine bedding up to 1 meter, sometimes gleied.
3. Sorrel spruce and birch forests with areas of aspen stands on sandy loam, less often on sandy sod-podzolic soils with moraine underlayment up to 1 meter, temporarily excessively moisturized or gleied.

Along the reconstructed section of the P-80 road Sloboda-Papernya, 0.000 km - 14.770 km, spruce forests occupying the largest areas of various sizes have become the most widespread. Spruce shrubby-green forests occupy relatively podzolic and sod-podzolic sandy loam soils and light loamy fresh soils, and are represented by mossy spruce forests. Mossy spruce stands are mainly monodominant and are formed by common spruce (*Picea abies*), occasionally involving birch (*Betula pendula*) and common pine (*Pinus sylvestris*). The pterygium tier is developed very poorly, in many areas it is absent. In the undergrowth there are alder buckthorn (*Frangula alnus*), mountain ash (*Sorbus aucuparia*), European euonymus (*Euonymos europaeus*), rarely common hazel (*Corylus avellana*).

Species composition of the ground cover is relatively poor; in depressions blueberry (*Vaccinium myrtillus*), cowberry (*Vaccinium vitis-idaea*), scattered groups of shamrock (*Oxalis acetosella*), maianthemum bifoliate (*Maianthemum bifolium*) are noted, in a well-developed moss layer of the depressions *Pleurozium schreberi*, *Dicranum scoparium*, *D. undulatum*, *Hylocomium proliferum* and

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others can be found (Figure 17).



Figure 17.

Typological group of south taiga moss-bilberry spruce forests combined with shrub-polytric forests in the study area is represented by spruce blueberry species, which have limited distribution and are confined to low-relief element even with wet podzolic and sod-podzolic sandy and loamy gleied soils. Apart from spruce, birch, pine, aspen (*Populus tremula*) are present in stands, especially at the edges near the forest road. The undergrowth is quite rare, there is a mountain ash, buckthorn, honeysuckle (*Lonicera xylosteum*), euonymus, hazel. The main edificator and dominant of the upper tier of the living ground cover is blueberry. Also, there are cranberries, spiked wood rush (*Luzula pilosa*), common sorrel, chickweed timber (*Stellaria nemorum*), may lily, adder-spit (*Pteridium aquilinum*), lungwort (*Pulmonaria obscura*). The moss tier is developed (Figure 18).



Figure 18.

The typological group of broad-leaved spruce, broadleaf pines and spruces and sorrel spruce, combined with fern and nettle-goutweed forests, is the most floristically rich and structurally complex in the spruce forests of the studied territory. This group includes sorrel spruces (most common), as well as goutweed, fern and adder-spit (Figure 19).

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Figure 19.

Sorrel and goutweed spruces are formed on highly fertile sod-podzolic loamy soils, where optimal conditions for the growth and development of broad-leaved species are created, which are abundantly encountered in the undergrowth. In the depressions among the spruce and goutweed spruce forests, where the soils are characterized by high humidity and acidity, phytocenoses of the fern spruce forest are formed. On slightly elevated plateau elements, slopes of ridges and hills, spruce forests are found.

As part of the stand, there is an admixture of pine, aspen, birch rivet, English oak (*Quercus robur*), Norway maple (*Acer platanoides*), big-leaf linden (*Tilia cordata*).

The undergrowth is well developed and formed by many plant and wood species (honeysuckle, copepod, hazel, buckthorn, mountain ash). In living soil the constant dominant is sorrel, boreal ferns act as co-dominant species: bracken, athyrium female (*Athyrium filix-femina*), dryopteris male (*Dryopteris filix-mas*), prickly-toothed fern (*Dryopteris carthusiana*), as well as numerous types of nemoral grasses: goutweed (*Aegopodium podagraria*), great nettle (*Urtica dioica*), weaselsnout (*Galeobdolon luteum*), European hazelwort (*Asparum europaeum*), hepatic (*Hepatica nobilis*), rockweed (*Asperula odorata*), bugle-weed (*Ajuga reptans*) and others. The mossy layer is composed of green mosses: *Hyloco Mium splendens*, *Rhytidiadelphus triquetrus*, *Mnium cuspidatum*, *Dicranum undulatum*, *D. scoparium*, *Climacium dendroides*.

Pine forests along the existing P-80 road have limited distribution and occupy small areas.

The typological group of pine shrub-green forest is represented by pine mossy forests (Figure 20). In the composition of these phytocenoses, spruce is a constant co-edificator, in poorer soils – this position is taken by drooping birch.

Original inv.No.	<div></div>					Repl. Inv. No.	<div></div>	<p><i>Pine forests</i> along the existing P-80 road have limited distribution and occupy small areas.</p> <p>The typological group of pine shrub-green forest is represented by pine mossy forests (Figure 20). In the composition of these phytocoenoses, spruce is a constant co-edificator, in poorer soils – this position is taken by drooping birch.</p>		
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Figure 20.

The undergrowth is rare, rowan and buckthorn can be found here. In the living ground cover green mosses predominate (*Pleurozium schreberi*, *Dicranum sp.*, *Hylocomium proliferum*); bushes are growing in groups: blueberry, cranberries, herbaceous plants: forest cow-wheat (*Marampyrum sylvaticum*), umbellate wintergreen (*Chimaphila umbellata*), European pyrole (*Pyrola rotundifolia*).

Most commonly broad-leaved pine forests can be observed in the study area - blueberry, sorrel and brake forests, belonging to the typological group of broadleaf pine and brake-mossy-sorrel forests developing on fresh, well drained, comparatively fertile soddy-podzolic sandy loams and loamy soils (Figure 21).



Figure 21.

Among broad-leaved species, oak, linden, and maple take part in the formation of phytocenoses. Also in the stands there is a significant admixture of birch and spruce. Plantings have complex composition, often two or three tiers, sometimes a single tier, but with a powerful undergrowth formed by alder buckthorn, mountain ash, European spindle tree, dyer's broom (*Genista tinctoria*), Russian broom (*Chamaecytisus ruthenicus*).

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The soil cover of these communities are the elements of different flora and cenotic groups: from boreal bushes (blueberries, cranberries) and herbs (shamrock, European starflower (*Trientalis europaea*), may lily), to types of immoral communities (dead-nettle (*Lamium galeobdolon*), millet grass (*Milium effusum*), etc.).

In the study area near the P-80 road subors with complex composition and layering were formed on the rich sandy and loamy soils. The soil cover here is also very diverse (Figure 22).



Figure 22.

The small-leaved forests of the study area are represented mainly by birch and black alder.

Alder gray (*Alnus incana*) does not form separate formations in the study area, but is found singly in admixture to small-leaved young forests, in mixed forests, along the slopes of hills and fringes.

Birch forests along the road are found in separate small areas, mainly on lands with excessive moisture (km 6.7 and km 13.0). Birches are represented both as drooping birch forests on sites of pine, spruce and broad-leaved spruce forests, and as native furry birch forests in the marshes.

Secondary drooping birch forests belong to the same type of vegetation: drooping-birch green mossy blueberry forests in combination with shrubby and mossy ones (blueberry- and mossy forests). The stands include spruce, less often pine, aspen, furry birch (*Betula pubescens*) (Figure 23).

The main components of the undergrowth tier, shrubby-grassy and moss cover are the same plants that are specific for indigenous phytocenoses. In the ground cover there is blueberry; green mosses are widely distributed (*Dicranum*, *Pleurozium schreberi* species), long-moss cover includes *Polytrichum commune*, sedge (*Carex*), horsetail (*Equisetum palustre*), in microdepressions - sphagnum (*Sphagnum palustre*).

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Figure 23.

Furry birch forests (Figure 24) are represented by a typological group – furry-birch sedges with willow family tier on fens. They are characterized by high water cut and low flow of groundwater.

The forest stands are pure or with an admixture of pine, spruce, aspen, birch, occasionally black alder (*Alnus glutinosa*). In the underbrush of willow (*Salix cinerea*, *S. aurita*, etc.), alder buckthorn can be found. Sedges such as *Carex viscaria*, *C. nigra*, *S. riparia*, *C. canescens* et al., ferns, common reed (*Phragmites australis*), fern (*Thelypteris palustris*), European lycopus (*Lycopus europaeus*), cowslip (*Caltha palustris*), quail sheather (*Lythrum salicaria*), and others are represented in the ground cover.



Figure 24.

Black-alder forests are found in local terrain depressions, where lowland swamping processes are developing, and near the P-80 road, where they are represented by a strip along the stream at km 2.9.

The forest stands includes sticky alder forest with dropwort, nettle and fern, found in the flood plain of the Domelka river, except for alder black; furry and drooping birch, aspen, spruce, and occasionally the ordinary ash (*Fraxinus excelsior*) are present. In the undergrowth, there is a buckthorn, various kinds of willow, rarely hazel, euonymus, raspberry (*Rubus idaeus*). In the ground cover, there are tamarin (*Filipendula ulmaria*), ferns (*Athirium filix-femina*, *Driopteris spinulosa*, *D. thelypteris*), nettle (*Urtica dioica*), common loosestrife (*Lysimachia vulgaris*), marsh bedstraw

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(*Galium palustre*), marsh merigold (*Caltha palustris*). In wetlands - sedges and marsh herbs.

In some areas of the study area, along the P-80 road, there are protective tree plantations, which, as a rule, perform the functions of protective plantations along highways and field shelterbelts (Figure 25).



Figure 25.

The species composition of plantations differs significantly on different sections of the road and is represented by the following trees: spruce, birch, pine, linden, aspen, which are planted either in pure single or double rows, or in mixed rows.

In most cases the trees in protective stripes are middle-aged, in relatively good condition and fulfill their functions. Some plantations require additional care in the form of removal of dead and drying trees, pruning and removal of branches of the 2-3d class in the crown. On the site of cut or lost trees, it is recommended to plant new ones. Selection of tree species is carried out depending on the conditions of growth in accordance with the "Assortment of Native and Introduced Trees and Shrubs, Recommended for Landscaping of Industrial and Urban Areas, Motorways in the Zones of Air Pollution with Gaseous Nitrogen Compounds, Formaldehyde, Benz(a)pyrene, Hydrogen Chloride" (2005). Planting of birch and linden is not recommended. Studies, carried out at the Institute of Experimental Botany of the National Academy of Sciences of Belarus, showed a low salt tolerance of these species, which are located along the Minsk ring road.

Landings should be kept away from the roadway at a certain distance (10 meters or more), since the salt tolerance of the recommended species is significantly inferior to the present halophytes. Closer to the road it is recommended to plant filter trees. Recommended schemes of planting and a list of woody and shrubby species are as follows: 1st row - low-growing salt-tolerant shrubs for hedges; 2nd row - salt and gas-resistant large-sized shrubs; 3d row is represented by salt-, gas- and metal-resistant trees.

The reconstructed section of the P-80 road passes through a territory which is subject to intensive anthropogenic impact. These are lands under construction and lands used in agricultural production.

Considerable areas are occupied by the synanthropic herbal communities here: weed-field, sown grass (meadow agrophytocenosis) and roadside vegetation, which indicates a high degree of development of this territory. At the same time, meadow phytocenoses prevail in the structure of grassy vegetation, located at a considerably remote stage of succession.

On agricultural lands (active arable land, hayfields on sown meadows, etc.), the sagittal

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vegetation is quite widespread.

The structure of the vegetation cover of these territories includes the agricultural crops, which are the absolute dominants here, under the canopy of which the following weed-field species of plants grow: quitch (*Elytrigia repens*), creeping thistle (*Sonochus arvensis*), loose silky belt (*Apera spica-venti*), kew weed (*Galinsoga parviflora*), frost-blite (*Chenopodium album*), cursed thistle (*Cirsium arvense*), pickpurse (*Capsella bursa-pastoralis*), common orache (*Atriplex patula*), wild oat (*Avena fatua*), wild camomile (*Tripleurospermum inodorum*), knotgrass (*Polygonum aviculare*), buckwheat crab (*Fallopia convolvulus*) and others.

This type of vegetation does not have a great impact on the preservation of the biological diversity along the road.

Natural meadow vegetation is practically absent, represented by dry meadows, which often do not form a continuous cover, but form small-cereal or small-herbaceous associations. Meadow communities are anthropogenically-natural ecosystems, transformed by human economic activity. Species composition of these meadows includes a significant number of ruderal plant species.

Meadow vegetation closely adjoins the herbaceous ruderal vegetation of wastelands, underutilized and unused areas, other disturbed habitats, formed as a result of human activities. For this type of vegetation, the following plant species are specific for the investigated territory: croupgrass, great plantain (*Plantago major*), dandelion (*Taraxacum officinale*), wormwood (*Artemisia absinthium*), plain wormwood (*Artemisia campestris*), curled sorrel (*Rumex crispus*), hoary alyssum (*Berteroa incana*) and others.

Ruderal vegetation does not have any zoological value.

The road P-80 passes near the residential development of settlements, where residential vegetation is widespread. This type of vegetation is represented by lawn, flower, shrub plantations, wood plantings. This type of vegetation does not have a great impact or value on the preservation of the biological diversity.

In the investigated territory, marsh vegetation is fragmentarily encountered. Low-lying swamps are grassy with areas of forest, shrubs (Figure 26). Tree stands is represented by birch, alder, occasionally aspen, and also willows, which sometimes form continuous thickets. The vegetation cover is represented by the following species: various species of sedge, common reed (*Phragmites australis*), forest reed (*Scirpus sylvaticus*), broadleaf cattail (*Typha latifolia*), two-stem reed (*Phalaroides arundinacea*), yellowtop (*Calamagrostis neglecta*), fowl bluegrass (*Poa palustris*), etc.

The projected section of the P-80 road crosses the Domelka River, where coastal and aquatic vegetation is present, consisting of plant communities and populations of aquatic plants, completely or mostly submerged in water (hydrophytes), and habitat of the plants with excessive moisture (hygrophytes).

There are no species of plants listed in the Red Book of the Republic of Belarus in the study area.



Figure 26.

According to the Smolevichi District Inspectorate of Natural Resources and Environmental Protection (letter No. 08-37 / 75 dated 12 April 2017) wild plants belonging to the species listed in the Red Book of the Republic of Belarus or belonging to a conservation of the national or local significance as the PAs of the Republican And local significance are absent on the territory of the

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planned economic activity (Annex 1).

According to letter No. 08-43/344 dated 20 April 2017 (Annex 1), the Minsk Regional Inspectorate for Natural Resources and Environmental Protection does not have information on the presence of plants listed in the Red Book of the Republic of Belarus on the territory of the project.

According to the letter of the State Specialized Forestry Service "Borovlyansky Spetsleskhoz" No. 1054 dated 30 May 2017 (Annex 1), no places of growth of plants which are listed in the Red Book of the Republic of Belarus have been identified in the zone of influence of the projected facility.

Fauna

In accordance with zoogeographical zoning, the section of the reconstructed P-80 road Sloboda-Papernya 0.000 km - 14.770 km, refers to the Transitional Area [1].

The P-80 road, 0,000 km - 14,770 km, passes both on lands occupied by forest vegetation and on agricultural lands where the territory is characterized by low-value communities with low species richness.

Entomofauna. The entomocomplexes in the study area are represented by widespread species that inhabit the corresponding ecosystems throughout the territory of Belarus. Species composition of coleoptera in agroecosystems is characterized by widespread types of open spaces; there are species of insects pests of agricultural crops on agricultural lands. Types of pests of forest species are common in forest biocenose where the road passes along forest-covered lands.

Mesofauna is represented by widespread species, specific not only for the given area, but also for the whole country.

Ichthyofauna. The reconstructed section of the road crosses only one river - the Domelka, which belongs to the watercourses of the third category, the composition of the ichthyofauna of this watercourse is poor and quantitatively small. In the ichthyofauna, general freshwater fish species predominate (common roach, rudd, river perch, etc.).

In accordance with the Republican integrated scheme for the allocation of fishing grounds, approved by the Ministry of Agriculture and Food of the Republic of Belarus No. 29 dated 18 June 2014, there are no fishing grounds on the Domelka River.

Batracho- and herpetofauna. Species of amphibians and reptiles that are widely encountered on the territory of the entire Minsk region live in the area of the projected object location.

The batracho- and herpetofauna of the study area is characterized by relative poverty of species composition, which is due to the strong development of the territory, the weak development of the hydrological network with the predominant filling in the spring period, and also during rainy periods during the summer. The reservoirs near the highway are represented by artificial ponds, while the natural forest water bodies of the temporary type are represented by local landscape depressions and are quite rare.

In different types of biotopes, the following species of amphibians are encountered: gray toad (*Bufo bufo*), grass frog (*Rana temporaria*), the edible frog (*Pelophylax esculenta*), red bellied midge (*Bombina bombina*), common newt (*Lissotriton vulgaris*) and others.

Reptiles are represented by banal species: lizard (*Lacerta agilis*), viviparous lizard (*Zootoca vivipara*), grass-snake (*Natrix natrix*).

Field investigations, held in April 2017, did not found out mass migration of amphibians in the area of reconstruction of the P-80 road. However, the studies were carried out under very low ambient temperature, which excluded the possibility of reliable determination of amphibians' breeding places and the presence of migration corridors. In the development of project documentation to identify possible migration corridors, location and intensity of their use by amphibians, additional studies are needed.

Ornithofauna. Ornithofauna territory near the reconstructed P-80 road is quite diverse. It is dominated by species of birds belonging to the forest and tree and shrub ecological complexes; there are also numerous types of complex environmental and commensal species of open landscapes.

The route of the road passes through the agricultural lands at a considerable distance, but agricultural landscapes are poor in terms of biodiversity, and the range of birds living there is small. skylark (*Alauda arvensis*), stamping meadow (*Saxicola rubetra*), tawny pipit (*Anthus campestris*), warbler gray (*Sylvia communis*), yellowhammer (*Emberiza citrinella*) and others can be found on

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farmland; there are also birds of prey: marsh lun (*Circus aeruginosus*), buzzard (*Buteo buteo*), etc.

The birds that are frequently encountered during route observations in the study area near populated areas, as well as in agricultural fields, are rook (*Corvus frugilegus*), jackdaw (*Corvus monedula*), gray crow (*Corvus cornix*), magpie (*Pica pica*), house sparrow (*Passer domesticus*) – they belong to a synanthropic ecological complex.

The following species of birds relate to forest and woody and shrubby ecological complexes: chaffinch (*Fringilla coelebs*), wren (*Troglodytes troglodytes*), pied flycatcher (*Ficedula hypoleuca*), oreole (*Oriolus oriolus*), chiffchaff (*Phylloscopus collybita*), wood warbler (*Ph. sibilatrix*), great titmouse (*Parus major*), tree pipit (*Anthus trivialis*), hedge-sparrow (*Prunella modularis*), great spotted woodpecker (*Dendrocopos major*), jay (*Garrulus glandarius*) and many others are noted in forested areas and on the territories covered with arboreal and shrubby vegetation.

In the area of the facility there are water bodies, wetlands and marshes, so there are species of coastal-water and wetland ecological complexes like the following: mallard duck (*Anas platyrhynchos*), common teal (*Anas crecca*), garganey (*Anas querquedula*), white stork (*Ciconia ciconia*), gray heron (*Ardea cinerea*), black-headed gull (*Larus ridibundus*) and others. The following birds can occur when crossing the territory during their flight: white-fronted goose (*Anser albifrons*), bean goose (*Anser fabalis*), bluebill (*Aythya fuligula*), red-head bluebill (*Aythya ferina*), wigeon (*Anas penelope*). However, in the vicinity of the route of the P-80 road the birds of the coastal water and water-related environmental swamp complexes were not recorded.

No bird species listed in the Red Book of the Republic of Belarus, as well as those that negatively react to anthropogenic forcing were found in the area of the planned economic activity.

The teriofauna of the studied territory is quite diverse. The mammals are represented by the widespread species which are typical for natural forest and open landscape.

On agricultural lands, open areas of grass stands the most common are the representatives of rodent family (*RODENTIA*): field mouse (*Apodemus agrarius*), common vole (*Microtus arvalis*), dark vole (*Microtus agrestis*), root vole (*Microtus oeconomus*), also the species of the soricomorpha group are common representatives: common mole (*Talpa europaea*), shrew (*Sorex sp.*) and others.

The most favorable habitat for mole, common shrew (*Sorex araneus*), Laxmann's shrew (*S. caecutiens*), even-toothed shrew (*S. isodon*), pigmy shrew (*S. minutus*) etc. are moist forest areas with abundant loose ground cover and developed grass and understory.

Agricultural lands can serve as the fodder base for the European hare (*Lepus europaeus*) (Arctic hare (*Lepus timidus*) mostly inhabits forest biotopes), predators - foxes (*Vulpes vulpes*), forest ferret (*Mustela putorius*), vair (*Mustela nivalis*). The usual species, found everywhere, is the hedgehog (*Erinaceus europaeus*).

In forest biotopes, there are often representatives of the Rodents group, such as the red vole (*Myodes glareolus*), the yellow-necked mouse (*Apodemus flavicollis*) and the forest mouse (*A. sylvaticus*). In addition, the abundance of the common squirrel (*Sciurus vulgaris*) is quite high in the forest biotopes (especially in different spruce forests). Among forest predators pine marten (*Martes martes*), forest ferret, common fox, raccoon dog (*Nyctereutes procyonoides*), erminea (*Mustela erminea*), vair are spread in the region of the planned economic activity. Forest ferret, erminea, vair are also often found in valleys of rivers and streams, places with low relief, abandoned agrocenoses.

Erminea is included in the list of rare and endangered species of wild animals listed in the Red Book of the Republic of Belarus in accordance with the Resolution of the Ministry of Natural Resources and Environmental Protection of the Republic of Belarus No. 26 dated 09 June 2014.

The following species of artiodactyls live in the forest areas of the site: European roe deer (*Capreolus capreolus*), wild boar (*Sus scrofa*), noble deer (*Cervus elaphus*), elk (*Alces alces*), which present the main danger for road traffic.

The section of the P-80 road, 0,000 km - 14,770 km, passes through the territory of the following hunting farms:

- Establishment "Minsk Regional Organizational Structure" of the republican state-public association "Belarusian Society of Hunters and Fishermen" - zones: B (the zone of hunting management predominantly for small game), C (rest zone), A (hunting zone mainly for ungulates) (Figure 27);

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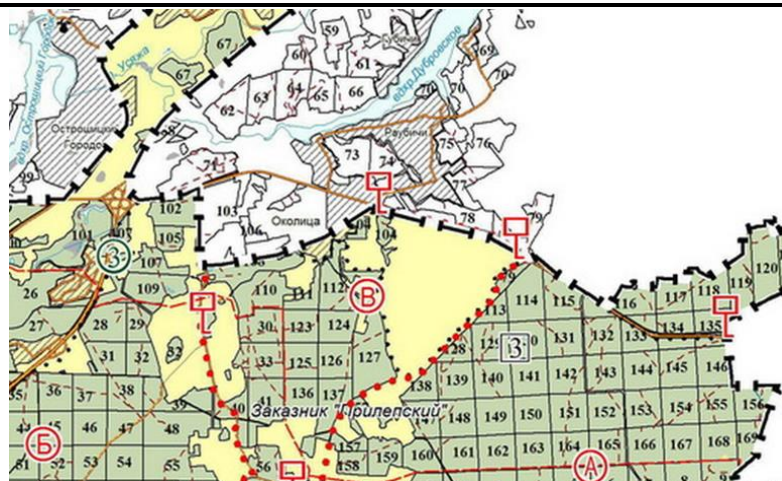


Figure 27.

– Establishment “Smolevichi Regional Organizational Structure” of the republican state-public association “Belarusian Society of Hunters and Fishermen” - zone B (zone of hunting management mainly for small game) (Figure 28).



Figure 28.

Data on the accounting of the main types of game animals in the hunting farms, on the territory of which the road passes, are presented in Table 5.

Table 5.

Animal	Number of game animals/Density of species per thousand ha	
	“Smolevichi Regional Organizational Structure” of the republican state-public association “Belarusian Society of Hunters and Fishermen”	Minsk Regional Organizational Structure” of the republican state-public association “Belarusian Society of Hunters and Fishermen”
Elk	130 / 5,8	95 / 5,0
European roe deer	470 / 15,4	370 / 13,8
Noble deer	120 / 4,8	110 / 5,8

According to the map-scheme of the main migration corridors of the hoofed animals on the territory of Belarus (Figure 29), developed by SSPC “SPC NAS of Belarus for Biological Resources” in the framework of the project “Development of the Scheme of the Main Migration Corridors of the Model Species of Wild Animals on the Territory of the Republic of Belarus for 2013-2015” financed by the Ministry of Natural Resources and Environmental Protection of the Republic of Belarus, the projected P-80 road at the section from Okolitza village to the boundary of the works in the vicinity of Ostroshitsky Gorodok crosses the migration corridor of ungulates M2-M3-M6-M7 and at the section from Okolitza settlement to Sosnovaya settlement serves as a north-eastern border of the said

According to the information of “Minsk Regional Organizational Structure” of the republican state-public association “Belarusian Society of Hunters and Fishermen” (Annex 1), 2 roe deer and 2 wild boars died on the territory of the hunting farm in 2013 on the P-80 road; in 2014 16 wild boar animals were killed, in 2015 - one roe deer, in 2016 - 1 elk and 3 roe deer. All road accidents involving wild animals are concentrated on the road segment km 7 - km 13, while the largest concentration of accidents involving wild boars and elks was observed at km 7 and km 8.5, while in other areas rare single cases of wild animals entering the road were noted.

Карта-схема основных миграционных коридоров копытных животных на территории Беларуси



Spatial distribution of road accidents involving wild animals on the studied section of the P-80 road is shown in Figure 1.

According to the data of Smolevichi District Inspectorate of Natural Resources and Environmental Protection there are no habitats of wild animals belonging to the species included in the Red Book of the Republic of Belarus on the territory of the planned economic activity (Annex 1).

According to the letter of the State Specialized Forestry Service "Borovlyansky Spetsleskhoz" No. 1054 dated 30 May 2017 (Annex 1), the habitats of animals listed in the Red Book of the Republic of Belarus have not been identified in the zone of influence of the projected facility.

3.2 The existing level of anthropogenic impact on the environment. Level of pollution of natural environment components

3.2.1 Atmospheric air

According to the analysis of long-term results of atmospheric air quality monitoring and according to the stationary observations of the State Institution "The Republican Center for Hydrometeorology, Control of Radioactive Pollution and Environmental Monitoring", the level of atmospheric air pollution on the territory of the Minsk region is characterized as permissible [7].

According to the data of the Ministry of Natural Resources and Environmental Protection of the Republic of Belarus [13] in 2015, the total gross emissions of pollutants into the air from stationary and mobile sources on the territory of the Minsk region amounted to 255.6 thousand tons, which is 0.7 thousand tons less than in 2014 (Figure 30).



Figure 30.

Carbon oxide predominated (54.3%) in the content of gross emissions of pollutants into the air in 2015, the same picture is observed for previous years; hydrocarbons and non-methane volatile organic compounds (NMVOCs) amounted to 28.4%; nitrogen oxides - 9.5% (Table 6).

Table 6.

Region	Solids	Carbon oxide	Sulfur dioxide	Nitrogen oxides	Hydrocarbons (including NMVOCs)	Other	Total
Brest	7,3	79,8	1,3	18,0	55,4	4,8	166,6
Vitebsk	8,9	76,9	27,5	21,4	69,1	4,7	208,5
Gomel	8,2	80,5	21,8	21,6	68,1	5,5	205,6
Grodno	8,1	73,5	1,0	19,9	45,9	5,9	154,3
Minsk city	4,4	94,5	0,8	18,1	28,4	0,2	146,4
Minsk	10,7	138,8	3,2	24,4	72,5	6,0	255,6
Mogilev	6,4	58,4	1,3	16,8	37,1	2,1	122,1
Total	54,0	602,4	56,9	140,1	376,2	29,2	1 258,9

In 2015, the volume of emissions of pollutants from stationary sources increased by 1.4 thousand tons and amounted to 75.9 thousand tons (Table 7).

Table 7.

List of indicators	2010	2011	2012	2013	2014	2015
Quantity of pollutants discharged from stationary sources, thous. tons	1554,5	1460,1	1288,1	1069,2	1514,6	1442,0

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List of indicators	2010	2011	2012	2013	2014	2015
Absorbed and neutralized air pollutants from stationary sources, thousand tons	1503,4	1408,2	1218,9	998,3	1440,1	1366,1
In % of the total amount of pollutants evolved from stationary sources	96,7	96,4	94,6	93,4	95,1	94,7
Used pollutants caught by gas treatment plants, thousand tons	1462,1	1372,7	1177,4	969,5	1407,8	1317,7
In % of the total amount of caught and neutralized pollutants	97,3	97,5	96,6	97,1	97,8	96,5
Emissions of pollutants into the atmospheric air from stationary sources, thous. tons	51,1	51,9	69,2	71,0	74,5	75,9
Including: from burning fuel	22,7	18,4	20,5	21,3	16,4	20,7
From technological and other processes	28,4	33,6	48,7	49,7	58,1	54,4

The long-term dynamics of emissions of pollutants into the air from stationary sources (thousands of tons) on the territory of the Minsk and Smolevichi districts of the Minsk region is shown in Table 8.

Table 8.

Territory	Emissions of pollutants into the atmospheric air from stationary sources, thous. tons					
	2010	2011	2012	2013	2014	2015
Minsk region	51,1	51,9	69,2	71,0	74,5	75,9
Minsk district	4,8	4,1	7,2	9,8	9,9	9,2
Smolevichi district	3,6	3,7	4,4	3,8	3,4	3,1

Among the substances polluting the air basin, the largest number are hydrocarbons, their share in 2015 in the Minsk region accounted for 44.4%. Emissions of carbon monoxide amounted to 17.4 thousand tons (23.0%), nitrogen dioxide - 5.6 thousand tons (7.4%).

The structure of emissions of pollutants into the air by individual ingredients from stationary sources is presented in Table 9.

Table 9.

List of indicators	2010	2011	2012	2013	2014	2015
Total (thousand tons) including:	51,1	51,9	69,2	71,0	74,5	75,9
solids	9,0	8,2	7,4	6,9	6,4	6,1
sulfur dioxide	5,4	4,2	4,5	3,3	2,4	3,1
carbon oxide	13,6	12,5	15,5	17,9	17,1	17,4
nitrogen dioxide	5,9	5,7	6,5	5,8	6,4	5,6
hydrocarbons	8,8	12,0	24,1	23,5	30,7	33,7
non-methane volatile organic compounds	2,9	3,2	3,6	4,1	3,5	2,9
other	5,5	6,2	7,6	9,5	8,1	7,1

The main share in the structure of emissions of pollutants into the atmospheric air is occupied by mobile sources of emissions - 70.3%.

The main contribution to the structure of emissions of pollutants into the air is still made by mobile sources (vehicles). In the Minsk region, emissions from mobile sources accounted for 70.3% of total emissions in 2015. Compared to 2014, emissions from mobile sources decreased by 2.1 thousand tons and amounted to 179.7 thousand tons.

According to the National Statistical Committee of the Republic of Belarus, emissions of

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pollutants into the air from mobile sources per inhabitant of the Minsk region amounted to 127 kg in 2015 (in 2014 - 129 kg).

In order to improve the quality of atmospheric air by reducing the amount of pollutant emissions from mobile sources in the Minsk region, cars are transferred to gas, rolling stock is renewed, fuel is refueled in accordance with European standards, and rational organization of traffic in cities is organized.

In 2015, 7,258 samples of atmospheric air were collected and tested by state sanitary inspectorates in urban and rural settlements of the Minsk region, of which 10 (0.14%) (in 2014 - 0.22%) did not meet the hygienic standards for phenol and dust content [3]

The existing level of atmospheric air pollution in the area of reconstruction of the P-80 road Sloboda-Papernya, 0.000 km - 14.770 km, is estimated by the background concentrations of pollutants, which characterize the pollution of the atmosphere created by existing sources of emissions of existing industrial facilities, traffic on the territory and other factors .

Indicative values of background concentrations of pollutants in the air of rural settlements of Minsk and Smolevichi districts of the Minsk region provided by the State Institution "Republican Center for Hydrometeorology, Control of Radioactive Pollution and Environmental Monitoring" (letter No. 14.4-18 / 501 dated 17 May 2017) (Annex 1) are given in Table 10.

Table 10.

Pollutant code	Name of pollutant	Air Quality Standards, µg/m3			Values of background concentrations, µg/m3
		Maximum single concentration	Average daily concentration	Average annual concentration	Rural settlements of Minsk and Smolevichi districts
2902	Solids*	300	150	100	69
0008	Solids10**	150	50	40	26
0330	Sulfur dioxide	500	200	50	37
0337	Carbon oxide	5000	3000	500	616
0301	Nitrogen dioxide	250	100	40	30
0303	Ammonia	200	—	—	49
1325	Formaldehyde	30	12	3	18
1071	Phenol	10	7	3	3,1
0602	Benzene	100	40	10	0,9
0703	Benz(a)pyrene ***	—	5,0 Ng / m3	1,0 Ng / m3	0,78 Ng / m3

* Undifferentiated dust / aerosol composition

** solid particles, fractions up to 10 microns in size

*** for the heating season

Background concentrations of pollutants in the ambient air in the area where the facility is located do not exceed the maximum permissible concentrations of pollutants in the air of settlements and places for mass recreation of the population approved by the Ministry of Health of the Republic of Belarus No. 113 dated 08 November 2016.

Compliance with the MPC is ensured taking into account the effects of summation of polluting chemicals in the ambient air in accordance with the requirements of paragraph 7 of the Sanitary Norms and Regulations "Requirements for Atmospheric Air in Populated Areas and Places for Mass Recreation of the Population" approved by the Ministry of Health of the Republic of Belarus No. 141 dated 30 December, 2016, Table 11.

Table 11.

Pollutant		Hazard class	MPCs.t. Mcg / m3	Maximum single concentration	
Code	Name			Mcg / m3	Shares of MPCs.t.

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I – acceptable	up to 1,6	up to 3,0	up to 5,0	up to 7,1
II – weak	1,7 – 3,2	3,1 – 4,8	5,1 – 6,4	7,2 – 8,0
III – moderate	3,3 – 6,4	4,9 – 9,6	6,5 – 12,8	8,1 – 16,0
IV – strong	6,5 – 12,8	9,7 – 19,2	12,9 – 25,6	16,1 – 32,0
V – dangerous	12,9 and higher	19,3 and higher	25,7 and higher	32,1 and higher

Hygienic assessment of the degree of atmospheric air pollution by one pollutant according to average daily and maximum single concentrations

Degree of atmospheric air pollution	The average daily concentration of one substance in MPC shares	Maximum single concentration of one substance in MPC shares
I – acceptable	up to 1,0	up to 1,0
II – weak	1,1 – 1,5	1,1 – 2,0
III – moderate	1,6 – 2,0	2,1 – 3,0
IV – strong	2,1 – 3,0	3,1 – 4,0
V – dangerous	3,1 and higher	4,1 and higher

Calculation of the value of the complex indicator “P” in the location of the reconstructed facility is shown in Table 12.

Table 12.

Name of the pollutant	Hazard class	Maximum single permissible concentration, Mcg/m3	Minsk region		
			Maximum permissible concentration, Mcg/m3	Multiplicity of the excess of the maximum single permissible concentration	
				Actual	Reduced to the 3rd hazard class
Solid particles (undifferentiated in composition dust/aerosol)	3	300,0	69	0,23	0,23
Solid particles, fractions with size up to 10 microns	3	150,0	26	0,17	0,17
Sulfur dioxide	3	500,0	37	0,07	0,07
Carbon oxide	4	5000,0	616	0,12	0,10
Nitrogen dioxide	2	250,0	30	0,12	0,18
Ammonia	4	200,0	49	0,25	0,20
Formaldehyde	2	30,0	18	0,60	0,90
Phenol	2	10,0	3,1	0,31	0,47
Benzene	2	100,0	0,9	0,009	0,01
Benz(a)pyrene ***	1	5,0 Ng / m3 (MPS s.t.)	0,78 Ng / m3	0,02	0,03
Total value of “P”			1,09		
Degree of pollution			I – acceptable		

The total “P” indicator of atmospheric air pollution, determined by the background maximum-single concentrations of pollutants in the atmospheric air of rural settlements of the Minsk and Smolevichi districts of the Minsk region located in the zone of influence of the reconstructed object "P-80 road Sloboda-Papernya, 0.000 km - 14,770 km" is 1.09, which corresponds to the permissible degree of air pollution.

Background concentrations of pollutants in the air in the rural areas of Minsk district of the Minsk region (including on the territory of the republican landscape reserve "Prilepsky") do not exceed the standards of environmentally friendly concentrations of pollutants in the air of specially protected natural areas, individual natural complexes and objects of specially protected natural areas, as well as natural areas which are subject to special protection approved by the Resolution of the Ministry of

Original inv.No.	Signature and date	Repl. Inv. No	Total value of P						1,09	
			Degree of pollution						I – acceptable	
<p>The total “P” indicator of atmospheric air pollution, determined by the background maximum-single concentrations of pollutants in the atmospheric air of rural settlements of the Minsk and Smolevichi districts of the Minsk region located in the zone of influence of the reconstructed object "P-80 road Sloboda-Papernya, 0.000 km - 14,770 km" is 1.09, which corresponds to the permissible degree of air pollution.</p> <p>Background concentrations of pollutants in the air in the rural areas of Minsk district of the Minsk region (including on the territory of the republican landscape reserve "Prilepsky") do not exceed the standards of environmentally friendly concentrations of pollutants in the air of specially protected natural areas, individual natural complexes and objects of specially protected natural areas, as well as natural areas which are subject to special protection approved by the Resolution of the Ministry of</p>										
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Table 13.

Code of the pollutant	Name of the pollutant	EFC value, µg/m3			Values of background concentration	
		Maximum single concentration	Daily average concentration	Annual concentration	µg/m3	Share of EFC
2902	Solid particles	100,0	50,0	20,0	69	0,69
0330	Sulfur dioxide	100,0	70,0	20,0	37	0,37
0301	Nitrogen dioxide	200,0	75,0	30,0	30	0,15
0303	Ammonia	200,0	100,0	40,0	49	0,245

3.2.2 Soil cover

To assess the extent of existing soil contamination and determine the degree of man-caused soil loads during the implementation of the planned economic activity, the background content, the maximum permissible concentration (MPC) or the approximate permissible concentration (APC) of the chemical elements in the soil and their clark in the Republic of Belarus were used.

The average content of the detectable ingredients in the soils of the background monitoring network of the Minsk region [7], MPC (APC) [14] and clark [15] for the Republic of Belarus are shown in Table 14.

Table 14.

Indicator	SO ₄ ⁻	NO ₃ ⁻	Oil products	Cd	Zn	Pb	Cu	Ni	Mn
Background values, mg/kg	34,2	9,3		0,25	13,1	7,1	6,6	4,9	222
MPC (APC), mg/kg	160	130	100			32			1500
- sandy and sandy-loamy soils				0,5	55		33	20	
- loamy and clayey soils (pH < 5,5)				1	110		66	40	
- loamy and clayey soils (pH > 5,5)				2	220		132	80	
clark for the Republic of Belarus, mg/kg				0,1	35	12	13	20	247

At the observation point of the National Environmental Monitoring System of the Republic of Belarus (NSEM) included in the State Register of Observation Points, in 2015 sampling was conducted within a background monitoring network to determine the content of DDT in soils. The content of DDT, established for the Minsk region, as well as for the entire territory of the republic, is less than 0.0025 mg / kg, which does not exceed the established MPC (0.1 mg / kg).

According to the data of the State Institution "Republican Center for Hydrometeorology, Control of Radioactive Pollution and Environmental Monitoring", the content of pollutants in soils on the reference network of background monitoring (conducted within the framework of NSEM) relative to the data of previous years has changed insignificantly and can be used as a base for assessing pollution levels of soils.

3.2.3 Surface waters

To assess the degree of anthropogenic transformation of water bodies within the framework of the implementation of the State Program for the Development of the National System for Monitoring the Environment of the Republic of Belarus, a network of background monitoring of surface waters was organized.

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The existing state of the surface waters of the Dniepr basin, including the Domelka river, intersected by the reconstructed section of the R-80 road, which is a tributary of the fourth order of the Dniepr river (the Domelka → the Usiazha → the Gayna → the Berezina → the Dniepr), was determined according to the National Environmental Monitoring System of the Republic of Belarus [7].

In 2015, according to the data of the State Water Cadaster in Belarus, the abstraction of water from water bodies and groundwater decreased significantly - by 114 million m³, and amounted to 1396 million m³. More than half of the water withdrawn for use (59%) is still in groundwater. Most significantly, compared to 2014, the extraction (withdrawal) of water for use in the was decreased in the Minsk region - by 70 million m³, (Table 15), through which the route of the reconstructed P-80 road passes, which is more than 60% of the total reduction in the Republic of Belarus.

Table 15.

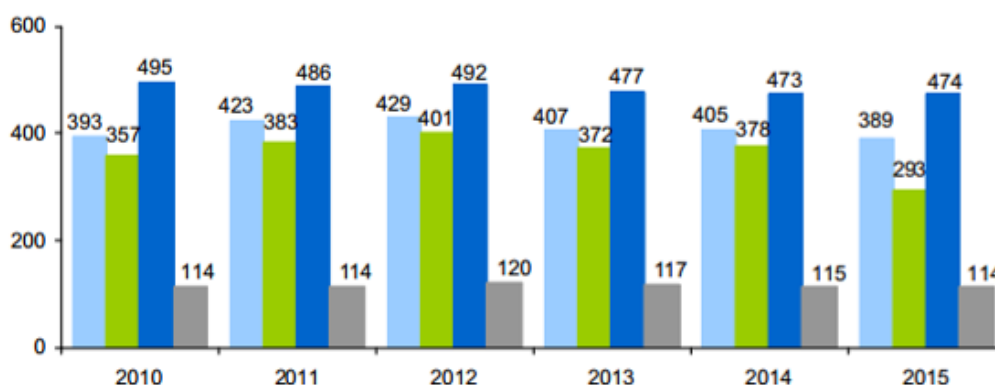
	Total		Including the underground horizons	
	2014	2015	2014	2015
Minsk region	498,3	427,8	247,5	238,9
Minsk district	76,6	71,2	75,4	70,7
Smolevichi district	21,7	23,4	21,7	21,0

Since 2012, there has been an annual decline in groundwater production and in 2015, compared to the previous year, the reduction in the Republic of Belarus was 19 million m³, of which 47% was in the Minsk region.

In 2015, 1270 million m³ of water was used for various purposes in the country's economy, which is 101 million m³ less than in 2014. At the same time, 474 million m³ was spent for domestic and drinking needs, and for production - 389 million m³. In general, in 2015, as in previous years, there was a reduction in the use of water for production needs in the republic. In 2015, compared to the previous year, the volume of water used for pond fisheries decreased by 23% and amounted to 293 million m³ of water. The amount of water used for irrigation and agricultural water supply was about 9% of the total amount of water used.

The dynamics of water use (million m³) for various needs in the republic is shown in Figure 31.

According to the State Water Cadaster, in 2015, 948 million m³ of wastewater was allocated, including 870 million m³ of wastewater to water bodies, among which the normatively purified waters were quantified. The sluicing in the Minsk region was 145.8 million m³, including 128.0 million m³ of water in water bodies. In the Minsk region, the wastewater discharge amounted to 3.6 million m³, of which 0.1 million m³ was discharged to water bodies; in the Smolevichi region, the wastewater disposal amounted to 10.3 million m³, of which 9.7 million m³ was transferred to water bodies [16,17].



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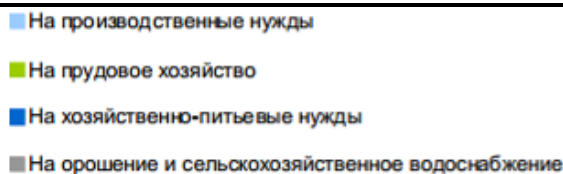


Figure 31.

The amount of pollutants entering the sewage into water bodies in recent years tends to decrease. Exceptions are the sulfate ion and ammonium ion, the discharge amounts of which in 2015 increased by 14 and 12.5%, respectively.

The total number of metals discharged into water bodies in 2015 was the lowest for the period 2010-2015. At the same time, their main quantity (90%) is iron. In small towns lead, cobalt, fluoride ions and phenols also come with sewage in small quantities.

Data on the discharge of pollutants in sewage into water bodies in the Minsk region are presented in Table 16.

Table 16.

Name of the pollutant	Unit of measurement	Quantitative value
Organic matter (according to BOD ₅)	thous. tons	1,29
Oil and oil products in dissolved and emulsified state	thous. tons	0,02
Suspended substances	thous. tons	2,14
Sulfate ion	thous. tons	3,09
Chloride ion	thous. tons	9,43
Ammonium ion	thous. tons	0,86
Nitrite ion	thous. tons	0,02
Nitrate ion	thous. tons	0,25
Fluoride ion	tons	0
Total iron	tons	41,00
Lead	tons	0,07
Copper	tons	0,28
Zinc	tons	1,23
Chromium	tons	0,31
Cobalt	tons	0
Molybdenum	tons	0
Nickel	tons	0,15
Phenols	tons	0,06

The values characterizing the technogenic chemical load of the main basins of the republic are given in Table 17. Among the main basins of the country, the rivers of the Dniepr basin are distinguished by the magnitude of the man-made chemical impact: the Berezina and its influx - the Svisloch, into which most of the controlled pollutants are discharged. The main technogenic load in the Berezina basin is caused by pollutants discharged into the Svisloch river.

The priority pollutants discharged in sewage are ammonium ion, phosphate ion, nitrite ion, organic substances (BOD₅), ferrum compounds [13].

Table 17.

River basin	Discharge of pollutants in wastewater in the river basins of Belarus, thous. tons							
	Organic substances (BOD ₅)	Oil and oil products	Phosphate ion (in terms of P)	Sulfates	Ammonium nitrogen	Nitrite nitrogen	Copper	Other metals (Fe total., Zn, Ni, Cr total.)
1. Dniepr	4,91	0,07	0,46	30,53	3,54	0,07	3,11	199,3
1.1. Sozh	0,66	0,01	0,08	3,27	0,75	0,01	0,3	30,82
1.2. Berezina	2,28	0,04	0,22	19,25	2,00	0,04	1,38	91,37

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1.2.1. Svisloch	1,75	0,03	0,18	9,73	1,13	0,03	1,08	54,64
2. Pripyat	1,28	0,02	0,11	4,00	0,45	0,01	0,24	41,06
3. Neman	1,74	0,01	0,07	8,69	1,64	0,03	0,35	53,18
3.1. Viliya	0,26	0	0,02	0,97	0,14	0,01	0,02	8,70
4. Z. Dvina	1,02	0,01	0,06	12,93	0,55	0,02	1,05	43,17
5. Z. Bug (incl. Narev)	0,72	0,01	0,01	1,25	0,02	0	0,10	13,13
5.1. Mukhavets	0,04	0	0	0,3	0,02	0	0,02	0,93

The assessment of the state of Belarusian water bodies in 2015 was based on hydrochemical and hydrobiological indicators obtained from the National Environmental Monitoring System of the Republic of Belarus.

Observations of the state of surface waters were carried out according to hydrochemical and hydrobiological indicators.

Surface water monitoring was carried out by hydrochemical indicators at 27 water bodies in the Dniepr basin in 2015 (20 rivers, 5 reservoirs and 2 lakes), including 6 transboundary sections of the Dniepr, the Sozh, the Vikhra, the Iput and the Besed rivers. The monitoring network consisted of 76 observation points. More than 710 water samples with more than 20,080 hydrochemical determinations were analyzed. Observations on the hydrobiological indicators were carried out on transboundary sections of watercourses and on the Svisloch river, at only 10 points of observation. The scheme of location of the network of points of monitoring of surface waters of the Dniepr basin is shown in Figure 32 [7].

The ecological state of the Dniepr river and its tributaries is determined both by the natural geochemical features of the territory, by the self-cleaning ability of rivers, and by the anthropogenic load associated with the introduction of urban wastewater, industrial effluents and effluents from agricultural lands.

To assess the level of pollution of water bodies within the NSEM, approved evaluation criteria (surface water quality indicators [18]) and environmental indicators (BOD₅ and the concentration of ammonium nitrogen, phosphate and nitrate concentrations) recommended by the international community are used which allow to compare the assessment of the state of surface waters on the territory of the Republic of Belarus and other countries.

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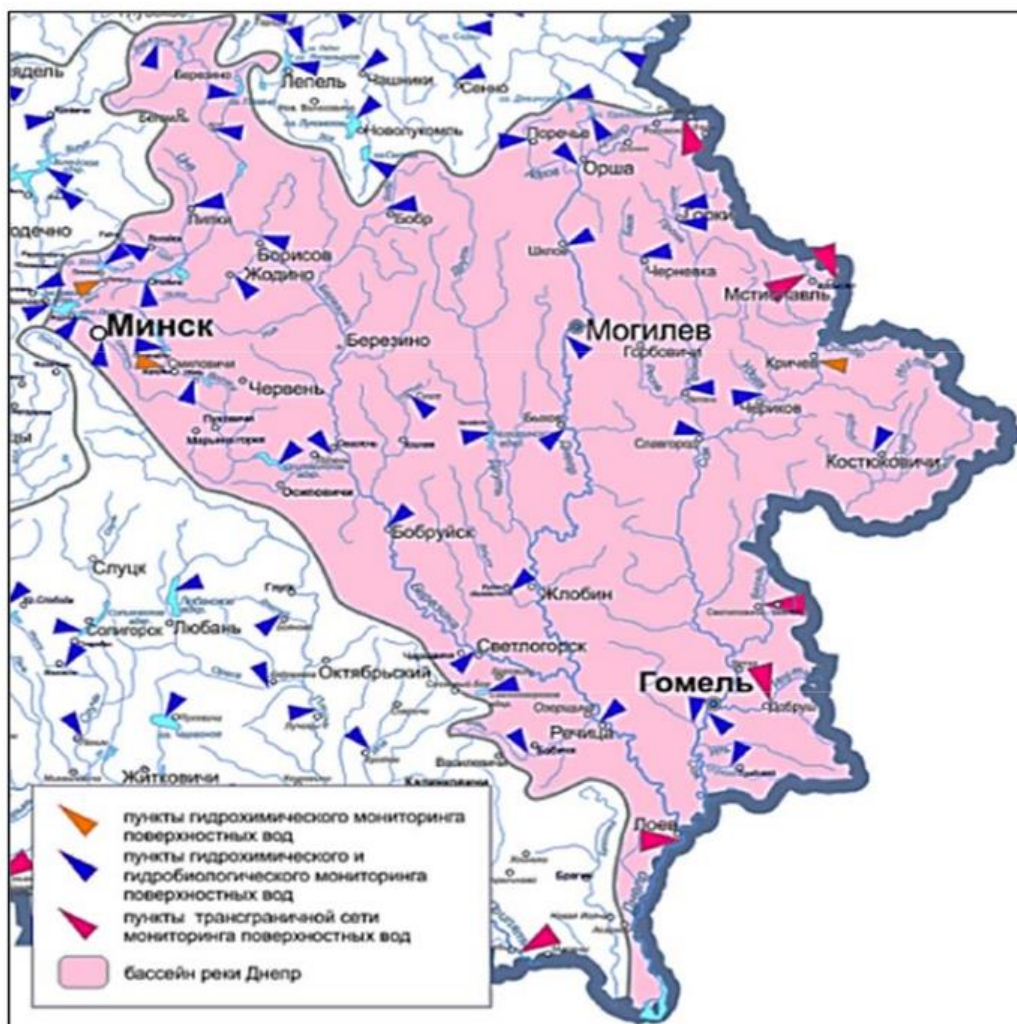


Figure 32.

The quality of surface waters with respect to the metal content is specified by means of comparing their actual concentrations found in the water of water bodies with their maximum permissible concentrations determined by the natural background content. The maximum permissible concentrations of metals in the water of surface water bodies in the Dniepr basin [18] are presented in Table 18.

Table 18.

Name of the watercourse	Estimated background of metal content, mg/dm ³			
	Ferrum total	Manganese	Copper	Zinc
For the rivers of Dniepr, Berezina, Besed, Vikhra, Iput, Pronya, Svisloch, Sozh	0,270	0,038	0,0045	0,016
For other watercourses	0,250	0,035	0,0043	0,014

The hydrochemical status for most of the water bodies of the Dniepr basin was assessed as excellent and good, only 8.2% of the basin watercourses were assessed as satisfactory ones.

For water bodies of the Dniepr river basin, the same as for water bodies of the whole republic, the main share of pollutants are nitrogen and phosphorus compounds. A comparative analysis of hydrochemical data over the past two years revealed that in 2015 there was a slight decrease in the number of water samples contaminated with biogenous matters (Figure 33).

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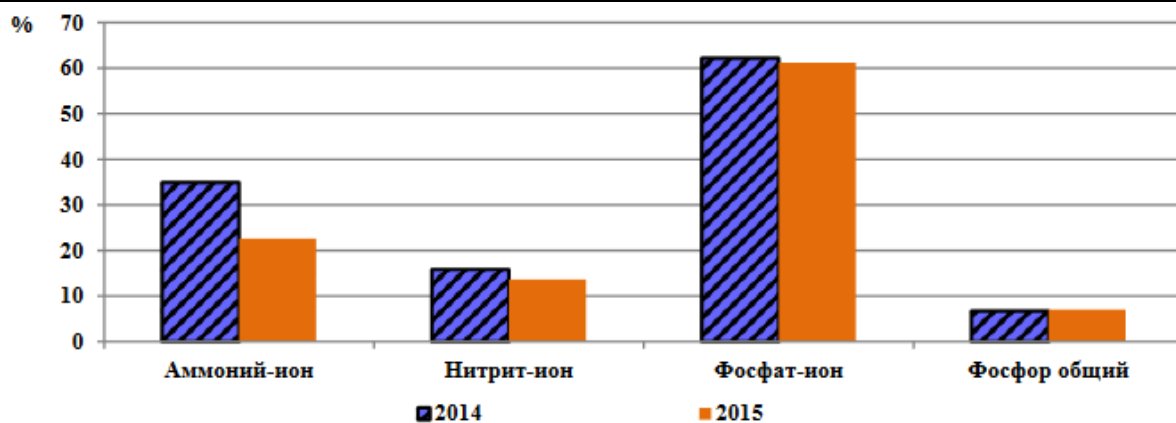


Figure 33.

It should be noted that the pollution of the surface water with phosphate ion in the reporting year, as in the past, is still a characteristic feature of the Dniepr river basin which has been lasting for a number of years. Pollution of surface waters with this biogen, which has a long-lasting character, signals about stable trends of eutrophication of water bodies by the pool.

Analysis of hydrochemical observation results revealed a list of sites streams, in which the water showed increased concentrations of nutrients throughout the year (nitrogen and phosphorus compounds).

The tributaries of the Dniepr River. The water from two major tributaries comes to the Dniepr – the river Berezina with its tributaries – the Gayna, the Cna, the Bobr, the Plissa, the Svislach, the Vyacha, the Loshitsa, the Volma, the Sushanka and the river Sozh with its tributaries – the Vikhra, the Udog, the Pronya, the Porositsa, the Basya, the Uza, the Besed, the Zhadunka, the Iput, the Teryukha, as well as the rivers Dobysna and Vedrich.

The content of the main anions in the water of the Berezina river and its tributaries was expressed in the following concentration ranges: bicarbonate ion - from 55.0 mg/dm³ in the water of the Plissa river (above Zhodino) to 201.0 mg/dm³ in the water of the Svisloch river (Korolischevichi settlement); sulfate ion - from 8.0 mg/dm³ in the water of the Gaina river to 41.4 mg/dm³ in the water of the Svisloch river (Svisloch settlement); chloride ion from < 10.0 mg/dm³ in the water of the Gaina river to 171.0 mg/dm³ in the water of the Loshitsa River (Minsk).

The concentrations of cations in the water of the Berezina river and its tributaries are varied: calcium - up to 89.7 mg/dm³ in the water of the Berezina river (below Svetlororsk), magnesium - up to 27.2 mg/dm³ in the water of the Plissa river (above Zhodino town).

The amount of the suspended matter in the water of the tributaries of the Dniepr river was fixed in the range from 3.2 to 16.2 mg/dm³ with a maximum in the water of the Berezina river on the section which is below Svetlogorsk.

The average annual water content of dissolved oxygen in the tributaries of the Dniepr basin corresponded to the standard values. However, from July to September in the water of the rivers of Volma and Berezina, which are the habitat of the family of salmon and sturgeon, there was a slight decrease in this indicator to 6.25-7.79 mgO₂/dm³ (at a rate of 8.00 mgO₂/dm³ in summer) .

The mean annual concentrations exceeding the limiting indicator for watercourses that are the habitat of sturgeon, according to BOD₅, are noted only in the water of the Berezina river in Svetlogorsk area (3.32-3.68 mgO₂/dm³); according to CODCr - in the Gaina rivers (27,9 mgO₂ / dm³) and the Berezina from the town of Brody to the town of Svetlogorsk (27.5-31.5 mgO₂/dm³) at the rate of 25.0 mgO₂/dm³. The presence of easily oxidizable organic substances (BOD₅) in the water of tributaries of the basin of the river Dniepr was at the satisfactory MPC level and varied from 1.24 mgO₂/dm³ to 4.74 mgO₂/dm³.

The analysis of the nutrient load showed that since 2012 the main contribution to the pollution of the tributaries of the Dniepr with biogenic substances makes the phosphate ion (Figure 34).

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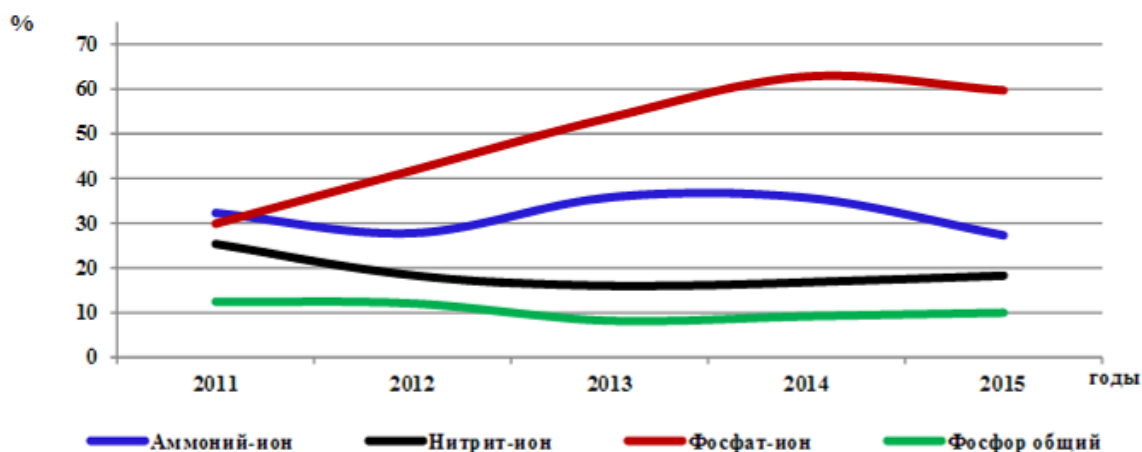


Figure 34.

In 2015, 59.7% of the sampled water from the tributaries of the Dniepr was characterized by an excessive phosphate ion content, which is slightly lower than in the previous year (year 2014 - over 63%). Compared to the previous year, the number of tributaries of the Dniepr basin decreased, where stable phosphate pollution was noted throughout the year. However, in 9.6% of the water samples (7.4% of the samples in 2014), the amount of biogen exceeded the limiting value by 2,5 times - in the river Plissa near the town of Zhodino, the Svisloch near the settlement of Korolishchevichi and the settlement of Svisloch, the Uza in the area of Gomel, Berezina above the town of Bobruisk and below Svetlogorsk, Dobysna. The maximum concentration (0.516 mgP/dm^3) was recorded in the water of the Svisloch river near the settlement of Korolishchevichi (Figure 35).

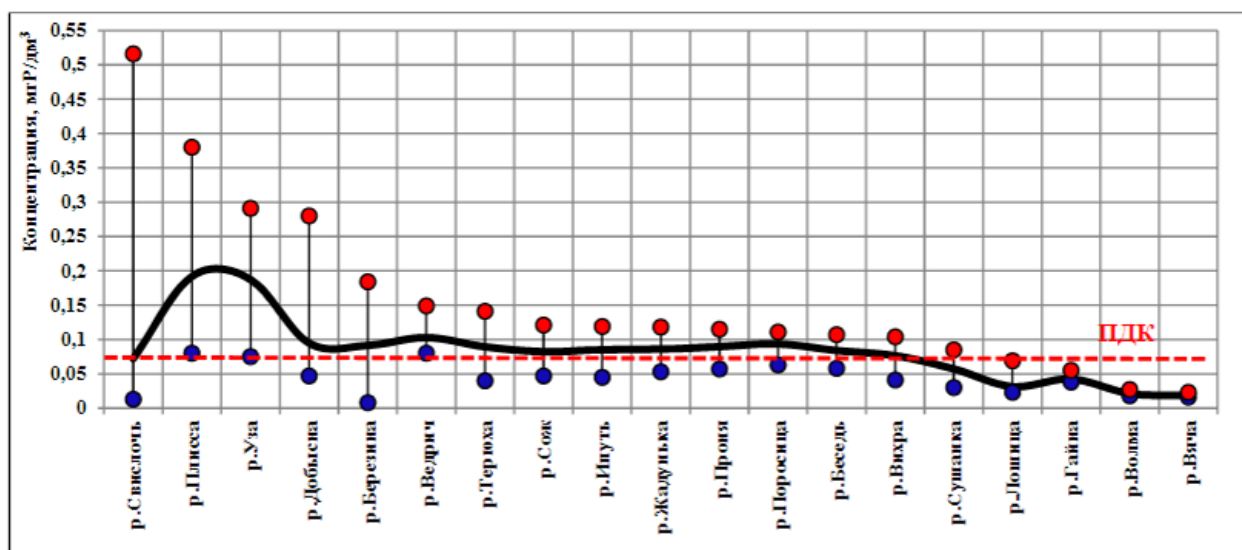


Figure 35.

In the tributaries of the Dniepr basin, the increased total content of phosphorus was recorded in 10% of the samples taken, which is slightly higher than in the previous year. The highest values were recorded in water samples taken from the Plissa river (up to 0.446 mg/dm^3) and the Dobysna (up to 0.340 mg/dm^3) in February and in the river Uza (up to 388 mg/dm^3) in August. The maximum concentration was recorded in the water of the Svisloch river near the settlement of Korolishchevichi - up to 0.650 mg/dm^3 in June (Figure 36).

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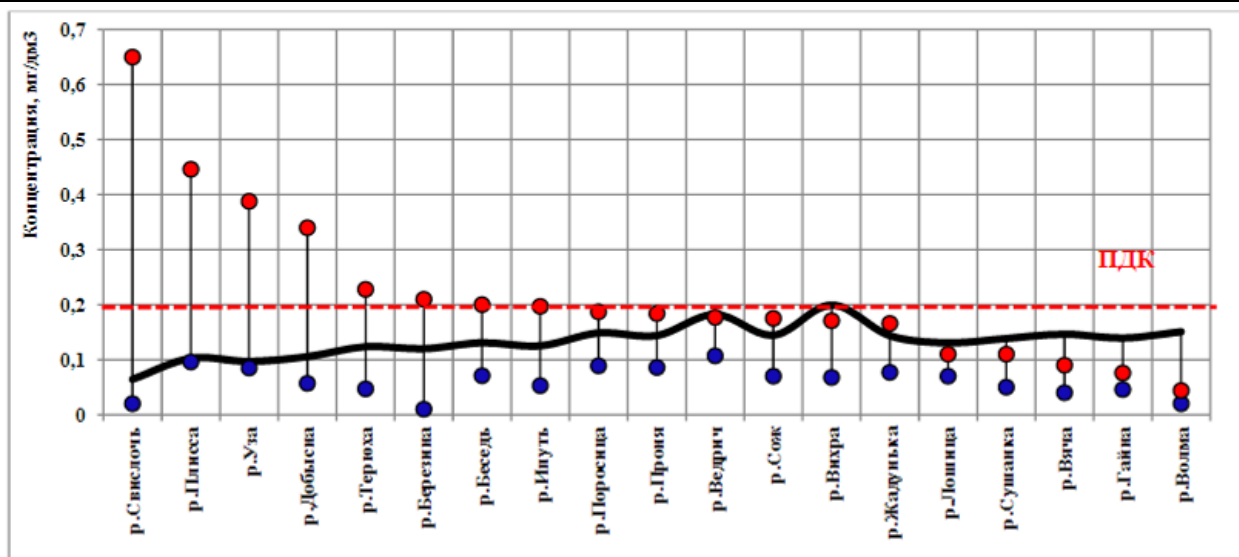


Figure 36.

During the reporting period, in 27.3% of the water samples collected in the tributaries of the Dniepr basin, an excess of the limiting value for ammonium ion was noted. The most frequent exceedances of MPC for this indicator were recorded in the water of the Svisloch river near Korolishchevichi and Svisloch settlements, Uza river in the area of Gomel, the rivers Plissa, Berezina, Loshitsa, Sushanka; the maximum value (up to 2.66 mgN/dm^3) was recorded in the water of the Svisloch river near Korolishchevichi settlement (Figure 37). In the reporting year, the water quality of the Berezina river deteriorated due to the content of the ammonium ion in it. Throughout the length from Brody settlement to Svetlogorsk, the average annual content exceeds the limiting value and amounts to $0.43\text{-}0.61 \text{ mgN/dm}^3$. The maximum concentration of 1.15 mgN/dm^3 was recorded in the river water below Borisov in February.

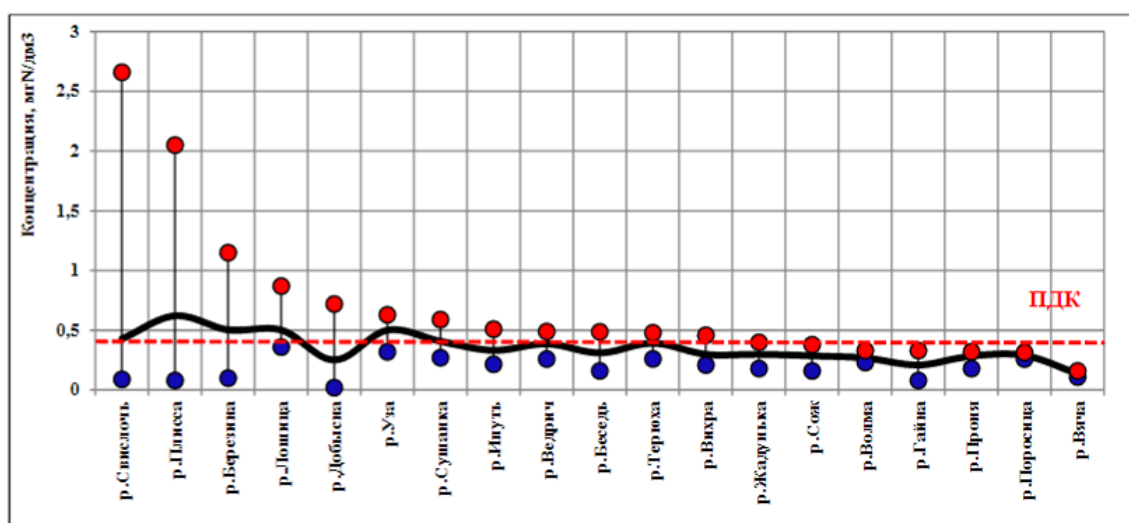


Figure 37.

The average annual nitrite ion content in the inflows of the basin varied from 0.012 mgN/dm^3 to 0.091 mgN/dm^3 . The most frequent exceedance of MPC for this indicator (in 100% of selected water samples) was recorded in the water of the river Svisloch on the section from Korolishchevichi settlement to the town of Svisloch. In the water of the Berezina river, the average annual concentrations exceeding the limiting index can be traced from the observation point below Bobruisk to the observation point below Svetlogorsk and they amount to 0.025 and 0.031 mgN/dm^3 , respectively (Figure 38).

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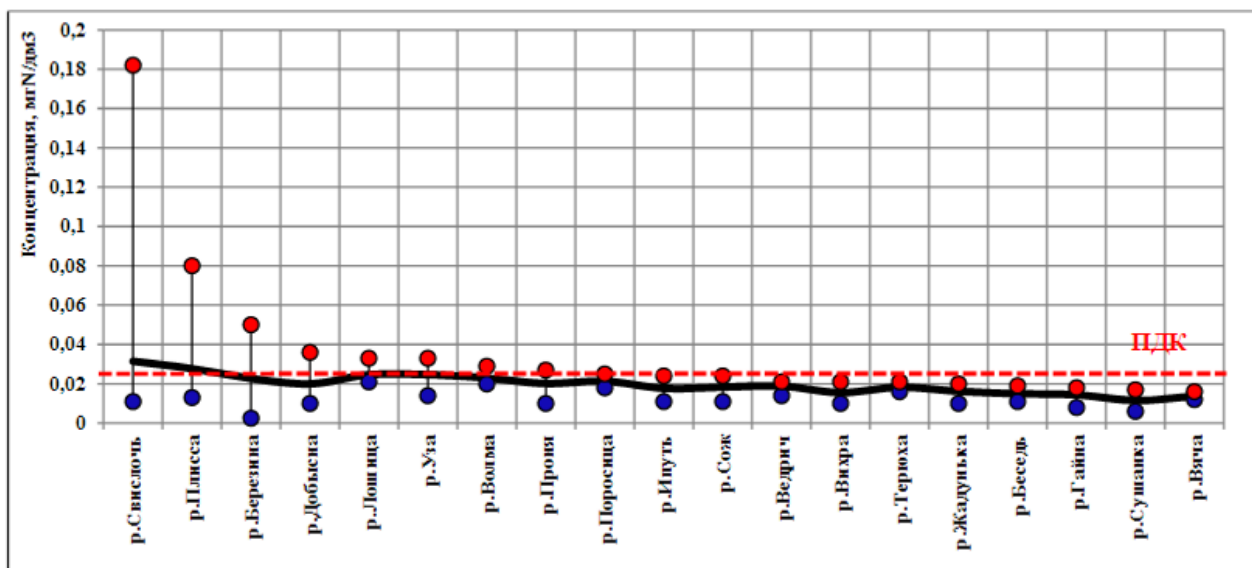
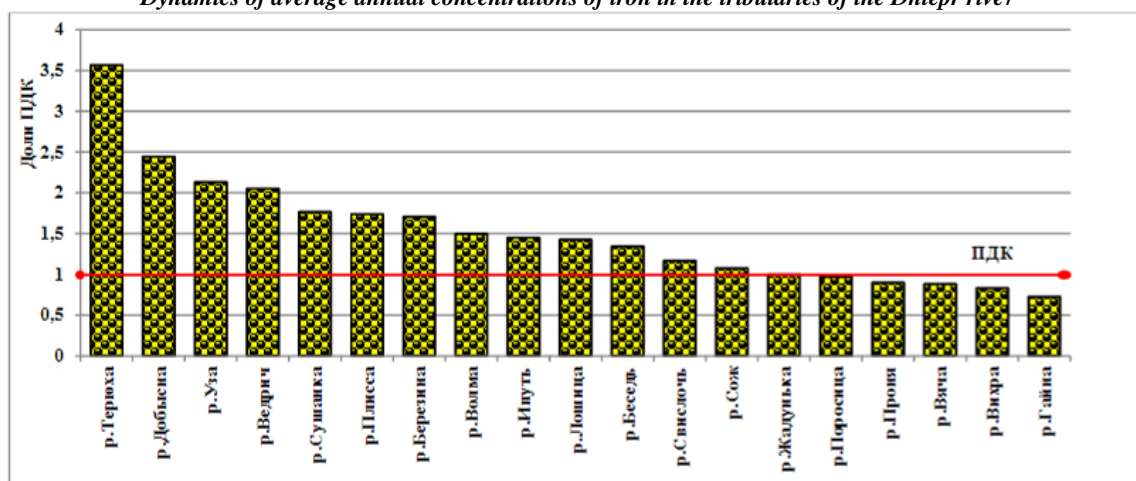


Figure 38.

The average annual concentrations of nitrate ion in the tributaries of the Dniepr river basin corresponded to the quality standards and were observed in the range from 0.20 mgN/dm³ to 3.93 mgN/dm³.

In 2015, at almost all observation points, the exceedance of the water quality standard of the tributaries of the basin was observed caused by ferrum total (74.7% of samples) and manganese (53.4% of samples). The greatest content of these metals was recorded in the water of the Teryukha river (Figure 39).

Dynamics of average annual concentrations of iron in the tributaries of the Dniepr river



Dynamics of average annual concentrations of manganese in the water tributaries of the Dniepr river

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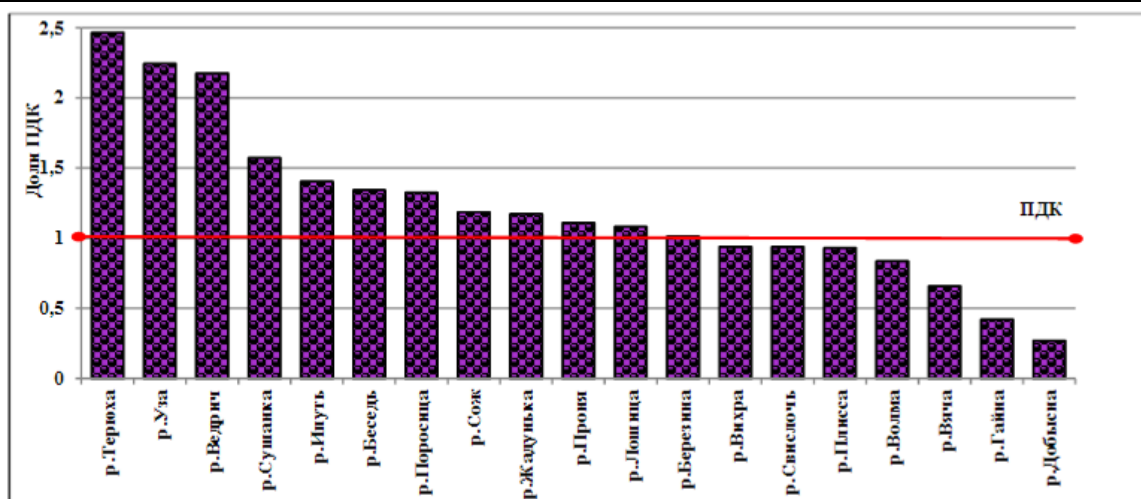


Figure 39.

As can be seen from Fig. 40, the excess of the annual average amount of copper is fixed only in the Loshitsa, Svisloch and Vyacha rivers.

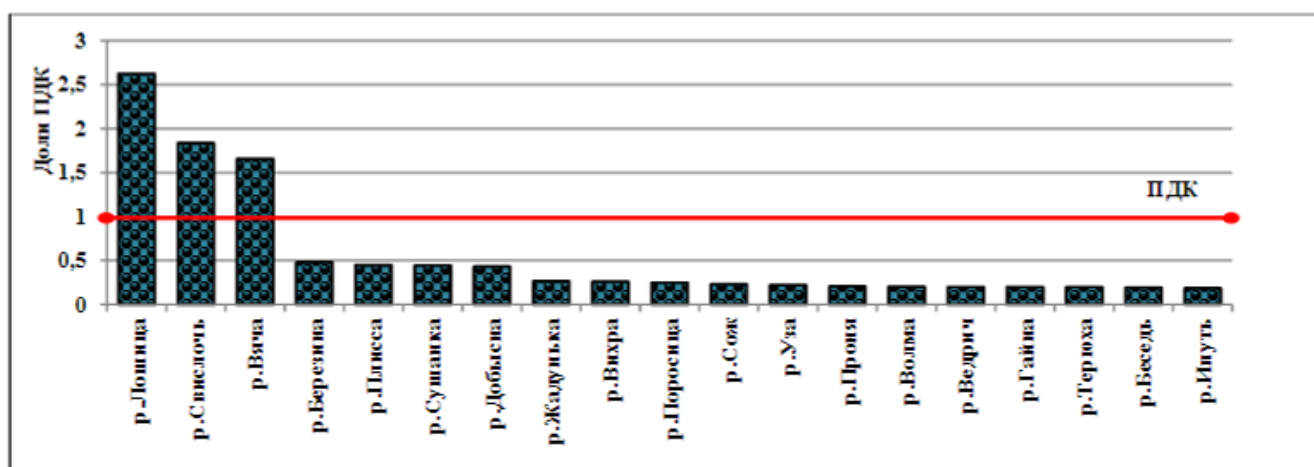


Figure 40.

The average annual zinc content varied from 0.004 mg/dm³ in the water of the Gaina river to 0.028 mg/dm³ in the Sushanka river. Exceedance of the maximum allowable concentration limit for zinc was recorded in the Vyacha, Svisloch, Loshitsa and Sushanka rivers.

Compared to 2014, the percentage of samples with exceedances of the maximum allowable concentration for petroleum products decreased from 5.3% to 3.0%. The average annual content of oil products in the tributaries of the Dniepr basin was in the range from 0.010 mg/dm³ to 0.060 mg/dm³. Increased concentrations of the ingredient from 0.092 mg/dm³ to 0.104 mg/dm³ were observed in the water of the Loshitsa and Svisloch rivers in Minsk (Aranskaya str. and near Korolishchevichi settlement).

The content of synthetic surfactants in the inflow water did not generally exceed the limiting value (0.1 mg/dm³), in only one sample of water collected in September from the Plissa river below Zhodino, the surfactants of which content reached 0.118 mg/dm³.

As can be seen from the presented data, the average annual concentrations of pollutants (phosphate ion, total phosphorus, ammonium ion, nitrite ion, nitrate ion, total ferrum, copper, zinc, petroleum products, synthetic surfactants) in the water of the Gaina River, the second-order tributary of which is the river Domelka, intersected by the projected section of the P-80 road, complied with the quality standards.

Phytoplankton. The taxonomic diversity of periphyton on transboundary sections of the Dniepr varied from 39 to 66 species and varieties, which is significantly higher than the level during the previous period of observations. Among the communities of algae fouling of tributaries of the river, diatoms prevailed (from 29 to 58 taxa).

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Diatoms dominate in the abundance (from 50.88% of the abundance in the Dniepr river near Sarvira settlement to 91.54% of the abundance in the Besed river near Svetilovichi settlement). A significant contribution to the structure of the community was also made by the green algae (up to 32.48% of the abundance in the Dniepr river near Sarvira settlement) and blue-green algae (up to 36.68% of the abundance in the river Vikhra above Mstislavl town).

The minimum value of the saprobity index was registered on the section of the Besed river near Svetilovichi (1.74) due to the dominance of oligosaprobic species. The maximum value of the index (2.01) was recorded in the Dniepr river in the Love settlement; this is due to the dominance of α -mesosaprobic diatoms.

Macrozoobenthos. The total taxonomic diversity of the *macrozoobenthos* organisms was 45 species and forms - from 31 near Sarvira settlement to 26 near the city of Loev, 18 of which belonged to *Chironomidae* and 6 to *Mollusca species*. In bottom cenoses, pure water indicating species were presented, including 3 species of *Ephemeroptera* (from the genera *Cloeon* and *Procleon*) and 4 species of *Trichoptera* (including β -mesosaprobe of *Hydropsyche* species). The values of the biotic index, as in previous years, are consistently high and equal 8.

In the transboundary sections of the tributaries of the Dniepr, the total taxonomic diversity of the bottom communities was 89 species and forms, 28 of which belonged to *Chironomidae* family (mainly from the subfamily *Chironominae*), 11 to *Mollusca* and 9 to *Odonata* (including the oligosaprobe of *Agrion virgo*). In the bottom cenoses of the river, numerous species-indicators of pure water were noted – 15 species of *Ephemeroptera* and 12 species of *Trichoptera*. The number of taxa in individual sections was in the range from 54 (the Besed river) to 38 species and forms (the Vikhra river). The values of the biotic index were stably high and equal 9.

Reservoirs of the Dniepr river basin. In 2015, observations on hydrochemical indicators were carried out on 2 lakes and 5 reservoirs, incl. at the Dubrovsky reservoir, located at a distance of about 560 m from the projected facility. The oxygen regime of the reservoirs of the Dniepr basin remained satisfactory throughout the year. The content of dissolved oxygen was indicated from 6.10 mgO₂/dm³ to 11.71 mgO₂/dm³. Elevated concentrations of the total organic matter (according to COD_{Cr}) were observed only in water of the Svetlogorskoye water reserve and lake Plavno.

The average annual content of ammonium-ion in water bodies varied from 0.15 mgN/dm³ to 0.48 mgN/dm³. The excess of biogen was recorded only in the water of the lake. During the observation period, the level of nitrite-ion and phosphorus indices in the water was satisfactory complying with the water quality standards and was within the following limits: nitrite ion <0.005-0.021 mgN/dm³, phosphate ion <0.005-0.050 mgP/dm³, total phosphorus - <0.005-0.083 mg/dm³.

The content of the nitrogen total according to Kjeldahl did not exceed the normative value and was recorded in the range from <0.5 mgN/dm³ (lake Pleven) to 1.96 mgN/dm³ (Vyacha reservoir).

Average annual concentrations of ferrum total (0.187-0.605 mg/dm³) exceeded the maximum allowable concentration in all observed reservoirs of the Dniepr river basin.

The presence of copper and zinc, exceeding the limiting values (0.0035 mg / dm³ for copper and 0.010 mg/dm³ for zinc), was recorded in the water of Vyacha, Dubrovskoye, Orekhovskoye and Plavno reservoirs. The average annual content of manganese in almost all water bodies exceeded the established standard of water quality (0.023 mg/dm³), except for the Svetlogorskoe reservoir.

The presence of oil products and synthetic surfactants in the water of the Dniepr basin was fixed in quantities meeting the established quality standards (below 0.05 mg/dm³ and 0.1 mg/dm³, respectively) [7,13].

3.3 Environmental and other restrictions

In order to preserve the useful qualities of the environment, the Law of the Republic of Belarus "On Environmental Protection" identifies areas which are subject to special protection:

- specially protected natural areas;
- habitats of wild animals and places of growth of wild plants belonging to the species included in the Red Book of the Republic of Belarus;
- natural areas of importance for reproduction, feeding, wintering and (or) migration of wild

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- resort areas, recreation areas;
- water protection zones, riverside rivers and reservoirs;
- zones of sanitary protection in places of water intake; and etc.

The projected road passes through the territory of the Minsk region (Minsk and Smolevichi districts).

Minsk region has 252 habitats of 367 species of wild animals and 245 places of growth of 60 species of wild plants included in the Red Book of the Republic of Belarus. In the region there are habitats of such rare species as the marsh turtle (Kopyl, Soligorsk districts), the cane toad (Smolevichi district), the kingfisher (Minsk region), the stream trout (Vолоzhinsky, Slutsk districts). In the Borisov and Volozhinsky districts are the habitat for the European bison. 58 species of fish live in the region's water bodies (catfish, eel, bream, ide, pike, tench, burbot, etc.), including three of the five species listed in the Red Book of the Republic of Belarus: trout brooch, grayling and barbel).

According to the Smolevichi District Inspectorate of Natural Resources and Environmental Protection, there are no places of growth of wild plants and habitats of wild animals belonging to the species included in the Red Book of the Republic of Belarus on the territory of the planned economic activity (Annex 1).

According to letter of the State Specialized Forestry Establishment "Borovlyansky Spetsleskhoz" No. 1054 dated 30 May 2017 (Annex 1), the habitats of animals and plants listed in the Red Book of the Republic of Belarus have not been identified in the zone of influence of the projected facility.

When making technical decisions on the reconstruction of the P-80 road, one should take into account the presence of this reserve.

In the area of the planned works on the reconstruction of the road section, protected plant and animal species, as well as rare biotopes and natural landscapes that are of environmental value are missing, and therefore minimal impact is expected on the reserve territory.

Also in the region of the reconstruction of the P-80 road Sloboda-Papernya, 0,000 km - 14,770 km, within the radius of 3 kilometers from the object, there are no monuments of nature of the republican and local significance (Figure 41).

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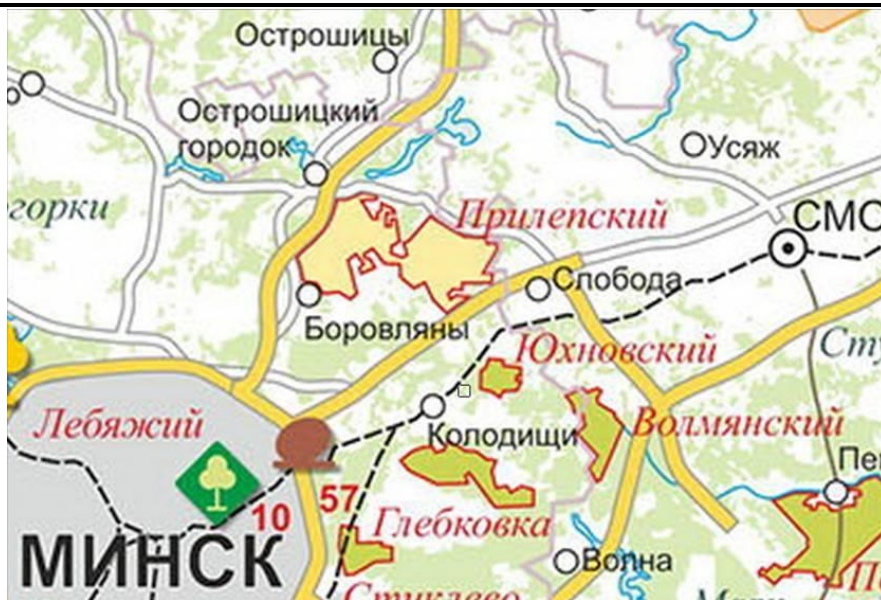


Figure 41.

Minsk region has a rich cultural heritage, there are historical and cultural values of the global cultural heritage (the Palace and park ensemble in Nesvizh and the complex of the former Jesuit monastery in Nesvizh), 9 objects of historical and cultural values of international importance.

On the territory of the region, there are 58 palace- and park complexes included in the State List of historical and cultural values of the Republic of Belarus related to the life and work of famous fellow countrymen.

On the territory of Minsk region there are 97 historical and cultural monuments included in the State list of historical and cultural values of the Republic of Belarus. They include 2 objects of the 1st category which have international significance, 32 objects of the 2nd category, which have national significance and 63 monuments of the third category of local significance.

On the territory of Smolevichy region there are 21 objects of historical and cultural values included in the State List of historical and cultural values of the Republic of Belarus, one of which is of national importance (2nd category), the rest are of local value (3rd category).

Within a radius of 3 km from the area of implementation of the planned economic activity, there are heritage objects (immovable historical and cultural values) to which the Resolution of the Council of Ministers of the Republic of Belarus No. 578 dated 14 May 2007 gives the status of historical and cultural value:

- The mass grave (1941) in the town of Ostroshitsky Gorodok;
- Church (nineteenth century) in the village of Raubichi;
- Barrow cemetery (IX-XII c.) in the village of Karpilovka;
- Mound of Glory (1969) on the 22nd km of the Minsk-Moscow highway.

All of these objects are outside the area of work for the reconstruction of the 0.000 km - 14.770 km section of the P-80 road Sloboda-Papernya and the planned activities will not have any impact on them.

In the area of the roundabout at the intersection with the P-40 road Borovlyany-Logoysk near Ostroshitsky Gorodok there is a monument - a T-34 tank, installed in memory of the servicemen of the 100th Infantry Division defending this site in 1941, and in honor of the tankers of the 5th Guards Tank Army, liberating the Ostroshitsky Gorodok in 1944 (Figure 42).

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Figure 42.

Since the existing roundabout interchange remains without reorganization, the planned reconstruction of the P-80 road will not have an impact on this monument.

According to the letter of the State Scientific Institution "Institute of History of the National Academy of Sciences of Belarus" (Annex 1), there is no information on the availability of archaeological sites on the territory of the planned works.

The State Institute for History of the National Academy of Sciences of Belarus approves the design of the facility "P-80 road Sloboda-Papernya, 0.000 km - 14.770 km".

In case archaeological artifacts are discovered during excavations, work on the site should be suspended and archaeology experts of the State Institute of History of NAS of Belarus shall be informed.

3.4 Assessment of socio-economic conditions in the region of the proposed activity

The P-80 road Sloboda-Papernya is a road of national importance and provides transportation links to nearby settlements in the Minsk region and Minsk. Intensive long-distance freight and passenger transportations are carried out on this road.

The projected section of the P-80 road 0.000 km - 14.770 km passes through the territory of the Minsk region.

Minsk region is the central, the largest region on the territory of the Republic of Belarus, which borders all regions of the republic. The area is 39.9 thousand km², the longest extension is from north to south amounts to 315 km, from east to west - 240 km. The area occupied (including Minsk) is 19.4% of the area of Belarus.

37% of the territory of the Minsk region is covered with forest - a combination of coniferous forests of Eastern European and broadleaf forests of the West European type.

The administrative division of the region is represented by 22 districts (Figure 43), 1 city of regional subordination, 2 cities of regional subordination, 18 urban-type settlements, 5207 rural settlements. The city of Minsk is not part of the region, but is a separate administrative-territorial unit.

Representative power: the regional Council of Deputies - 1, the district Soviets of Deputies - 22, the City Council of Deputies - 1; City councils of deputies of cities of regional subordination - 2, settlement and rural Soviets of Deputies - 222.

Executive power: regional executive committee - 1, district and city executive committees - 23, executive committees of cities of regional subordination - 2, settlement and village executive committees - 222.

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Figure 43.

The industry of the Minsk region is represented by more than 4 thousand enterprises, among which 350 are the large ones. The industrial complex produces 18% of the republican volume of industrial output.

The most significant activities for the region include chemical production (the share in the regional production volume is more than 32%), food production (more than 27%), machinery and equipment (about 7%), metallurgical production (more than 6%), vehicles and equipment production (more than 4%).

Chemical production has leading position in the region. The second most important for the region economic activity is the production of food products, including beverages, and tobacco. A significant place is occupied by the production of vehicles, machinery and equipment, metallurgical production, textile and clothing production, as well as the production of leather goods.

In the structure of industrial production of the republic, the region produces 100% of potassium fertilizers, 100% of roofing tiles, about 100% of cars, about 97% of quarry dumpers, more than 76% of vinegar, more than 73% of pasta, more than 64% of sugar, more than 53% of fibreboard, more than 51% of mineral water, more than 48% of soft drinks, more than 46% of chrome leather goods, more than 42% of knitted goods and much more.

8 enterprises extract mineral resources on the territory of the region, 6 of which are peat enterprises, which completely cover the region's demand for this type of fuel.

Agriculture. The region specializes in the production of milk, meat, grain, potatoes, sugar beet, vegetables and annually produces more than a quarter of the country's gross agricultural output. Agricultural lands occupy 1,622.1 thousand hectares, including arable land - 1091.1 thousand hectares, meadows - 521.2 thousand hectares, orchards - 9.8 thousand hectares.

Agricultural organizations of the region occupy 21% of the area of agricultural land in the

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republic. The square of agricultural lands per one agricultural organization is 4142 ha, 2855 ha of which are arable. 67% of lands are plowed. The score of fertility of agricultural lands is 30.4, of arable lands - 32.8, of fodder lands - 26.3.

The production of agricultural products is concentrated in 336 agricultural structures, 773 peasant (farm) farms and in 247828 personal subsidiary plots [19].

The reconstructed section of the P-80 road within the Minsk region is located in the Minsk and Smolevichi districts.

Minsk district is located in the central part of the Minsk region, the length of the region from north to south is more than 66 km, from the west to the east - about 60 km. Lining the capital with an almost regular diamond, it borders 9 of the 22 districts of the Minsk region (Figure 44). The area of Minsk region is 190 thousand hectares. The total area of settlements of the Minsk region is almost 3.5 times the area of the city of Minsk. The population of the region is 218,156 people (as of January 1, 2017).



Figure 44.

Minsk is the administrative center (it is not part of the district). Administrative-territorial division of the district is the following: the city of Zaslavl, Machulishchansky settlement council and 18 village councils: Borovlyansky, Goransky, Zhdanovichsky, Kolodishchansky, Krupitsky, Lugovoslobodskoy, Loshansky, Mikhanovichsky, Novodvorskiy, Ostroshitsko-Gorodoksky, Papernyansky, Petrishkovsky, Shershunsky, Samokhvalovichsky, Senitsky, Shomyslitsky, Yuzufovsky.

Almost one-third of Minsk region is occupied by forest. The relief is hilly, strongly crossed, the highest point is 342 meters, it is located near the village of Lysaya Gora. The depths of the Pristolochye are rich in deposits of mineral water, brick and aglopomite raw materials, sand and gravel material and construction sand.

The Ptich River and the Svisloch River with the tributaries Vyacha, Chernyavka, Volma flow on the territory of the district. The area's attractions include the reservoirs Zaslavskoe (Minsk Sea), Krinita, Drozdy, Vyacha, Volkovichi, Krylovo. A part of the Vileysko-Minsk water system passes through the district.

The economy of the Minsk region is determined by over 18,000 business entities, including about 10,000 legal entities and over 7,000 individual entrepreneurs. The number of employed in the economy is 137.7 thousand people.

Minsk district is known in the republic as the most important agro-industrial complex, which specializes in the production of milk, meat, eggs, grain, potatoes, sugar beets, vegetables. Today there are 14 agricultural organizations and 75 farms in the district. For many years, the following agricultural enterprises have been demonstrating stable results: RUE "Agrokombinat "Zhdanovichi", OJSC "Gastellovskoye", OJSC "Ignatichi", OJSC "Shchomyslitsa", Communal agricultural unitary enterprise "Minsk Vegetable Factory", OJSC "RAPS".

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<p>material and construction sand.</p> <p>The Ptich River and the Svisloch River with the tributaries Vyacha, Chernyavka, Volma flow on the territory of the district. The area's attractions include the reservoirs Zaslavskoe (Minsk Sea), Krinitsa, Drozdy, Vyacha, Volkovichi, Krylovo. A part of the Vileysko-Minsk water system passes through the district.</p> <p>The economy of the Minsk region is determined by over 18,000 business entities, including about 10,000 legal entities and over 7,000 individual entrepreneurs. The number of employed in the economy is 137.7 thousand people.</p> <p>Minsk district is known in the republic as the most important agro-industrial complex, which specializes in the production of milk, meat, eggs, grain, potatoes, sugar beets, vegetables. Today there are 14 agricultural organizations and 75 farms in the district. For many years, the following agricultural enterprises have been demonstrating stable results: RUE “Agrokombinat “Zhdanovichi”, OJSC “Gastellovskoye”, OJSC “Ignatichi”, OJSC “Shchomyslitsa”, Communal agricultural unitary enterprise “Minsk Vegetable Factory”, OJSC “RAPS”.</p>						
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The industrial potential of Minsk district determines the directions of development of the most important economic activities: metallurgical production and production of finished metal products (24,0) food production (31,6%), production of rubber and plastic products (9,4%), production of vehicles and equipment (12.7%).

In recent years, the district has developed a positive trend in the development of industrial production. The share of the district in the Minsk region was 20%. On the territory of the district there are enterprises that produce import-substituting products: a group of companies "Alutech" (metal structures and profiles from aluminum alloys), FPUE "Coswick" (parquet), Henkel Bautechnik JLLC (building mixes), FUE "Medindustriya Servis", IE Inkraslav (liquid soap, washing, cleaning and disinfecting agents), "Zaslavsky Paint and Varnish Factory" LLC (paint), "Master Flex" LLC (packaging tape with printed drawing), PUE "Enisei" (glassware), "Effective Packaging Systems" LLC (PET-Preform polyamide artificial casing), CJSC "Uniflex" (roll packaging and labels, photopolymer printing plates) and others.

The retail trade network of Minsk region has more than 450 objects of trade and public catering. 11 shopping centers with an area of 217 thousand square meters and markets with a sales area of more than 2000 square meters: construction market, automotive and clothing market "Torgovyj Dom - Koltso" CJSC. One of the directions of development of retail trade network is the opening of roadside service facilities (43 public catering facilities).

The educational area of the district consists of 42 institutions of general secondary education: 2 gymnasiums, 1 lyceum, 28 secondary schools, 2 primary schools, 9 educational and pedagogical complexes of the "school-kindergarten" type; 47 institutions of preschool education, 2 institutions of additional education: State Institution of Additional Education "Children and Youth Creativity Center of Minsk region", State Institution of Additional Education "Center for Tourism and Local History of Children and Youth "Vetraz", SUE "Center for Correction and Developmental Education and Rehabilitation", State Educational Institution "Minsk Regional Socio-Pedagogical Center". State Educational Institution "Children's Village "Istoki", children's health camp "Lesnoy Gorodok".

The healthcare system of the Minsk district includes 31 treatment and prevention organizations with a capacity of stationary units of 636 beds and outpatient clinics for 2 510 visits per shift.

There is a residential development of 4 settlements near the P-80 road in the Minsk district: Ostroshitsky Gorodok town, Beliye Luzhi village, Okolitsa village, Raubichi village, belonging to the *Ostroshitsko-Gorodoksky village council*.

In 16 settlements there are about 6 thousand people. The village council center is Ostroshitsky Gorodok, the area of land is more than 5 thousand hectares.

On the territory of the village council "Ostroshitsko-Gorodokskaya Secondary School" is functioning, as well as a kindergarten and the Republican Children's Hospital for Medical Rehabilitation. Training and production plant, where senior students master the profession of seamstress, tractor driver, driver and seller, is housed in a building that has a rich history.

Post office, a branch of OJSC "Belarusbank", a pharmacy, a number of food and manufactured goods stores, a library, a rural house of culture, a cafe, a bathhouse, a district department of the Ministry of Emergency Situations, a comprehensive reception center are at the service of the villagers. Medical help villagers can get in the medical outpatient clinic.

A number of enterprises of various forms of ownership function on the territory of the village council, including: OJSC "1st Minsk Poultry Factory" "Ostroshitsky Gorodok" and "Okolitsa" branches, "Engineering Center AMT-ENGINEERING" LLC, RMS-10, forestry, District Electric Network service "Ostroshitsky Gorodok", "Ozerny" residence, Training Center of the National Bank of the Republic of Belarus.

In 1974 the sports complex "Raubichi" was opened. Located on the territory of the Minsk Morainic Upland (the last, the fifth, the glacier stopped here), Raubichi is called the Belarusian Switzerland.

The sports complex is known far beyond its borders. A lot of people are actively engaged in winter sports here: jumping, skiing, slalom, biathlon and skiing.

A catholic church is located among the forest massif. It was built in 1758-62 and in four years after its construction the catholic church was converted into the Orthodox Uspensky Church. In 1976, after the restoration, the temple was adapted to the exposition of the Museum of Belarusian Folk Art.

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Today Uspensky Church in Raubichi is visited by more than 10 thousand people a year.

The battles under Ostroshitsky Gorodok occupy a special place in the history of the first days of the Great Patriotic War. Here, at the height of Janochkin Gorka hill, enemy tanks were stopped by Molotov cocktails. The 100th rifle division steadfastly held back the onslaught of the Germans for three days and defended the line assigned to it, destroying several hundreds of fascists and up to 30 enemy tanks. Deterrence of the enemy contributed to the evacuation of residents from the capital. Twenty-six years after the war, a T-34 tank was hoisted on a mass grave, the marble slabs carved the names of the warriors set by the forensic scientists on the medallions of the dead.

Over the years, officers and soldiers of the military unit 3310 of the internal troops patronize the memorial complex at Logoysk highway. Rallies and memorable meetings with the participation of veterans, the public, schoolchildren of the Ostroshitsky-Gorodok village council are held near the tank monument.

The memory of the underground workers and fellow villagers who died during the Great Patriotic War was immortalized on the obelisk, which was erected in the central square of Ostroshitsky Gorodok on the initiative of local schoolchildren on 3 July 1964, on the day of the 20th anniversary of the liberation of Belarus. [20]

2,800 people live in Ostroshitsky Gorodok (as of 01 January 2017). The social infrastructure of the agro-town is well developed.

483 people reside in the village of Raubichi, 22 people - in the village of Bely Luzhi; the inhabitants of these villages use the social infrastructure of Ostroshitsky Gorodok. In the village of Okolitsa there are 538 people, 819 people live in the military camp. On the territory of the military camp there is a post office; there are shops in the village. The nearest school, a kindergarten and other objects of social welfare of the non-residents are in Ostroshitsky Gorodok.

Smolevichi district is located in the north-east of the Minsk district, in the central part of the Minsk region, 35 km from the city of Minsk (Figure 45). The area of the district is 1.39414 thousand km². The length from the north to the south is 43 km, from the west to the east - 42 km, the Administrative Center is the town of Smolevichi; the population of the district is 45 308 people, including 16 547 people living in Smolevichi. On the territory of the district there are 190 settlements and 9 village councils: Drachkovsky, Zhodino, Zabolotsky, Zeleno-Borsky, Kurgan, Ozeritsko-Slobodskaya, Pekalinsky, Plissky, Usyazhsky. The territory of the district includes Zhodino which is the city of the regional subordination and the regional village of Sokol, which administratively reports to the Oktyabrsky district of Minsk.



Figure 45.

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The main industrial enterprises of the city and district are OJSC "TBZ "Usyazh ", OJSC "Smolevichi Factory of Reinforced Concrete Products", OJSC "Krasnoye Znamya", OJSC "Zelenoborskoye", branch of "DEM-Smolevichi", "Dorelektromash" LLC, branch of OJSC "Gomeldrev", "Parketny Zavod", "SarmatTermoEngineering" LLC, "SnackPro" LLC, "Unimitit" LLC, "Bel HuaweiTechnologis" LLC, Branch No. 1 of IE "Muenix", "SMIavtotrans" LLC, SE "Minsk Regional Technopark".

The basis of agricultural production in the region is formed by the grossing farms - PUE "Ozeritsky-Agro", SE "Zhodino AgroPlemElita", JSC "Smolevichi Broiler".

In 2016/2017 the system of education, sports and tourism of Smolevichi district represents 45 institutions. 2131 pupils are taught at establishments of preschool education.

Near the existing P-80 road in Smolevichy district there is a residential development of 3 settlements: Baguta village, Sosnovaya village, and Sloboda village, belonging to the *Ozeritsko-Sloboda village council*.

The center of the village council is the agro-town of Sloboda which is located 19 km from the city of Minsk in the Moscow direction. The total area of the village council is 1590 hectares. It includes 28 settlements with a population of 5,251 people.

There is the Minsk-National Airport Minsk-2 road which passes through the territory of the village council and a railway branch that connects Minsk with Borisov. Passenger and commodity trains of national and international importance pass through the station.

The village of Ozeritsko-Sloboda includes 28 settlements. The total number of permanent residents is 5,251 people, 3151 of which are of working age, 1093 are under the working age, and 1,007 are over the working age.

There are 42 allotment associations on the territory of the village council.

List of agricultural organizations includes the following:

- PUE "Ozeritskiy-Agro" specializes in vegetable growing on open and closed soil, plant growing and fodder production, cattle breeding.
- JSC "Smolevichi-Broiler" specializes in the production of poultry chicken broilers, the production of meat and sausage products and semi-finished products, the production of livestock and crop production, egg production, retail trade.

Small business objects:

- "Laboratoriya Kachestva" LLC, PTUE "Filney", "Galagroupinvest" LLC, CJSC "Istella Rosa", PE "Obmetko" in Sloboda town.
- Commercial and industrial private unitary enterprise "Kupalinka-2000" in the village of Luzhka, Zadomlya village, Sloboda town.
- PE "Beltekhstroy", NG CJSC "Malkut" in the village of Skurati.
- Shalamov PE in Domashany village and Luzhki village.
- "GubisAgro" LLC in the village of Anoshki.
- PUE "Stroznits" in the village of Prilepy.
- "Alkiona" ALC in the village of Dubrova.
- "Midivisana" LLC in the village of Dinarovka.

Trade infrastructure: trade is represented by shops of Smolevichi district and private entrepreneurs, outbound trade is organized.

Services: complex-reception center at Sloboda town.

Communication: post offices at Sloboda town and Prilepy village.

Healthcare: Ozeritsko-Slobodskaya medical outpatient clinic (Slogoda town), Prilepsk medical outpatient clinic (Prilepy village).

Education: State Educational Institution "Ozeritsko-Slobodskaya Secondary School", State Educational Institution "Educational and Pedagogical Complex "Prilepsky Kindergarten - Secondary School", State Educational Institution "Ozeritsko-Slobodsky Kindergarten".

Culture: Ozeritsko-Sloboda village library.

Religious organizations: Parish of the Intercession of the Holy Virgin. Work is underway to complete the construction of the Holy Patronage Church in Sloboda town with the improvement of the adjacent territory [21].

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Over the past few years, the structure of the population of the Minsk region has been dominated by women, both among urban and rural populations. The age and sex pyramid of the population is shown in Figure 48.

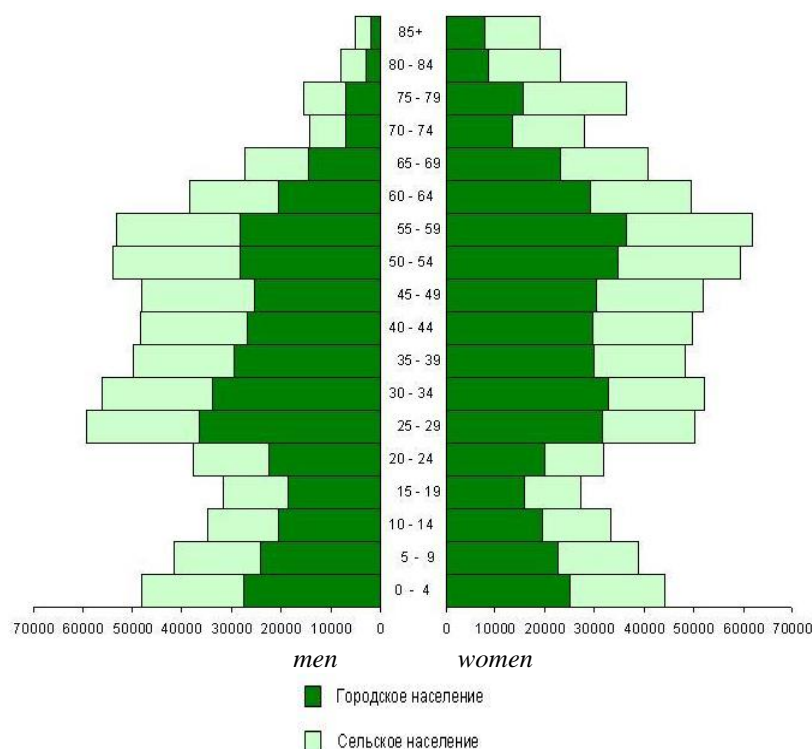


Figure 48.

The demographic situation in the Minsk region is fundamentally different from the rest of the country, the region is characterized by an increase in the population (both urban and rural), positive dynamics of natural and migration growth, which is primarily due to the proximity of the capital and the availability of its infrastructure. The main demographic indicators of the Minsk district of the Minsk region are presented in Table 19 [22].

Table 19.

Indicator	2011	2012	2013	2014	2015	2016
Population (at the beginning of the year), people						
– Minsk district	164 305	168 053	172 818	179 164	188 264	200 115
urban population	21 736	21 947	22 140	22 460	22 847	23 466
rural population	142 569	146 106	150 678	156 704	165 447	173 649
Indicator	2010	2011	2012	2013	2014	2015
Number of births	2 643	2 643	2 896	2 905	2 933	3 280
Number of deaths	1 909	2 001	1 836	1 807	1 722	1 874
Natural increase, decrease (-)	734	642	1 060	1 098	1 211	1 406
Number of the incomers	9 079	9 366	9 499	11 455	13 677	16 931
Number of the leaving people	6 155	6 260	5 794	6 207	5 758	6 516
Migration growth, decrease (-)	2 924	3 106	3 705	5 248	7 919	10 415

For the Smolevichi region as a whole, a slightly different picture of demographic processes is typical. The main demographic indicators of the Smolevichi district of the Minsk region are presented in Table 20 [22].

Table 20.

Indicator	2011	2012	2013	2014	2015	2016
Population (at the beginning of the year), people						
– Smolevichi district	42 935	42 827	43 209	43 517	43 866	45 308

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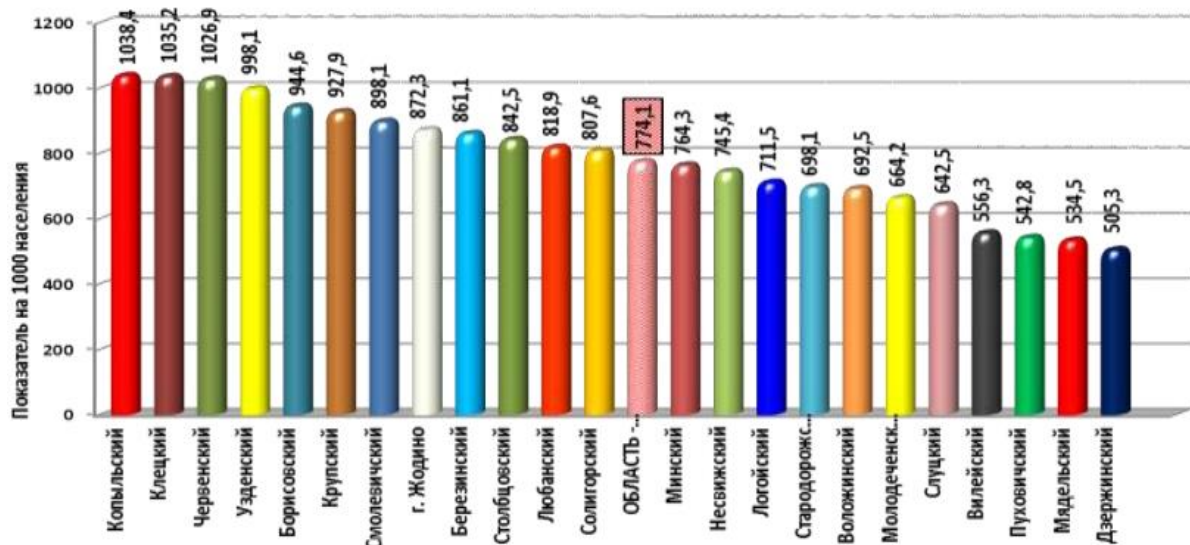


Figure 50.

In comparison to 2014, in most regions of the Minsk region, an increase in the incidence of primary morbidity in the population, including in Minsk and Smolevichi regions, was noted, with the observed increase in the incidence in the Minsk region higher than the primary incidence rate in the region and the republic as a whole. The indicators of primary incidence of the population in the above areas (per 1000 population) for the period 2000-2015 are given in Table 21.

Table 21.

Administrative unit	2000	2005	2010	2013	2014	2015	2015/2014 (growth in %)
Minsk district	680,0	707,4	694,3	709,4	724,7	764,3	+5,5
Smolevichi district	539,6	634,0	780,9	852,8	891,0	898,1	+0,8
Minsk region	751,2	793,0	796,8	790,6	737,4	774,1	+5,0
Republic of Belarus	723,5	774,4	816,7	813,8	758,8	781,2	+3,0

The leading cause of morbidity for many years remain respiratory diseases, which represent one of the most common pathologies in the structure of both general (29.1%) and primary (52.1%) morbidity (Figure 51).



Figure 51.

The second place in the structure of the primary morbidity of the population is traditionally occupied by injuries, poisoning and some other consequences of external causes (9.0% in adults, 3.5% of children). The prevention of injuries and their adverse consequences remain a key direction in

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preserving the health of the population, especially children and youth.

The third place in the proportion is occupied by the diseases of the musculoskeletal system - 5.7%. A serious problem for the Minsk region remains the incidence of the adult population with diseases of the circulatory system. Despite the fact that in the specific weight of the whole pathology this group occupies only the 4th place and makes up 3.9% in the structure of primary morbidity, it is the leading cause of mortality and disability of the adult population. Prevention and treatment of diseases of the circulatory system is currently one of the priority health problems.

Pathology of the neoplasms class remains one of the topical problems of medicine and public health. These diseases occupy the third place (after diseases of the circulatory system and old age) among the causes of death of the population of the Minsk region. High economic losses due to premature mortality and disability of the population put oncology in a number of socially significant problems.

In 2015, 16437 cases of neoplasms were registered in the Minsk region, 36.1% of which were malignant. The primary incidence rate was 11.6 per 1000 population, which is 7.4% higher than in the previous year.

Healthcare and strengthening of public health, prevention of diseases is a complex problem requiring the development of appropriate measures to overcome the accumulated problems in the field of public health with a view to effectively maintaining and strengthening the medical and demographic potential of the society.

The P-80 road Sloboda-Papernya is a road of the national importance which provides transportation links to nearby settlements in the Minsk region and Minsk city. Intensive long-distance freight and passenger transportations are carried out on this road.

Reconstruction of the section of the P-80 road will complete the construction of the Second Ring Road around the city of Minsk according to the parameters of the I category with a total length of 160 km, including the combined sections of the M-1 / E30 and M-2 roads.

The second ring road around Minsk will be the main transport corridor for the travelling transit traffic bypassing the capital, as well as for transport communications of the developing suburban zone with satellite cities: industrial ones - Dzerzhinsk, Zhodino, Fanipol; Agroindustrial cities and towns - Smolevichi, Stolbtsy, Uzda, Rudensk; Tourist-recreational ones - Zaslavl, Logoisk.

Currently, the P-80 road Sloboda-Papernya is a two-lane road, such roads are a place of increased injuries as a result of road accidents. Reconstruction of the highway provides for dividing the traffic flows into separate lanes by several meters of free space and emergency barriers, as well as installing non-traumatic signal posts, road signs, marking of the roadway, etc. Consequently, the project will have a positive impact on road safety and reduce the number of incidents on the road.

Modernization of the road will improve its transport and operational parameters, which, in turn, will have a direct impact on aspects of socio-economic development, such as road sector productivity, business efficiency and living standards.

With the improvement of transport-operational indicators of the road, the volume of cargo transportation will increase, roadside service will develop, which will lead to an increase in the socio-economic indicators of the region.

Thus, the reconstruction of the section of the P-80 road Sloboda-Papernya, 0,000 km - km 14,770, on the whole will have a positive impact on the socio-economic indicators of the region and the living conditions of the population.

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4. SOURCES AND TYPES OF IMPACT OF THE PLANNED ACTIVITY ON THE ENVIRONMENT

Possible impacts of the reconstructed section of the P-80 road Sloboda-Papernya, 0.000 km - 14.770 km, on the environment are related with the following:

- construction works;
- functioning of the facility as an engineering structure and with the action of mobile sources of influence - motor transport (operational impacts).

The impacts associated with construction work are, as a rule, temporary. Operational impacts will be manifested during the period of operation of the projected facility.

The main source of the direct impact of the road on human and the environment is the movement of vehicles.

It has the following impact:

- pollution of the environment by exhaust gases from the engines of vehicles moving along the road;
- pollution by dust and products of deterioration of a road covering and automobile tires during the movement of motor transport;
- pollution by surface runoff from the roadway of the soil cover, surface water sources, adjacent to the road of various types of vegetation;
- acoustic impact;
- influence on the flora and fauna by reducing the "quality" of the habitat;
- pollution of the roadside by industrial and domestic garbage.

The criterion of significance of such impacts is the safety of human life and health, the preservation of natural ecosystems.

Depending on the intensity, composition of traffic and road conditions, the magnitude of harmful impacts can be different, the zone of their distribution varies.

The area in which changes occur due to the construction or operation of a road is called the road impact zone. One-time excess of background contamination of the components of the natural environment, not reaching the maximum permissible values, is possible in the impact zone. The living or staying of people in this territory is almost safe and does not require restrictions. At the same time, certain changes in the environment affect vegetation, animals, and lead to gradual transformation of the landscape.

In accordance with the Sanitary norms and rules "Requirements for the Organization of Sanitary Protection Zones of Enterprises, Structures and Other Objects that are subjects of Impact on Human Health and the Environment" approved by the Resolution of the Ministry of Health of the Republic of Belarus No. 35 dated 15 May 2014 [23]; it is regulated that roadside clear zones shall be created on the republican highways. The size of roadside clear zones is determined in each specific case on the basis of calculations of the dispersion of pollutant emissions in the ambient air and the spread of physical impacts. The roadside clear zone should ensure an adequate level of public health safety from the harmful effects (chemical, physical) at its border and beyond it.

The roadside clear zone has a SPZ regime, except for the requirement to develop a SPZ project.

Estimated size of the roadside clear zone from the projected section of the road P-80 Sloboda-Papernya, 0,000 km - 14,770, km will be determined in each specific case, incl. taking into account the need to implement a complex of noise protection measures of an active and passive nature in a number of residential areas, at subsequent design stages as part of the "Environmental Protection" section.

The size of the roadside clear zone from the projected section of the road is established from the border of the territory of the facility. The volume of emissions of pollutants into the atmospheric air from unorganized sources will be more than 30% of the total emission.

4.1. Exposure to atmospheric air. Forecast and assessment of changes of its condition

In accordance with the sanitary norms and rules "Requirements for Atmospheric Air in Populated Areas and Places for Mass Recreation of the Population" approved by the Resolution of the

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Ministry of Health of the Republic of Belarus No. 141 dated 30 December 2016 [24], when placing, designing, constructing and operating facilities, measures of reduction of emissions pollutants into the air to indicators that ensure compliance with MPC or Indicative safe exposure level (ISEL) [25], using low-waste and non-waste technologies shall be taken, as well as measures to reduce or prevent, among other things, the release of pollutants.

The main sources of air pollution during the construction of the road will be the following: operation of road construction equipment and vehicles for excavation, pavement; vehicles for the transportation of soil, building materials, fuel and lubricants; workers performing construction and installation work; mechanical processing of building materials; minor repairs, painting works, etc.

Most of these types of impacts are insignificant, the problem of impact can be solved during the project implementation by implementing environmental measures to prevent and minimize them.

The main sources of pollution of the atmosphere during the roads operation are the vehicles which move along them. The impact of road transport on the atmosphere is mainly related to the emissions of exhaust gases from cars and traffic noise.

The amount and composition of exhaust gases is determined by the design features of motor vehicles (for different groups of motor vehicles, depending on the type of fuel, type and power of the engine), the mode of operation of the engines, the technical condition of the vehicles.

The forecasted degree of pollution of the atmosphere from moving vehicles is determined by the amount of run-off emissions that depend on the specific emissions of pollutants, the quality of the road surface, the intensity, composition and mode of traffic on the road.

According to the data on traffic intensity, carried out by the specialists of the State Enterprise "Belgiprodor: in December 2016 and May 2017, the current average annual traffic intensity on the projected section of the P-80 road Sloboda-Papernya, 0.000 km - 14.770 km is from 4346 and up to 9256 cars per day. The composition of the traffic is dominated by passenger transport, which is about 66-80% of the total flow. The movement of heavy-duty road trains is 8-17%.

The average annual daily and maximum hourly traffic intensity was calculated in accordance with GOST 32965-2014 "Roads of Public Use. Methods for Recording the Traffic Flow Intensity".

When determining the prospective traffic intensity, an annual increase in the traffic intensity of vehicles along the road, taken at a rate of 2.1% for trucks, buses, minibuses and 3.3% for cars was taken into account.

To calculate the emission of pollutants into the air from the movement of vehicles, the average-weighted traffic intensity was considered.

The composition of the traffic flow and the weighted average traffic intensity of the vehicles on the reconstructed section of the P-80 road Sloboda-Papernya, 0.000 km - 14.770 km for a 20-year period, are provided in Table 22.

Table 22.

Calculation model *	Intensity of traffic of vehicles		
	Per day	Per hour	Maximum per hour
Passenger car (petrol, gas)	7490	654	890
Passenger car (diesel)	1872	164	222
Minibus (petrol, gas)	247	22	29
Minibus (diesel)	371	32	44
Truck (petrol, gas)	248	22	29
Truck (diesel)	373	33	44
Truck, more than 3,5 t (diesel)	1629	142	194
Bus (diesel)	95	8	11
Total	12325	1077	1463

* Classification of motor vehicles is given in accordance with TCCP 17.08-03-2006 (02120) "Environmental Protection and Nature Management. Atmosphere. Emissions of Pollutants and Greenhouse Gases into the Air. Rules for Calculating Emissions of Motor Vehicles in Human Settlements" (item 5, table 5).

The list of pollutants and the amount of expected emissions into the atmosphere for road transport are determined in accordance with TCCP 17.08-03-2006 (02120) "Environmental Protection and Nature Management. Atmosphere. Emissions of Pollutants and Greenhouse Gases into the Air.

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Rules for Calculating Emissions of Motor Vehicles in Populated Areas", taking into account changes No. 1 and No. 2.

The following traffic parameters are used to calculate emissions of pollutants and greenhouse gases:

- composition and intensity of motor vehicles traffic;
- speed of traffic flow;
- length of the projected road section;
- number of traffic stops.

Estimated emission values, g/s (calculated from the maximum intensity values) and t/year (calculated from average intensity values) are presented in Table 23.

Table 23.

Name of the substance	Emission of the pollutant		
	g/day	g/sec	t/year
Carbon oxide (CO)	650 824	0,894143	237,551
Nitrogen oxides (NO _x)	300 546	0,412909	109,699
Volatile organic compounds (VOC)	108 170	0,148611	39,482
Methane (CH ₄)	6 121	0,008409	2,234
Solid particles (PM)	11 662	0,016022	4,257
Non-Methane Volatile Organic Compounds (NMVOC)	102 050	0,140202	37,248
Carbon dioxide (CO ₂)	29 180 422	40,090	10650,854
Sulfur dioxide (SO ₂)	7 959	0,010934	2,905
Cadmium (Cd)	0,093	1,275·10 ⁻⁷	0,000034
Chrome (Cr)	0,463	6,359·10 ⁻⁷	0,000169
Copper (Cu)	15,742	0,000022	0,005746
Nickel (Ni)	0,648	8,908·10 ⁻⁷	0,000237
Selenium (Se)	0,093	1,275·10 ⁻⁷	0,000034
Zinc (Zn)	9,260	1,272·10 ⁻⁵	0,003380
Ammonia (NH ₃)	8 371	0,011500	3,055
Nitrogen dioxide (N ₂ O)	7 948	0,010919	2,901
Indeno (1,2,3-cd) pyrene	0,184	2,530·10 ⁻⁷	0,000067
Benzo (k) fluoranthene	0,198	2,717·10 ⁻⁷	0,000072
Benzo (b) fluoranthene	0,266	3,651·10 ⁻⁷	0,000097
Benzo(ghi)perylene	0,398	5,473·10 ⁻⁷	0,000145
Fluoranthene	3,389	4,656·10 ⁻⁶	0,001237
Benzo(a)pyrene	0,104	1,427·10 ⁻⁷	0,000038
Dioxins	0,001310	1,800·10 ⁻⁹	4,783·10 ⁻⁷
Furans	0,002740	3,765·10 ⁻⁹	1,000·10 ⁻⁶
Alkane	25 725	0,035342	9,389
Alkenes	22 609	0,031061	8,252
Alkynes	6 439	0,008847	2,350
Aldehydes	4 409	0,006057	1,609
Ketones	327	0,000449	0,119194
Cycloalkanes	898	0,001234	0,327783
Aromatic hydrocarbons	50 805	0,069800	18,544
Total, including carbon dioxide:			11 130,789
Total, excluding carbon dioxide:			479,935

The total volume of gross emissions from traffic on the reconstructed section of the P-80 road Sloboda-Papernya, 0.000 km - 14.7707 km, will be **11 130,789** tons per year, the largest values of gross emissions are expected for dioxide and carbon monoxide, nitrogen dioxide.

In the structure of the reconstructed object, the sources of emission of pollutants into the atmosphere can also be the engines of cars located at recreation areas and parking lots. The reconstructed section of the P-80 road provides for the location of two small recreational areas: at km 5.35 on the right and at km 5.6 on the left.

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Recreation areas are designed with separate entry and exit. The configuration of the sites provides for separate parking of cars and trucks, the scheme for placing machines presupposes their parking at an angle of 45°. The territory of recreational areas is planned with the allocation of a parking zone for heavy vehicles and buses and a parking lot for passenger cars.

At the subsequent stages of the design, after the configuration of the rest areas and parking lots, the number of car spaces for cars, heavy vehicles and buses has been specified, the emission of pollutants will be calculated in accordance with Regulating Document 0212.2-2002 "Calculation of Emissions of Pollutants into the Air from Stationary Sources of Road Transport Enterprises ". For diesel-fueled cars, five pollutants are calculated: carbon monoxide CO, hydrocarbons CH, nitrogen oxides NOx, calculated as nitrogen dioxide NO2, solid particles C, sulfur compounds (calculated as SO2). For cars operating on gasoline fuel, the emission of carbon monoxide CO, hydrocarbons CH, nitrogen oxides Nox (calculated as nitrogen dioxide NO2) sulfur compounds (calculated as dioxide Sulfur SO2) are calculated.

As the long designing experience shows, the annual emission of pollutants in the recreation area does not exceed 0.7 tons / year.

In order to organize the maintenance of the road in winter and ensure the proper transport and operational condition of the road, comfortable and safe transportation of vehicles on it, in accordance with the task to develop a feasibility study for investment, it is planned to build a salt warehouse with a capacity of 2500 tons on the territory of the existing LRD- 54 (Ostroshitsky Gorodok town).

Currently, the storage of sand and salt mixture is openly carried out on the asphalted area. The planned construction of a closed warehouse for storage of anti-icing materials will prevent their moistening, caking and frosting, and also eliminate the negative impact of salt on the environment.

At the subsequent stages of the design, the list of polluting substances, the amount of emissions should be defined in the section of the project documentation "Environmental Protection". During the preparation, storage and release of anti-ice materials, as a rule, dust is released into the atmosphere with inorganic dust of silica content of less than 70% and solid particles. Also, the source of air pollution can be the movement of road machinery and vehicles on the territory of production sites. Nitrogen dioxide, soot, sulfur dioxide, carbon monoxide, saturated hydrocarbons C₁₁-C₁₉ are also released.

Since residential development is located in the immediate vicinity of the border of the existing LRD-54 base, it is necessary to develop a design of a sanitary protection zone at the subsequent design stages to adjust the basic size of the SPZ (50 m) with the justification of the adequacy of the designed (calculated) SPZ boundaries and the assessment of the health risk of the population.

The draft sanitary protection zone is subject to sanitary and hygienic examination in accordance with the procedure established by law (clause 10.25 of the "Unified List of Administrative Procedures Carried Out by State Bodies and Other Organizations with Respect to Legal Entities and Individual Entrepreneurs" approved by Resolution of the Council of Ministers of the Republic of Belarus No. 156 dated 17 February 2012).

The main hygienic criterion for assessing the risk of exposure to pollutants on the environment is the maximum permissible concentration (MPC) - the maximum amount of a substance that guarantees the absence of a negative direct or indirect effect on the health of current and subsequent human generations and the ecosystem.

To estimate the impact of the reconstructed section of the P-80 road Sloboda-Papernya, 0.000 km - 14.770 km on the atmospheric air, based on the estimated emissions of pollutants, a calculation of the dispersion of pollutants in the ground layer of the atmosphere with determination of the concentrations reached at the boundary of the residential zone of settlements, adjacent to the studied road section at a distance from 7 to 200 m from the edge of the roadway of the P-80 road, and also on the border of the territory of the "Prilepsky" landscape reserve has been performed.

Calculation of dispersion was carried out using the software - the unified program for calculation of atmospheric pollution "Ecolog" (version 4, Integral company), which allows to calculate surface concentrations of pollutants in the atmosphere in accordance with the "Method for Calculating the Concentrations of Harmful Substances in the Air Contained in the Emissions of Enterprises (OND-86)". Unified Program of air pollution estimation "Ecolog" is included in the list of operating software for calculating atmospheric pollution recommended for use by the Ministry of Natural Resources and

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Environmental Protection of the Republic of Belarus by letter No. 04-2 / 2123 dated 19 June 1998.

Calculation of dispersion, carried out with the consideration of the background concentrations of pollutants in the area of planned reconstruction and taking into account the climatic characteristics of the terrain, was carried out for 18 main pollutants and summation groups 6005 (ammonia, formaldehyde), 6009 (nitrogen dioxide, sulfur dioxide).

To calculate the dispersion, a straight section of the route of the reconstructed road was used; type of emissions source - "highway" (No. 8, L = 1 km). The calculation is carried out in conventional coordinate systems with a grid spacing of 10 m.

Background concentrations of pollutants in the area of planned road reconstruction, meteorological characteristics and factors determining the conditions for the dispersion of pollutants in the ambient air are provided by the State Agency for Hydrometeorology, Control of Radioactive Contamination and Environmental Monitoring (Annex 1).

The points lying on the border of the residential zone of settlements located at a distance of less than 200 m from the axis of the reconstructed section of the motorway were taken as points of calculation; the calculations were made at a distance from 7 to 200 m from the edge of the roadway of the P-80 highway, as well as at the border Territory of the landscape reserve "Prilepsky".

The calculation of the dispersion of pollutants in the surface layer of the atmosphere, the parameters of the emission sources, the dispersion map with the isolines of the calculated concentrations are presented in Annex 2.

The calculation results are considered to be satisfactory if the following conditions are met:

$Q + Q_b \leq 1$ (MPC share)

$Q \leq 1$ (when $Q_b = 0$ of the MPC share), where:

Q – concentration of harmful substance in the calculated point, share of MPC;

Q_b – Background concentration in the calculated point, MPC shares.

The substances for which calculation of dispersion is not feasible by the criterion of expediency $E3 = 0.01$ are indicated in Table 24.

Table 24.

Code of the pollutant	Name of the pollutant
0124	Cadmium and its compounds (in terms of cadmium)
0163	Nickel (metallic nickel)
0203	Chrome (VI)
0229	Zinc and its compounds (in terms of zinc)
0368	Selenium amorphous
0401	Saturated aliphatic hydrocarbons C1-C10
0410	Methane

The results of determining the estimated maximum surface concentrations of pollutants at the border of the residential development of settlements / at a distance from 7 to 200 m from the edge of the roadway during the most unfavorable period are given in Tables 25 and 26.

Table 25.

Code of the pollutant or the summation group	Name of the pollutant or the summation group	Estimated maximum surface concentration of pollutant in MPCs.t. shares	
		considering background concentrations	Not considering background concentrations

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		7 m from the edge of the roadway	25 m from the edge of the roadway	50 m from the edge of the roadway	75 m from the edge of the roadway	7 m from the edge of the roadway	25 m from the edge of the roadway	50 m from the edge of the roadway	75 m from the edge of the roadway
0140	Copper and its compounds (in terms of copper)	$4,3 \cdot 10^{-4}$	$2,8 \cdot 10^{-4}$	$1,9 \cdot 10^{-4}$	$1,4 \cdot 10^{-4}$	$4,3 \cdot 10^{-4}$	$2,8 \cdot 10^{-4}$	$1,9 \cdot 10^{-4}$	$1,4 \cdot 10^{-4}$
0301	Nitrogen (IV) oxide (nitrogen dioxide)	0,18	0,16	0,15	0,14	0,06	0,04	0,03	0,02
0303	Ammonia	0,25	0,25	0,25	0,25	0,005	0,005	0,005	0,005
0330	Sulfur dioxide (sulfur dioxide anhydride)	0,07	0,07	0,07	0,07	0,00	0,00	0,00	0,00
0337	Carbon oxide	0,13	0,13	0,13	0,13	0,007	0,007	0,007	0,007
0550	Unsaturated aliphatic hydrocarbons	0,61	0,40	0,27	0,20	0,61	0,40	0,27	0,20
0655	Aromatic hydrocarbons	0,04	0,03	0,02	0,01	0,04	0,03	0,02	0,01
0703	Benz(a)pyrene	0,02	0,02	0,02	0,02	0,004	0,004	0,004	0,004
1325	Formaldehyde (methanal)	0,61	0,60	0,60	0,60	0,01	0,00	0,00	0,00
2754	Saturated aliphatic hydrocarbons $C_{11}-C_{19}$	$7,9 \cdot 10^{-3}$	$5,2 \cdot 10^{-3}$	$3,5 \cdot 10^{-3}$	$2,6 \cdot 10^{-3}$	$7,9 \cdot 10^{-3}$	$5,2 \cdot 10^{-3}$	$3,5 \cdot 10^{-3}$	$2,6 \cdot 10^{-3}$
2902	Solid particles	0,23	0,23	0,23	0,23	0,00	0,00	0,00	0,00
6005	Ammonia, formaldehyde	0,85	0,85	0,85	0,85	0,005	0,005	0,005	0,005
6009	Nitrogen (IV) oxide, sulfur dioxide	0,25	0,23	0,22	0,21	0,056	0,036	0,026	0,016

Table 26.

Code of the pollutant or the summation group	Name of the pollutant or the summation group	Estimated maximum surface concentration of pollutant in EFCs.t. shares					
		considering background concentrations			Not considering background concentrations		
		border of the reserve territory	25 m from the edge of the roadway	50 m from the edge of the roadway	border of the reserve territory	25 m from the edge of the roadway	50 m from the edge of the roadway
0301	Nitrogen (IV) oxide (nitrogen dioxide)	0,22	0,20	0,18	0,07	0,05	0,03
0303	Ammonia	0,25	0,25	0,25	0,005	0,005	0,005
0330	Sulfur dioxide (sulfur dioxide anhydride)	0,37	0,37	0,37	0,00	0,00	0,00
2902	Particulate matter	0,70	0,69	0,69	0,01	0,00	0,00
6009	Nitrogen dioxide, sulfur dioxide	0,60	0,57	0,55	0,08	0,05	0,03

The results of determining the estimated maximum surface concentrations of pollutants at a distance of more than 75 m from the edge of the roadway during the most unfavorable period are given in Annex 2.

The analysis of the obtained results showed that none of the counted pollutants and summation groups are recorded in the calculated points of excess of MPCs.t. and EFCs.t. in the surface layer of the atmosphere.

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The calculated maximum values of the expected surface concentrations of pollutants at the calculated points, taking into account the background level of atmospheric air pollution, will be the following: 0,18 MPCs.t. for nitrogen dioxide; 0,25 MPC s.t. for ammonia; 0,07 MPCs.t. for sulfur dioxide; 0,13 MPC s.t. for the carbon oxide; 0,02 MPC s.t. for benzo(a)pyrene; 0,61 MPC s.t. for formaldehyde; 0,23 MPC s.t. for solid particles; 0.85 MPC s.t. for summation group 6005 (ammonia, formaldehyde); 0,25 MPC s.t. for summation group 6009 (nitrogen dioxide, sulfur dioxide).

The calculated values of the expected maximum surface concentrations of copper and its compounds will be 0.00043 MPCs.t.; unsaturated aliphatic hydrocarbons - 0.61 MPCs.t.; aromatic hydrocarbons - 0.04 MPCs.t.; saturated aliphatic hydrocarbons C11-C19 - 0,0079 MPCs.t.

The calculated maximum values of the expected surface concentrations of pollutants at the boundary of the territory of the "Prilepsky" landscape reserve, taking into account the background level of atmospheric air pollution, will be: 0.22 EFCs.t. for nitrogen dioxide; 0,25 EFCs.t. for ammonia; 0,37 EFCs.t. for sulfur dioxide; 0,70 EFCs.t. for solid particles; 0,60 EFCs.t. for summation group 6009 (nitrogen dioxide, sulfur dioxide).

The calculations show that the contribution of the reconstructed object to the surface concentration of pollutants is no more than 0.61 MPCs.t. (unsaturated aliphatic hydrocarbons). The main contribution to the formation of surface concentrations of formaldehyde, nitrogen dioxide, ammonia, sulfur dioxide, carbon oxide, particulate matter, benz(a)pyrene is done by the background level of atmospheric air pollution.

The total indicator of atmospheric air pollution "P", determined from the maximum values of the estimated maximum short-time concentrations of pollutants in the atmospheric air, corresponds to the permissible degree of atmospheric pollution on the territory of the site of the reconstruction object, Table 27.

Table 27.

Name of the pollutant	Hazard class	MPCs.t., $\mu\text{g}/\text{m}^3$	7 m from the edge of the roadway		
			MPC, $\mu\text{g}/\text{m}^3$	Multiplicity of the excess of the maximum permissible short-time concentration	
				Actual	Reduced to the 3d hazard class
Copper and its compounds	2	3,0	0,00129	0,00043	0,000645
Solid particles (undifferentiated dust / aerosol composition)	3	300,0	69	0,23	0,23
Carbon oxide	4	5000,0	650	0,13	0,104
Sulfur dioxide	3	500,0	35	0,07	0,07
Nitrogen (IV) oxide	2	250,0	45	0,18	0,27
Ammonia	4	200,0	50	0,25	0,2
Formaldehyde	2	30,0	18	0,61	0,915
Saturated aliphatic hydrocarbons C ₁₁ -C ₁₉	4	1000,0	7,9	0,0079	0,00632
Aromatic hydrocarbons	2	100,0	4	0,04	0,06
Benz(a)pyrene	1	5,0 Ng/m ³ (MPCs.t.)	0,001	0,02	0,04
Unsaturated aliphatic hydrocarbons	4	3000	1830	0,61	0,488
Total "P" indicator			1,0		
Degree of pollution			I – acceptable		

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Thus, the reconstructed section of the P-80 road Sloboda-Papernya, 0.000 km - 14.770 km, will not have a significant impact on atmospheric air pollution, the state of this natural component will not change significantly and will remain within acceptable limits.

Determination of the cost parameters of the impact on atmospheric air and on climate change connected with air pollutant emissions and greenhouse gas emissions was carried out in accordance with Amendments No. 1 and No. 2 to TCCP 17.08-03-2006 (02120).

The assessment of the impact of polluting substances (PS) (rubles per motor vehicle), which has traveled one kilometer, is calculated by the formula:

$$OB = \frac{\Pi_g + \Pi_k}{O \cdot L},$$

where Π_g – the consequences of the impact of pollutant emissions on atmospheric air, rubles;;
 Π_k – consequences of the impact of greenhouse gases emissions on the climate change, in rubles;
 O – the volume of the whole traffic of vehicles, cars;
 L – length of the section.

The effects of pollutant emissions on air (Π_g) in rubles, are determined depending on the volume of emission of the i pollutant and the conditions of exposure of the subjects to the i pollutant and are calculated by the following formula:

$$\Pi_g = 10^{-3} \cdot \Pi_c \cdot K_{np} \cdot \sum_j (\Phi_{nj} \cdot \Pi_{nj}),$$

where Π_c – impact of pollutant emissions on the subjects of exposure, in rubles;;
 K_{np} – coefficient which takes into account the purging of the road section, determined according to Table D.1 of Annex D of Amendment No. 1 to TCCP 17.08-03-2006 ($K_{np} = 0.7$);

Φ_{nj} – coefficient which takes into account the susceptibility of group j of subjects to the pollutant emissions, depending on the security, exposure and remoteness of group j from road impact subjects, determined according to Table D.2 of Annex D in Amendment No. 1 of TCCP 17.08-03-2006;

Π_{nj} – density of the group j of impact subjects, taking into account the averaging of the territory of settlements adjacent to the road over the selected elements (a person per a kilometer of the road), determined on the basis of demographic data or according to Table D.3 of Annex D of Amendment No. 1 to TCCP 17.08-03- 2006.

Consequences of the emissions impacts of pollutants for impact subjects Π_c (in rubles) is calculated according to the formula:

$$\Pi_c = 10^{-3} \cdot \sum_i E_i \cdot C_{ei},$$

where E_i – emission mass of the pollutant, g;

C_{ei} – cost indicator of the consequences of the emission of i pollutant, rubles / kg, determined according to Table D.4 of Annex D of Amendment No. 2 to TCCP 17.08-03-2006.

The consequences of the impact of greenhouse gas emissions on climate change Π_k , in rubles, are determined depending on the volume of greenhouse gas emissions and are calculated by the formula:

$$\Pi_k = 10^{-6} \cdot \sum_i E_i \cdot C_{ki},$$

where E_i – emission mass of i polluting gas, g;

C_{ki} – cost indicator of consequences of the impact of the emission of i greenhouse gas, in rubles/ton, determined according to Table D.5 of Annex D of Amendment No. 2 to TCCP 17.08-03-2006.

$$\Pi_c = 10^{-3} \cdot \sum_i E_i \cdot C_{ei} = 44\,468\,295,34 \text{ rubles.}$$

$$\Pi_g = 10^{-3} \cdot \Pi_c \cdot K_{np} \cdot \sum_j (\Phi_{nj} \cdot \Pi_{nj}) = 10^{-3} \cdot 44\,468\,295,34 \cdot 0,7 \cdot 1\,923 = 59\,858\,772,36 \text{ rubles.}$$

$$\Pi_k = 10^{-6} \cdot \sum_i E_i \cdot C_{ki} = 15\,951,75 \text{ rubles.}$$

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Territories which are directly adjacent to apartment houses, buildings of educational institutions	from 7 am till 11 pm (day)	55	70
	from 11 pm till 7 am (night)	45	60

The projected section of the P-80 road Sloboda-Papernya passes near the following settlements: Sloboda, Sosnovaya, Baguta, Cooperative of individual developers "TAVOLGA", Raubichi, Belye Luzhi, Ostroshitskiy Gorodok.

According to the results of acoustic calculations, the existing noise levels in a number of calculated points in the residential area (Sosnovaya, Baguta, Raubichi, Belye Luzhi, Ostroshitskiy Gorodok) adjacent to the P-80 road exceed the permissible levels established by the Sanitary Norms, Rules and Hygienic Standards "Noise in Workplaces, Vehicles, Residential, Public Buildings and Residential Buildings", approved by the Decree of the Ministry of Health of the Republic of Belarus No 115 dated of 16 November 2011 (hereinafter referred to as the Sanitary Rules).

Determination of the noise load from the transport stream is performed by the calculation using a software package "Ecolog-Shum" for calculating and normalizing the acoustic impact from industrial sources and transport (Annex 3).

The program complex "Ecolog-noise" implements the requirements of GOST 31295.1-2005 (ISO 9613-1: 1993) Interstate standard. "Noise. Attenuation of sound during propagation on the ground. Part 1. Calculation of sound absorption by the atmosphere ", and GOST 31295.2-2005 (ISO 9613-2: 1996) Interstate standard. "Noise. Attenuation of sound during propagation on the ground. Part 2. General method of calculation "adopted by the Interstate Council for Standardization, Metrology and Certification (Minutes No. 28 of 09.12.2005).

These documents were put into effect by the Decree of the State Standard of the Republic of Belarus No. 63 dated 18 December 2006 as the state standards of the Republic of Belarus since 01 June 2007.

The letter of the Ministry of Natural Resources and Environmental Protection of the Republic of Belarus No. 13-12 / 875-vn dated 12 April 2016 approved the use of the "Ecolog-Shum" software package in the development of urban development facilities, in the environmental impact assessment, the development of projects "Environmental Protection" architectural and construction projects and the development of pre-project documentation.

The estimated noise levels on the territory of the settlements nearest to the object are presented in Table 29.

Table 29.

Name of residential territory	Acceptable sound levels, dBA, day / night	Calculated noise level, dBA	
		from 7 am till 11 pm	from 11 pm till 7 am
Sloboda	55 / 45	50,1	44,6
Sosnovaya		64,4	58,9
Baguta		62,1	56,5
CID "Tavolga"		50,9	45,3
Raubichi		63,9	58,4
Okolitsa		71,0	65,5
Belye Luzhi		68,3	62,9
Ostroshitskiy Gorodok		69,4	63,9
Ostroshitskiy Gorodok (area 2)		63,7	59,5

Based on the forecasted prospective of the traffic intensity and the expected composition of the traffic flow, a possible increase in the potential noise load on the population residing in the residential areas adjacent to the reconstructed highway is expected.

In order to reduce the impact of traffic noise on the adjacent residential area (in the conditions of existing buildings), it is necessary to consider the expediency of using the maximum possible range of measures aimed at providing acoustic comfort, taking into account specific building conditions,

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technical and economic requirements, the expected dynamics of growth in intensity of motor transport traffic, changes in the possible future qualitative and quantitative composition of the transport stream.

Determination of the calculated size of the roadside clear zone from the reconstructed facility providing a sufficient level of public health safety from acoustic impact will be carried out at subsequent design stages.

4.3 Impact on the geological environment. Forecast and assessment of changes in geological conditions and relief

The main sources of impact of the reconstructed P-80 road Sloboda-Papernya, 0.000 km - 14.770 km, on the geological environment includes the following types of work:

- work on the preparation of the road lane (reconstruction of communications, construction of sites for builders camps and for construction needs, construction of bypass routes);
- backfilling of the roadbed;
- reconstruction or construction of bridge structures.

The impact of the projected road on the geological environment is related, first of all, to the construction of a roadbed - an artificial relief form. This involves the movement of significant masses of soils, the creation of excavations and dumps of soil. The earthen canvas, acting as a dam, often causes the draining of the territory on one side of the road and bogging it on the other, up to the formation of an open water mirror (with insufficient provision of drainage and water-passing facilities).

Possible types of impact of the planned activities for the reconstruction of the road on the geological environment are:

- landslides, screes, slicks, other types of movements of earth masses due to their undercutting in the course of construction work;
- erosion of land due to the concentration of water flows by artificial structures, cuvettes and ditches;
- change of the coastline of water bodies, cross-section of watercourses, activation of channel processes in the construction of bridges;
- increase of the sedimentation and siltation of riverbeds by products of erosion of construction sites and loose ground, as well as during the construction of bridge supports and during the process of laying a road in floodplains.

Possible consequences of the operation of the reconstructed road for the geological environment are: the change in dynamic loads on soils, the stressed state of the rocks, the directivity of the natural and the occurrence of technogenically caused erosion-accumulation processes.

The project should provide for measures to minimize possible impacts of the construction and operation of the road on the geological environment and terrain.

Water discharge trays, that are provided for draining water from the roadway, and the construction of rainwater wells aims to protect the roadsides and slopes of the roadbed from erosion at a height of the embankment of more than 3 meters, on the concave curves, at bus stops, on the approaches to the bridges through the watercourses and at the congresses of transport interchanges.

Anti-erosion measures shall be envisaged, such as: strengthening the slopes of the roadbed, strengthening the bottom of the cuvettes and the sole of the embankment by sowing grass on a layer of fertile soil, strengthening the roadsides, etc.

The measures to prevent flooding of adjacent territories include the installation of culverts in low relief areas.

4.4. Impact on land and soil cover. Forecast and assessment of changes in the state of land resources and soil cover

Possible impacts of the planned activities for the reconstruction of the P-80 road Sloboda-Papernya, 0.000 km - 14.7 km 70, on land and soil cover are:

- change in the structure of land use as a result of the allocation of land under the erected roadbed and the broadening of the existing roadbed;

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- dehumidification and waterlogging of soils when the conditions of groundwater flow change as a result of excavations in conditions of close groundwater occurrence or in the design of deep excavations;

- soil pollution from mobile sources of pollution (road transport);
- contamination of soils with combustive-lubricating materials of cars, road-building machines and mechanisms on the projected sites for construction needs, during the construction and development of projected off-shore quarries, in soil-unloading sites, as well as on parking sites of excavating and transporting machines and other road construction machines and mechanisms.

One of the types of impact of the planned activity on land resources is the change in the structure of land use as a result of the allocation of land for the construction of the facility. The route of the projected road passes through the lands occupied in agricultural production (arable land, pastures, etc.), and also through the lands of the State forest fund. In the area of the planned economic activities for the reconstruction of the section of the P-80 road passing through the territory of Smolevichi and Minsk districts of the Minsk region, the following land users are located:

- RUE "Minskavtodor-Center"
- Municipal Unitary Enterprise "Minskobdorstroy"
- PUE "Ozeritsky Agro"
- RUE "Minskenergo"
- State Institution "State Memorial Complex "Khatyn"
- Department of ideological work, culture and youth affairs of Smolevichy Regional Executive Committee
- Farming enterprise "Bakumenko Y.V."
- State Forestry Management Service "Smolevichsky Leskhov"
- RUE "Beltelecom"
- Main Directorate of the Commander of the Internal Troops of the Ministry of Internal Affairs of the Republic of Belarus
- State Specialized Forestry Management Service "Borovlyansky Spetsleskhov"
- Manufacturing communal subsidiary unitary enterprise "Minsk Forest Park Economy"
- OJSC "1st Minsk Poultry Factory"
- Establishment "Minsk City Specialized School for Children and Youth of the Olympic Reserve of Trade Unions for Winter Sports"
- Establishment "Republican Center for Olympic Training in Winter Sports "Raubichi"
- OJSC "Gazprom Transgaz Belarus"

The project for the reconstruction of the road will provide for a permanent and temporary allocation of land for the roadway, transport interchanges, detours, sites for construction needs, builders camps, storage of fertile soil, re-engineering utilities, etc.

In order to reduce the impact of the projected road on the land resources of the region, the allocation of land under the roadbed and road facilities should be adopted at the minimum level.

The project should envisage compensation to land users for material losses and losses of agricultural and forestry production.

All temporarily allocated land is subject to recultivation or landscaping with the sowing of grasses on fertile soil.

Impacts on the soil cover during the construction phase of the road will be associated with the cutting of trees and shrubs in the zone of permanent diversion.

At sites of logging which are located in the right-of-way, with a shallow groundwater level, in favorable geomorphological conditions, bogging processes may become more active due to the disappearance of the biological transpiration factor.

The removal of the *layer of fertile soil* is envisaged for the width along the base of the embankment and the external borders of the slopes of the excavation of the erected roadbed and from the slopes of the existing road, as well as from the areas foreseen by the project for detours, sites for the needs of construction and builders' camps, during the arrangement of transport interchanges, junctions, drainage.

The design solutions for the removal, conservation and use of the fertile soil layer should be

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developed in accordance with the requirements of the "Regulations on the Removal, Use and Conservation of the Fertile Soil Layer in the Production of Works Associated with Land Disturbance", approved by the Order of the State Committee for Land Resources, Geodesy and Cartography of the Republic of Belarus No. 01-4/78 dated 24 May 1999 (as amended by the resolution of Land Committee under the Council of Ministers No.49 dated 08 December 2004).

When removing the fertile soil layer, the project should provide for measures that exclude the deterioration of its quality (mixing with underlying layers, fuel, oils, etc.). A fertile soil layer that is not used immediately in the course of work is stored and handed over to the responsible official according to the agreement, which specifies the volume, storage and use conditions of the fertile soil.

In the case of passing the route of the projected road along the swampy areas, it will be tapped to the mineral bottom.

Measures for the conservation of the fertile soil layer in the production of excavation work and its further use to restore the fertility of the reclaimed lands in the course of carrying out works related to the disturbance of lands and landscaping, and also the places for storing the fertile soil layer and the procedure for applying it to the reclaimed areas should be envisaged.

The removed fertile layer is fully recommended for the following use:

- to strengthen the roadsides, slopes and bottom of the cuvettes;
- for reclamation of the route lane of permanent and temporary road relocation;
- for the improvement of disturbed lands.

Peat from the decortication can also be used on the site with land reclamation and fortification works. The peat that is not used on the site can be exported and used for reclamation of quarries, as well as transferred to interested agricultural enterprises for restoring the fertility of arable land.

Violations, removals of vegetation cover and topsoil, variation of topography in the construction (cutting slopes, excavations development, etc.), redistribution and concentration of snow and transformation of drainage amplify danger of activation processes of planar and linear erosion of the soil. Water and wind erosion of the slope roadbed is very dangerous during the construction.

With a proper strengthening of the slopes and margins of the roadbed, as well as the bottom of the cuvettes by sowing grass on a layer of fertile soil, the risk of activating erosion and slope processes will be minimal.

According to letter No. 03-09/1205 dated 20 April 2017 of the Ministry of Natural Resources and Environmental Protection of the Republic of Belarus (Annex 1) within the route requested for the reconstruction of the "P-80 road Sloboda-Papernya, 0.000 km - 14.770 km", located on the lands of Minsk and Smolevichi regions to the southeast of the settlement Ostroshitsky Gorodok, Okolitsa, Sosnovaya, mineral deposits were not identified by the works performed.

For the purposes of forecast evaluation of soil contamination in the zone of influence of the planned P-80 road Sloboda-Papernya, 0,000 km - 14.770 km, in the framework of the EIA, results of the monitoring, carried out by "BeldorNII" were used within the research project "Organize Observations of Complex Influence of Highways on the State of the Environment" (topic 21.370.5.2006, No. of state registration 20065286). This work was carried out in accordance with the Decree of the President of the Republic of Belarus No. 251 "On Approval of the State Program for the Development of the National System for Monitoring the Environment in the Republic of Belarus for 2006-2010" dated 18 April 2006 in accordance with TOR No. 48.

Since the pollution of the soil cover in the zone of influence of the motor road is mainly associated with the emission of pollutants, determined by the composition and intensity of traffic, the assessment of the level of soil contamination is made for an analogous object having the intensity and composition of the vehicles traffic close to the perspective parameters of the traffic in the projected section of the automobile roads.

The site of the M-2 road Minsk-National Airport Minsk was chosen as an analogue site, located in the area of the village of Korolyov Stan, which is an object of monitoring the complex impact of highways on the environment.

In accordance with the regulations for monitoring the complex impact of roads on the environment, approved by the department of "Belavtodor", the controlled indicators of soil contamination on the compulsory list were heavy metals (gross forms of lead, cadmium, zinc and copper), petroleum products, sodium, potassium, chlorides, pH, cation-exchange capacity. The

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additional list determined the content of sulfates, nitrates, exchangeable calcium, magnesium, nickel and manganese.

Sampling of soils to determine the content of pollutants was carried out in accordance with GOST 17.4.4.02-84 [26]. Soil samples were taken at distances of 10, 50 and 100 m from the road at a depth of 0-20 cm (without plant litter).

The chemical analysis of soil samples was carried out by the Central Branch Laboratory of RUE "Belgeologiya" in accordance with the normative documents included in the "List of Measurement Techniques Allowed for Use in the Work of Environmental Control Laboratories of Enterprises and Organizations of the Republic of Belarus" [27,28].

Control of the level of soil contamination with technogenic toxicants is carried out by comparing the results obtained during laboratory testing of samples with the MPCs (APCs) established in the Republic of Belarus [14,29].

The results of determining the level of soil contamination in the zone of influence of the analogous object are presented in Tables 30-31.

Table 30.

Distance from the edge of the road	Gross content, mg / kg					
	Pb	Cd	Zn	Cu	Ni	Mn
10 m	10,73	<0,50	25,45	7,12	5,21	309,86
50 m	8,64	<0,50	19,34	4,61	5,62	243,32
100 m	10,24	<0,50	24,67	9,70	7,29	388,32
MPC/APC, mg/kg*	32	1,0	55	33	20	1500
Background content, mg/kg**	6,2	0,11	31,3	5,2	4,6	133

* - Hygienic Standard 2.1.7.12-1-2004 list of maximum permissible concentrations (MPC) and approximately permissible concentrations (APC) of chemical substances in soil [12].

** - According to NSEM (at observation points located on territories that are not subject to economic activity of the person).

Table 31.

Distance from the edge of the road	Aqueous extract, mg/100g				Oil products, mg/kg	NO ₃ ⁻ fluent, mg/100g (salt extract)
	Cl ⁻	SO ₄ ²⁻	K ⁺	Na ⁺		
10 m	5,01	0,58	2,50	7,70	315,57	<0,10
50 m	5,63	0,39	0,75	2,80	17,99	<0,10
100 m	3,13	0,41	5,30	1,20	13,70	0,67
MPC/APC, mg/kg*		160,0			100/500*	130,0
Background content, mg/kg**		50,2			21,66	8,0

* Maximum permissible concentrations of oil products in soils for different categories of land [26].

The content of gross forms of heavy metals that make up motor transport emissions in the soil of the affected area of the projected facility is expected to be slightly higher than the background indicators, but will not exceed their allowable concentrations.

Excess of the hygienic standard for the content of oil products, sulphates and nitrates is also not predicted.

4.5 Impacts on surface and groundwater. Forecast and assessment of changes of the state

According to Art. 25 of the Water Code of the Republic of Belarus No. 149-3 dated 30 April 2014, when designing facilities that impact water bodies, measures should be envisaged to ensure water protection from pollution and contamination, as well as to prevent harmful effects on water bodies; application of the best available technical methods; prevention of emergency situations;

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prevention of flooding, waterlogging, salinization of lands, soil erosion.

In accordance with the Water Code of the Republic of Belarus No. 149-3 dated 30 April 2014 (Article 46), the water discharged from the roadway to the environment does not belong to wastewater. At the same time, potential pollutants of water bodies may include emissions from motor vehicles, wear products of coatings, tires and brake pads, materials used to combat ice, construction cargo that, when washed with rain and meltwater, can lead to saturation of surface runoff by various polluting substances.

Implementation of the planned activity will not have a significant impact on the groundwater. The impact on surface water can occur both during the construction phase and during the further operation of the facility.

Most of the impacts on natural waters during the construction phase will be temporary and local. Construction works will produce only minor, localized and short-term negative impacts. Such impacts are common for road construction and can be controlled by overseeing environmental aspects and using appropriate building codes.

The reconstructed section of the P-80 road crosses the river Domelka. In order to minimize the possible adverse impact of the projected facility on surface and groundwater, a set of measures should be envisaged to drain stormwater from the reconstructed road beyond the coastal strip or clean it in accordance with the requirements of the Water Code of the Republic of Belarus No. 149- 3 as of April 30, 2014 and TCCP 45-3.03-19-2006 (02250) "Motorways. Design Standards" and other technological regulations in the field of environmental protection, ensuring sanitary and epidemiological welfare of the population.

It is necessary to observe restrictions on the production of works in the coastal strips and the regime for carrying out activities within the water protection zones of surface water bodies in the area where the facility is located in accordance with the requirements of Art. 53, 54 of the Water Code of the Republic of Belarus.

The system of road drainage must consist of a number of structures and separate structural measures designed to prevent waterlogging of the roadbed, as well as to intercept and drain water coming from the surface of the road.

In order to protect the surface water from dust pollution, it is provided for the installation of coatings of capital type, which exclude dust formation.

To ensure surface drainage from the side-route lane and maintain the existing hydrogeological balance, as well as to pass small watercourses, culvert should be arranged.

To ensure drainage on small embankments, a cuvette construction is performed. Slopes and bottom are strengthened by sowing grasses with plating. The bottom of cuvettes with a longitudinal slope of more than 10 ‰ is strengthened by gravel or concrete.

In order to preserve the greenery and reduce the additional drainage of ground in the places where the road passes through the recesses, a cavity cross-sectional profile with a drainage device under the sand underlayment layer and retaining walls has been adopted.

In the places of the embankment construction which is more than three meters, on the concave curves, at bus stops, on the approaches to the bridges through the watercourses and at the congresses of the traffic interchanges, water-discharge trays are provided for draining water from the roadway and the rainwater wells are constructed.

After the diversion of water from the roadway near the river Domelka and the village of Okolitsa, sewage treatment plants are arranged.

Since the territory of the existing LDD-54 is located in the water protection zone of the Ostroshitskoye reservoir and the sanitary protection zone of the Borovlyansky water intake, in order to ensure the requirements of the current legislation, the project documentation must provide for a corresponding set of measures. Currently, the storage of sand and salt mixture is carried out openly on the asphalted area. The planned construction of a closed warehouse for storage of anti-icing materials will prevent their moistening, caking and frosting, and also eliminate the negative impact of salt on the environment.

In general, the implementation of the proposed measures in compliance with basic environmental standards, both by construction organizations and individuals operating this highway, should minimize the anthropogenic load on surface and groundwater to the level of the ability of these facilities to self-

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purification and self-repair.

4.6 Influence on flora and fauna. Forecast and assessment of changes of the state

When building and reconstructing motor roads, natural plant communities are subjected to the greatest changes as a result of direct impact during the performance of preparatory and construction works.

The change in the natural environment, connected with the construction or reconstruction of the road, significantly affects vegetation, which is often accompanied by the destruction of the natural vegetation of roadside areas, the change in ecological regimes on the right-of-way and on adjacent areas.

Significant damage to ecosystems is caused by excavation, after which there remain areas of naked soil, serving as a springboard for penetration into the community of new species, as well as disturbance of the natural hydrological regime, often leading to the decay or strong weakening of stands. One cannot ignore the cluttering of roadside garbage, the drift along the route of weedy species, the concentration along the new edge of the activity of synanthropic and opaque plant species.

There are cases of flooding areas adjacent to roads due to miscalculations in the construction of culverts.

Waterlogging and flooding are dangerous and quite widespread anthropogenic influences that promote swamping of lands which were previously drylands. This, in the case with forest biogeocenoses, adversely affects the growth of wood, and, ultimately, leads to dryness, focal or mass drying of trees.

In the subsequent operation of the road, plantings that grow in its vicinity are affected by pollution, directly or indirectly associated with road transport.

The problem of the impact of motor roads on natural vegetation has become increasingly important in recent years in connection with the rapid growth of traffic and the development of road infrastructure.

In the immediate vicinity of the projected facility is the republican landscape reserve "Prilepsky". The border of the reserve passes along the right-of-way of the P-80 road on the south side in the following sections: km 12.1 - km 13.4, km 11.6 - km 11.9, km 7.9 to the administrative border of Minsk region (km 4, 4). +

The calculated maximum values of the expected surface concentrations of pollutants at the boundary of the territory of the "Prilepsky" landscape reserve, taking into account the background level of atmospheric air pollution, will be the following: 0.22 EFCs.t. for nitrogen dioxide; 0,25 EFCs.t. for ammonia; 0,37 EFCs.t. for sulfur dioxide; 0,70 EFCs.t. for solid particles; 0,60 EFCs.t. for the summation group 6009 (nitrogen dioxide, sulfur dioxide).

According to preliminary data, the broadening of the roadbed during the reconstruction of the P-80 road is planned, mainly, to the right.

In the area of the planned works on the reconstruction of the road section, protected plant and animal species, as well as rare biotopes and natural landscapes that are of environmental value are absent, and, therefore, minimal impact is expected on the reserve territory.

Reconstruction of the P-80 road will not affect the valuable part of the "Prilepsky" reserve and the planned operations will not entail significant changes in the reserve ecosystem. The route of the reconstructed road P-80 Sloboda-Papernya, 0,000 km - 14,770 km, passes both in the open area, which is currently occupied mainly by agricultural lands, and along the territory of the following forestries: State Forestry Management "Smolevichi Leskhoz", State Specialized Forestry Service "Borovlyansky Spetsleskhoz".

On the right-of-way used for broadening the roadway of the existing motor road, when it is being reconstructed, works will be provided for the cutting of arboreal and shrubby vegetation with stump rooting.

Harvesting of timber and its sale should be done in accordance with the established procedure by land users. In the occupied areas of the forest fund, the harvesting of timber and its sale will be carried out in accordance with the established procedure by legal entities that are managing the forestry.

In order to ensure favorable environment for the life and health of citizens, the rational (sustainable) use of flora resources, removal of flora objects should be done in accordance with the

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requirements of the Law of the Republic of Belarus "On the Flora" No 205-Z (amend. on 18 July 2016) dated 14 June 2003.

In order to reduce the negative impact on the plant communities in the region, the removal of vegetation objects is taken at a minimum level.

Planted forest which falls into the zone of permanent afforestation are quite representative to the plantations along the reconstructed section of the road.

The reconstruction of the section of the P-80 road Sloboda-Papernya, 0.000 km - 14.770 km, does not in general affect the rare component of the flora of this region. From the point of view of the influence on the flora of the territory under study, the work on the reconstruction of the motor road is completely permissible and does not contradict the preservation of floral diversity.

According to information from the district inspectorates of natural resources and environmental protection and "Borovylyansky Spetsleskhov" no places of growth of plants included in the Red Book of the Republic of Belarus have been identified in the zone of possible impact of the planned activity.

The fauna of the location area of the projected facility is relatively trivial, including typical widespread species.

Entomofauna. On the territory of the proposed economic activity, the entomocomplexes are represented mainly by widespread species that inhabit the corresponding ecosystems throughout the territory of Belarus.

Mesofauna is represented by widespread species, specific not only for the given area, but also for the whole country.

Reconstruction of the P-80 Sloboda-Papernya road section, 0.000 km - 14.770 km, will not cause significant harm to the entomofauna of the region.

The reconstructed section of the P-80 road crosses the river Domelka, which belongs to the watercourses of the third category. The composition of the ichthyofauna of the river crossed is poor and quantitatively small.

In accordance with the Republican integrated scheme for the allocation of fishing grounds, approved by the Ministry of Agriculture and Food of the Republic of Belarus No. 29 as of 18 June 2014, there are no fishing grounds on the Domelka River.

The unfavorable impact on the ecosystem of watercourses during the construction work on river sites is manifested in the appearance of a zone (cloud) with increased turbidity of water, as well as in the destruction of parts of natural shores and coastal shallow water courses.

Since it is not possible to carry out the measures provided for in clauses 2 and 3 of Article 23 of the Law of the Republic of Belarus of July 10, 2007 "On the Fauna" when carrying out work on the reconstruction of culvert facilities, at subsequent design stages after specifying the size of culverts, the terms of reconstruction etc., compensation payments should be calculated as a result of damage to fish stocks.

The procedure for determining the amount of compensation payments and their implementation is established by the Decree of the Council of Ministers of the Republic of Belarus No. 168 dated 7 February 2008 (No. 255, as amended on 29 March, 2016)

The following documents can be used as the initial data in determining the amount of compensation payments, along with the design solutions:

- "Republican Integrated Scheme for the Location of Fishing Areas" approved by the Decree of the Ministry of Agriculture and Food of the Republic of Belarus No. 29 dated 18 June 2014;

- Resolution of the Ministry of Natural Resources and Environmental Protection of the Republic of Belarus No. 72 dated 18 August 2008 "On Methods of Determining the Harm Caused to Fish Resources as a Result of Their Illegal Seizure or Destruction";

- "Rules of Fishing and Fishing Industry Management", approved by the Decree of the President of the Republic of Belarus No. 580 dated 08 December 2005 (as amended by Decree of the President of the Republic of Belarus No. 552 dated 01 December 2014).

In accordance with the requirements of Article 23 of the Law of the Republic of Belarus No. 257-3 dated 10 July 2007 (No 399-3 as amended on 18 July 2016) and article 12 of the Regulation on the procedure for determining the amount of compensation payments and their implementation, approved by the Resolution of the Council of Ministers of the Republic of Belarus No. 168 as of 7

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February 2008 (as amended by the Council of Ministers, resolution No 1158 dated 31 August 2011, resolution No 255 dated 29.03.2016), if the financing of construction works is carried out at the expense of the republican budget, compensation payments for harmful impact on objects of wildlife and (or) their environment habitats are not made.

The diversity of amphibians and reptiles in the area of planned economic activity is characterized by a high degree of mediocrity and does not have unique features or features of species diversity and abundance due to significant transformation of the land in most of the study area and the poor development of the hydrological network of the region.

Possible impact of road reconstruction will be a decrease in the number of amphibians in connection with the death of the reproductive part of local species.

The mass migration activity of amphibians was not observed in the study area, however, in the further development of project documentation, additional studies are needed to identify possible migration corridors, their location and the intensity of their use by amphibians.

Ornithofauna of the territory near the reconstructed road P-80 is quite diverse. Both nesting and migratory birds are widely represented. Poultry species that are related to forest and arboreal and shrub ecosystems prevail, as well as numerous types of synanthropic ecological complex and types of open landscapes.

When the road is reconstructed, both the direct destruction of the biota and the indirect impact on birds through noise and dust pollution will occur, and the spatial structure of the ornithofauna will be redistributed, especially in the early years of road reconstruction and operation. There will be a decrease in the density of a number of forest species of birds or their local concentrations beyond the influence of the road. Subsequently, due to the high mobility of this group of vertebrates, the number of background and common bird species will reach the average indicators.

No species of birds listed in the Red Book of the Republic of Belarus and negatively reacting to anthropogenic impact have been identified along the study site. Reconstruction of the road will not cause significant damage to the nesting and feeding areas of birds.

The basis of the species composition of mammals are massive, widespread species, characteristic of natural forest and open landscapes.

As a result of the operation of the reconstructed highway, there may be a direct and indirect impact on fauna representatives of the area.

Direct impact can be expressed in the death and trauma of animals as a result of possible road accidents with their participation.

The main elements of road structures (embankments, slopes, fences along roads) are the obstacles to the natural activity of animals, often limiting their access to feeding areas, water sources or mating partners, which will adversely affect the demographic structure of populations. In this case, populations living on different sides of the road may differ in demographic parameters, such as mortality, sex ratio and fertility. These changes do not necessarily threaten the existence of the species, but may be the key to a population with a low species density and dependent on permanent migrations. Also, the process of fragmentation will be extremely negative, where the local density of animal populations is greatly reduced in ecologically capacious areas of the habitat, while reducing the likelihood of re-settling. The most negative effect of the barrier can affect the genetic structure of populations, because in the absence of free gene exchange, many lethal recessive mutations will go to a homozygous state, and animals with such a genotype will die. In small populations such genetic isolation can lead to their extinction.

According to the data of the hunting farms, dozens of wild animals die every year as a result of road accidents on various sections of the roads of the Republic of Belarus, but the percentage of irrational losses for hunting farms is insignificant. Nevertheless, there is a high degree of danger of the consequences of road accidents involving wild animals for life and health of people, as well as road safety and property safety, which requires special measures to minimize possible damage to property and health of road users.

In accordance with the Rules for Hunting and Hunting Industry Management, approved by the Decree of the President of the Republic of Belarus No. 580 dated 8 December 2005, the optimal number of game animals is the number of hunting animals that can live for a long time in hunting grounds, are able for natural reproduction, are able to use fodder resources effectively, when the

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greatest yield of quality hunting products without significant harm to the components of the natural environment, as well as life, health, citizens' property and the property of legal entities is ensured..

Excess of the number of wild ungulates is a factor contributing to an increase in their migrations in search of a forage reserve and, accordingly, influencing the number of intersections of these animals with the road. For road traffic the main danger is represented by such animals as moose, roe deer, deer, wild boar.

The main reasons for the ungulates entering the motor road are the forest tracts adjacent to the road on both sides; agricultural land which is used by ungulates as a feed base, and the presence of permanently operating elements of migration corridors and ungulate concentrations.

According to the scheme map of the main migration corridors of ungulates on the territory of Belarus, developed by the National Scientific Research Center of the National Academy of Sciences of Belarus for Bioresources, the projected P-80 road on the section from Okolitsa to the border in Ostroshitsky Gorodok crosses the migration corridor of ungulates M2- M3-M6-M7, and on the section from the village Okolitsa to the point Sosnovaya is the northeastern border of the indicated migration corridor.

According to the information of the district structures of the Republican State-Public Association "Belarusian Association of Fishermen and Hunters", there are sites on the P-80 road where there were regular facts of the death of wild animals (Figure 1).

To prevent ungulates from reaching the roadway and minimize the likelihood of accidents with their involvement on the specified sections of the road, the project documentation should provide for a set of measures, regulated by points 2 and 3 of Art. 23 of the Law of the Republic of Belarus "On the Fauna".

Indirect damage can be caused by pollution of adjacent territories with exhausted car gases and sewage from rain and meltwater, as well as salinization of territories along the road due to the use of anti-icing agents to combat winter slipperiness. Salt components (sodium and chlorine ions) of anti-ice reagents, as well as a wide range of substances from emissions of exhaust gases from cars, are able to accumulate in soil and vegetation, and in high concentrations are toxic to all components of biogeocenoses.

Afforested areas of the road can attract ungulates as places suitable for feeding. To reduce the attractiveness of forest belts, along the roads, species of arboreal shrub vegetation which are not preferred for animal feeding should be grown or planted. In addition, mowing should be carried out on the roadside and immediately after mowing the mown grass shall be removed.

According to information from the district inspectorates of natural resources and environmental protection and "Borovylyansky Spetsleskhoz", no habitats of animals included in the Red Book of the Republic of Belarus have been identified in the zone of possible impact of the planned activity.

Since the P-80 road Sloboda-Papernya, 0.000 km - 14.770 km, is planned to pass along the current direction, a relatively low degree of impact on the flora and fauna of the region is expected.

4.7 Impact of the waste management on the environment

The main sources of waste generation during the reconstruction of the road are preparatory and construction works.

According to Art. 4 of the Law of the Republic of Belarus "On Waste Management" No. 271-3 (as amended on 13 July 2004), the waste management system should be formed taking into account the following basic principles:

- Priority use of waste in relation to their disposal or burial, subject to compliance with the requirements of legislation on environmental protection and taking into account economic efficiency;
- Priority of waste disposal in relation to their burial.

Waste management in the course of the project implementation should be carried out in accordance with the requirements of Article 22 "Requirements for Waste Management in the Conduct of Construction Activities" of the Law of the Republic of Belarus "On Waste Management", and TCCPH 17.11-10-2014 (02120) "Environmental Protection and Nature Management. Waste. Rules for the Management of Construction Waste".

When developing the project documentation for the reconstruction of the projected facility, the

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section "Environmental Protection" should provide for a set of measures for construction waste management.

Construction waste generated during the preparatory and construction work during reconstruction should be temporarily stored in specially designated areas for its subsequent transfer for recycling, processing or disposal (if the recycling of the waste is not possible).

An indicative list of the main types of generated waste during preparatory and construction works, as well as the recommended methods for their utilization, are presented in Table 32.

Table 32.

Name of the waste	Waste code	Hazard class of waste	Generation source	Recommended utilization method
CONDUCT OF PREPARATORY AND CONSTRUCTION WORKS:				
Asphaltic concrete from disassembly of asphalt pavements	3141004	Non-hazardous	Disassembly of existing asphalt-concrete road surfaces	Removal to facilities for the use of this type of waste *
Pieces of concrete products	3142707	Non-hazardous	Disassembly of existing concrete structures	
Pieces of reinforced concrete products	3142708	Non-hazardous	Disassembly of existing reinforced concrete structures	
Substandard concrete structures and parts	3142705	Non-hazardous	Dismantling of existing concrete structures	
Concrete waste	3142701	Non-hazardous	Dismantling with crushing of the side stone, concrete structures, etc.	
Metal structures and parts of damaged iron and steel	3511500	Non-hazardous	Disassembly of road signs, barrier fencing, existing metal structures	
Mixed construction waste, waste from the demolition of buildings and structures	3991300	Class 4	Demolition of existing pavilions	
Stump waste	1730300	Non-hazardous	Felling of arboreal and shrubby vegetation	Use in the technical reclamation of quarries or removal to facilities for the use of this type of waste *
Boughs, branches, tops	1730200	Non-hazardous		

* According to paragraphs 3 and 4 of Art. 28 of the Law "On Waste Management": "Facilities for the waste management put into operation shall be the subject to registration in the register of the facilities for the use of waste in accordance with the procedure determined by the Council of Ministers of the Republic of Belarus. The operation of facilities for the use of waste not included in the register of such facilities is not allowed".

Wastes that are secondary raw materials and secondary material resources must be reused or recycled.

Wastes that cannot be used or which are rendered as harmless are subject to disposal at waste disposal sites.

In the reconstruction of the P-80 road Sloboda-Papernya, 0.000 km - 14.770 km, no hazardous and toxic wastes are expected.

Responsibility for the management of waste produced during preparatory and construction work (collection, accounting, export, processing and use, and / or neutralization) is the responsibility of the owner of the construction waste, i.e. on the contractor.

The collection and separation of construction waste by types is also carried out by the owner of the construction waste.

Prior to the removal of construction waste, the contractor must obtain permission from the territorial bodies of the Ministry of Natural Resources and Environmental Protection for the placement of construction waste at the landfill, maintain a book of construction waste records, accompanied by accompanying passports for the transport of waste for use or disposal.

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When installing bus stops and recreational areas on the reconstructed section of the P-80 road Sloboda-Papernya, it is necessary to provide for the installation of garbage containers.

4.8 Assessment of social consequences of the planned activities

Technical solutions for the reconstruction of the section of the P-80 road Sloboda-Papernya, 0.000 km - 14.770 km, will positively affect the social environment and improve road safety, namely by the following:

- separating the traffic flows moving towards each other, increasing the number of lanes and reducing the number of conflict points which will significantly reduce the number of accidents and the severity of their consequences;
- increase in the speed of traffic along the reconstructed section of the road by providing a rational transverse profile of the roadbed, construction of the coverings of the capital type and applying the newest Traffic Management Facilities will reduce the amount of pollutant emissions from passing vehicles;
- improving the transport and operational parameters of the road will affect such aspects of social and economic development as productivity of the road sector, business efficiency, investment attractiveness of the region and the living standards of the population;
- implementation of a complex of noise protection measures (including the installation of noise-shielding screens, if necessary) will make it possible to ensure the allowed noise levels in the residential areas established by the Sanitary Rules and Standards.

With the improvement of transport and operational indicators of the road, the volume of freight traffic will increase, roadside service will be developed (cafes, gas stations, recreation areas, etc.), which will lead to an increase in the socio-economic indicators of the region. Additional jobs will be created for the local population.

Implementation of the planned activities for the social and economic development of the district will have a positive effect.

Thus, the reconstruction of the section of the P-80 road Sloboda-Papernya, 0.000 km - 14.770 km, will have a positive effect on the socio-economic indicators of the region and the living conditions of the population.

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4.9 Assessment of the significance of the impact of the proposed activity on the environment

As part of the EIA for the reconstruction of the section of the P-80 road Sloboda-Papernya, 0,000 km - 14,770 km, an assessment of the significance of the environmental impact was carried out in accordance with the recommendations of paragraph 7.2 of the TCCP 17.02-08-2012 "Environmental Protection and Nature Management. Rules for Environmental Impact Assessment (EIA) and Report Preparation".

The components of the natural environment that can be affected, include: atmospheric air, land and soil cover, flora and fauna.

The scale of the impact on the natural environment is limited (impact on the environment is within a radius of 0.5 km from the facility's site).

The duration of exposure is a long-term (constant), observed for more than 3 years. The significance of the effect is moderate. Changes in the natural environment, exceeding the limits of natural variability, leading to the violation of individual components are assumed, while the natural environment retains the capacity for self-recovery.

The assessment of the significance of the impact is determined by the methodology given in Annex D of TCCP 17.02-08-2012 (based on the data in Tables D.1 - D.3) and amounts to 24 points (scale of impact - 2 points, duration of impact - 4 points, significance of changes in the natural environment - 3 points).

Reconstruction of the section of the P-80 road Sloboda-Papernya, 0.000 km - 14.770 km, is characterized by the medium impact on the environment.

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5. MEASURES TO PREVENT OR REDUCE POTENTIAL ADVERSE EFFECTS

To minimize or prevent possible negative environmental impacts and adverse environmental and related socio-economic consequences caused by the proposed activity, a number of environmental measures have been proposed.

5.1 Measures to prevent or reduce potential adverse effects on atmospheric air

In order to reduce the adverse impact of the planned activities on the atmospheric air, a number of environmental measures have been proposed:

- road sections passing through forest tracts are projected with the consideration of the natural winding of the route by prevailing winds;
- the organization of work on the construction of the road provides for the use of specialized enterprises and permanent production bases equipped with a system for monitoring the emission of pollutants entering the atmosphere, when organizing the construction of a road;
- materials and products used in the implementation of road construction and installation work must be allowed for use in accordance with the procedure established by the legislation of the Republic of Belarus;
- implementation of the measures to increase the number of road sections with traffic without speed limits to reduce the areas of deceleration and acceleration and increase the speed of traffic, resulting in reduced pollution of the atmosphere with exhaust gases;
- construction of equipment and vehicles with internal combustion engines must be regulated and tested for exhaust gas toxicity;
- quality management of fuel used for vehicles and road vehicles.

Additional measures to prevent or reduce potential adverse effects on atmospheric air for the period of operation of the reconstructed section of the road are not planned, as the expected levels of air pollution by motor vehicle emissions in the nearest residential area will not exceed the established hygienic standards.

The calculated maximum values of the expected surface concentrations of pollutants at the boundary of the territory of the "Prilepsky" landscape reserve, taking into account the background level of atmospheric air pollution, will not exceed the regulated ecological safe concentrations. The overall indicator of atmospheric air pollution "P" corresponds to the permissible degree of atmospheric pollution.

Since residential development is located in the immediate vicinity of the border of the existing LRD-54 base, it is necessary to develop a design of a sanitary protection zone in the subsequent design stages to adjust the basic size of the SPZ (50 m) with the justification of the adequacy of the designed (calculated) SPZ boundaries and the assessment of the health risk of the population. The draft sanitary protection zone is subject to sanitary and hygienic examination in accordance with the procedure established by law (clause 10.25 of the "Unified List of Administrative Procedures Carried Out by State Bodies and Other Organizations in Relation to Legal Entities and Individual Entrepreneurs" approved by the decision of the Council of Ministers of the Republic of Belarus No. 156 dated 17 February 2012).

Reduction of traffic noise ensuring compliance with the requirements of sanitary norms, rules and hygienic standards "Noise in Workplaces, Vehicles, Residential, Public Buildings and Residential Buildings" approved by the Decree of the Ministry of Health of the Republic of Belarus No.115 dated 16 November 2011, is carried out due to a complex of activities of an active and passive nature. Activities that do not require significant additional costs when implementing them are considered as passive; active measures include the installation of special noise protection structures that require additional, sometimes substantial, capital costs.

Providing a rational transverse profile of the roadbed and designing a line of longitudinal profile, taking into account the natural terrain, based on the conditions for ensuring optimal driving conditions, landscaping and planting of roads in accordance with the requirements of TCCP 337-2011 (02191) "Motorways. Improvement and Landscaping Standards", will significantly reduce the noise level from the traffic flow.

The choice of the noise protection means, determination of the necessity and expediency of their

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application should be made on the basis of the calculation of the necessary reduction of sound level in the residential area and determination of the required screen efficiency.

The construction of noise protection screens planned for consideration should ensure the reduction of transport noise levels penetrating the adjacent residential area to the permissible values regulated by sanitary norms, rules and hygienic standards "Noise in Workplaces, Vehicles, Residential, Public Buildings and Residential Buildings" approved by the Decree of the Ministry of Health of the Republic of Belarus No.115 dated 16 November 2011.

In accordance with the requirements of TCCP 45-2.04-154-2009 "Noise Protection. Building Design Standards" noise shields to improve their efficiency should be installed at the minimum permissible distance from the road taking into account the requirements for traffic safety, road maintenance and vehicles. The materials used for screening should have stable physicomachanical and acoustic characteristics, should be bio- and moisture resistant, and should not release harmful substances.

When selecting noise shield designs, in addition to reducing noise and road safety, one should take into account the convenience of installation and operation of facilities, their aesthetic qualities and harmonious combination with the landscape.

Thus, noise protection structures (screens) must meet the following requirements:

- ensure the reduction of traffic noise levels penetrating the territory of the residential development adjacent to the reconstructed section of the motor road to the permissible values regulated by the Sanitary Norms;
- ensure the safety of the traffic (do not limit visibility and not create situations that can lead to the occurrence of traffic accidents and the increase of their severity);
- shall not separate or destroy the drainage system from the roadway;
- ensure the compliance with the requirements of insulation standards for residential and public buildings and residential areas;
- allow people's approach to public transport stops and ground pedestrian crossings;
- shall be durable, i.e. be resistant to self-destruction, to corrosion of materials, to atmospheric influences, to harmful influence of exhaust gases and anti-ice reagents;
- shall be convenient and safe in operation (in the course of repair works, when cleaning the road from snow);
- shall be fireproof and protected from vandalism.

Calculation of noise shielding parameters (length and height) should be performed at the subsequent design stages, taking into account the qualitative and quantitative composition of the transport stream, the design decisions made.

In accordance with the Guidelines on the use of noise-reducing structures on public roads, approved by the Order of "Belavtodor" department No 16 dated 26 January 2005, the effect of green spaces to reduce the noise level depends on the nature of planting, trees and shrubs, the time of year, and also on the spectral composition of the noise.

Values sound attenuation index (β_{gr}) for the most common green lines on public roads in the Republic of Belarus (for the spring and autumn period) are shown in Table 33.

Table 33.

Line of green plantation	Width of the line, m	Decrease * of the noise level by the line, ΔL_{gr} , dBA	Decrease * of the noise level on 1 m of the width along the line, β_{gr} , dBA / m
Two-row fir fences with uncircumcised lower tree branches without daylight	6-10	2,0-3,6	0,34-0,36
Two-row fir hedges with cut (dry) lower branches with a daylight of up to 20%	8-9	1,5-1,6	0,17-0,23
Multi-row plantings with a daylight of up to 10% (including undergrowth)	15-25	6,8-8,8	0,34-0,35

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Multi-row plantings with a daylight of up to 20% (including undergrowth)	15-25	3,3-4,2	0,14-0,18
Two- and three-row coniferous-deciduous plantations with a daylight of up to 10%	15-30	5,8-7,5	0,25-0,30
Two- and three-row coniferous-deciduous plantations with a daylight of up to 20%	up to 24	up to 3,3	up to 0,14
Shrubby strips composed of white willow	up to 24	up to 3,8	up to 0,16

* Decrease in the sound level by a strip of green plantations ΔL_{gr} , dBA, is calculated by the formula: $\Delta L_{gr} = \beta_{gr} \times B_l$, where B_l is the width of the green plantation line, m.

The rational list of initial data for calculating the expected noise levels at the calculated points on the territory of settlements is determined by the type of external noise sources considered, the features of the planning structure and the terrain of the locality, the designation of the objects and areas protected from noise.

If it is not possible to reduce the levels of traffic noise penetrating the adjacent residential area to the permissible values established by the Sanitary Norms through the implementation of a package of noise protection measures of an active and passive nature and optimum insolation efficiency, the rules for recognizing residential houses and their adjacent territories which are not appropriate for living conditions of sanitary requirements and protection of the rights of citizens in the field of housing relations are determined by the requirements of the Housing Code of the Republic of Belarus [No 428-Z from dated 28 August 2012 (amend. on 10 January 2015).

In accordance with the sanitary norms and rules "Requirements for the Design, Construction, Overhaul, Reconstruction, improvement of Construction Sites, Commissioning and Construction of Buildings", approved by the Resolution of the Ministry of Health of the Republic of Belarus No. 24 dated 04 April 2014 (p. 16), state supervisory authorities, at the request of the developer, the customer of the project documentation, issue a conclusion on the possibility of placing the facility in order before the development of the project documentation, which is provisioned by art. 6 of the Regulations on the preparation and issuance of permits for construction of facilities approved by the Council of Ministers of the Republic of Belarus No 223 dated 20 February 2007.

With regard to the organization of noise protection measures in the residential area, the conditions for the reconstruction of the facility in the zones adjacent to the residential development area, it is advisable to address the State Institution "Minsk Zonal Center for Hygiene and Epidemiology"; state institution "Smolevichi Regional Center of Hygiene and Epidemiology".

For the period of the facility construction, a set of measures should be provided to ensure safe working conditions for workers and minimize the impact of emissions and levels of physical impacts on the adjacent territory:

- technological processes and equipment should correspond to the technological regulations applied to the technological processes and production equipment;

- all equipment of the organization must have technical documentation (passports, operating manuals, etc.) containing information on the levels of generated noise, vibration, infrasound, the presence of radiation, released chemicals, other possible adverse factors, and protective measures against unfavorable factors;

- when using machines under the conditions specified in the operational documentation, the noise levels, vibration, gas contamination in the workplace, as well as in the operation area of the machinery, must not exceed the hygienic standards of the set requirements for noise, vibration, and gas contamination in the workplace;

- used and manufactured construction materials (sand, gravel, cement, concrete, paint and varnish materials, etc.), products and structures must have documents confirming their safety and harmlessness to humans, etc.

5.2 Measures to prevent or reduce potential adverse effects on surface water and groundwater

The regime for carrying out activities within the coastal zones and water protection zones of surface water bodies crossed by the projected section of the P-80 road Sloboda-Papernya, 0.000 km - 14.770 km, shall be adopted in accordance with the requirements of the Water Code of the Republic of

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Belarus No. 149 -3, dated 30 April 2014.

In order to minimize the possible adverse impact of the projected facility on surface water bodies, a set of measures should be envisaged in the project documentation to remove stormwater from the projected road beyond the coastal strip or clean it in accordance with the requirements of the Water Code of the Republic of Belarus No. 149 -3, dated 30 April 2014, TCCP 45-3.03-19-2006 (02250) «Motorways. Design Standards" and other technological regulations in the field of environmental protection ensuring sanitary and epidemiological welfare of the population.

To mitigate the negative impact on surface and ground water during the construction of the road the following requirements must be met:

- mandatory observance of the boundaries of the territory allocated for the construction;
- compliance with restrictions on the production of work in coastal areas of water bodies;
- compliance with the regime for carrying out activities within the water protection zones;
- prohibition of unauthorized parking of vehicles;
- water used for sanitation and drinking purposes by workers must meet the requirements of the technological regulations for drinking-quality water;
- on the territory of the construction site, places for the storage of building materials, products and structures must be specially equipped;
- in the vicinity of the construction sites, it is necessary to build biotoilets for the needs of workers, as well as pits for domestic sewage and subsequent sludge disposal;
- to exclude the filtration of sewage into groundwater, the bottom and walls of the pit should be concreted;
- the length of stay of sewage in the pit should not exceed 3-4 days;
- wastewater must be transported by special vehicles to treatment facilities;
- areas where water is used regularly to reduce dust generation, including warehouses, concrete, crushed stone and asphalt plants, should be equipped with drainage systems for draining water into special settling tanks for solid particles;
- after settling, the water can be reused for dedusting and washing;
- it is forbidden to dump and drain any materials and substances obtained during the work into water sources and low relief places;
- it is necessary to constantly monitor that all permanent and temporary watercourses and spillways near the construction site are kept clean, free from debris and waste;
- all contaminated water and waste liquids from construction sites should be collected and transferred to special containers;
- the basing or operation of road-building machinery in close proximity to water sources is prohibited;
- construction sites should be located outside the protection zone of water bodies and delineated by catchments with concreted settlers.

To reduce the removal of pollutants from wastewater from the construction site, it is necessary:

- to regularly clean up the territory with the maximum mechanization of cleaning processes;
- to protect the territory with the regulation of the surface waters drainage through the temporary system into the sedimentation tanks;
- to localize the territory and places of refueling of construction machines and mechanisms, as well as areas where spillages and spills of harmful substances and oil products are unavoidable;
- to streamline the storage and transportation of building materials.

Prevention of entry into water bodies of building materials due to erosion and removal of storm water is ensured by storing these materials on specially prepared sites isolated by a surface drainage system.

Materials, actively interacting with water, should be stored in special warehouses under the roof; organic substances – in closed storages.

Construction equipment must be cleaned and washed in specially designated places. Construction of coatings that exclude dust formation should be provided for the protection of surface and ground water from dust pollution.

In order to ensure the compliance with requirements of the current legislation in the field of

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water protection, the territory of the reconstructed LRD-54 should be landscaped, equipped with a centralized sewerage system or watertight cesspools, other constructions to prevent contamination, clogging of water; it shall have an organized access for removal of the contents of these constructions, together with rainwater systems.

5.3 Measures to prevent or reduce potential adverse impacts on land and soil

The allocation of land under the roadbed and road structures should be taken at a minimum level by the project.

All lands requested for a temporary use permit, upon completion of construction work, should be provided for reclamation for adjacent agricultural lands and transferred to land users.

Measures should be envisaged for the conservation and further use of the fertile soil layer for restoring the fertility of the reclaimed lands in the course of work related to the disturbance of lands and landscaping, as well as the location of the storage of the fertile soil layer and the procedure for applying it to the recultivated areas.

When traversing the forest land, it is necessary to provide for the removal and storage of vegetative soil on technological sites, for other lands – on the temporary right of way.

When removing the fertile soil layer, measures must be taken to prevent deterioration of its quality (mixing with underlying layers, fuel, oils, etc.). A fertile soil layer that is not used immediately in the course of work is stored and handed over to the responsible official according to the document, which specifies the volume, storage and use conditions of the fertile soil.

The removed fertile soil and peat are preserved for further use to strengthen the slopes of the roadbed, the slopes of the cuvettes, the roadsides, the slopes of the sprinkled berms of road signs, the recultivation of abandoned areas, bypass roads.

Recultivation of land is carried out in accordance with Regulating Document 0219.1.26-2002 "Guidelines for the Recultivation of Lands Being Disturbed during the Road Construction".

In order to avoid waterlogging of the territory adjoining the road in all lowered areas, it is necessary to provide for the discharge of surface waters through the installation of culverts. For the drainage of water, it is recommended to install side drainage channels (cuvettes), pipes for passing watercourses and water under the earthen cloth and to prevent the possibility of stagnation near the road for a long time.

To prevent soil erosion, it is recommended to perform log strengthening work of the ravine at the pipes. To prevent erosion of the roadbed, it is necessary to provide for the reinforcement of slopes and roadsides. Slopes and the bottom of the cuvettes are strengthened by sowing grasses on the layer of fertile soil. The bottom of cuvettes with a longitudinal slope of more than 10 ‰ is strengthened by a non-woven geotextile cloth with seeds of perennial grasses. The norms for the introduction of mineral fertilizers and lime, as well as the sowing of grass seeds, are adopted in accordance with the recommendations of the Ministry of Agriculture of the Republic of Belarus.

The lands provided for temporary use must be brought into a condition suitable for their intended use and returned to their previous land users.

Lands temporarily withdrawn from agricultural traffic must be restored to agricultural lands.

Land plots are planned, covered with a fertile layer of soil, while the relief of the planned areas should not have closed depressions. Thawed and storm water from recultivated areas are diverted from the land.

Work on restoring the fertility of the recultivated lands is carried out by land users who are transferred the land after technical recultivation at the expense of enterprises that carried out land disturbance work on these lands within the timeframe envisaged by the project.

Acceptance and transfer of the recultivated land to the respective landowners and land users is carried out by a commission appointed by the district (city) executive committee, or by the village (settlement) Council of Deputies on whose territory these lands are located; the relevant document is issued.

In order to comply with the requirements of the legislation in the field of ensuring the sanitary and epidemiological welfare of the population, before the development of the project documentation, it is necessary to request information about the presence/absence of cattle cemeteries, biothermal pits and

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other burial places for animal corpses, which died from anthrax, on the site of the object and the adjacent territory (1000 m in each direction from the facility). This information is requested in Smolevichi Regional Veterinary Station and the Minsk Regional Veterinary Station Zone

5.4 Measures to prevent or reduce potential adverse effects on flora and fauna

Preservation and enhancement of ecosystem sustainability in the area of construction and reconstruction of the road section can only be achieved by applying a complex of appropriate organizational, technical and technological measures based on knowledge of the current state of communities and components of the biodiversity of the area and the likely way of their development, resulting from the planned impact.

Activities during the work in the area of the Republican landscape reserve "Prilepsky"::

Prior to the beginning of the reconstruction of the road section, it is necessary to obtain the opinion (attitude) of the Minsk Regional Executive Committee that manages the "Prilepsky" Reserve (reason: section 5 of the Regulations on the Reserve), regarding the conditions for the reconstruction of the facility on the territory of the republican landscape reserve "Prilepsky", taking into account the requirements for compliance with the regime of economic activities within the boundaries of the reserve, established in accordance with legislation.

According to Article 33 of the Law of the Republic of Belarus "On Specially Protected Natural Territories", No. 3335-XII dated 20 October 1994 (version of 28 April 2015, as amended on 18 October 2016), the main tasks of the state body, in the management of which the reserve is transferred to, are as follows:

- ensuring compliance with the established regime of protection and use of the reserve;
- organization of implementation of environmental protection measures;
- provision of conditions for conservation in natural state of natural complexes and objects within the boundaries of the reserve, etc.

Recommendations for minimizing the impact on flora objects

In order to ensure environment, which is friendly for human life and health, rational (sustainable) use of flora resources, the removal of flora objects should be carried out in accordance with the requirements of the Law of the Republic of Belarus "On the Flora" No. 205-3 dated 14 June 2003 (version of 18 July 2016)

According to the Article 37-1 of the Law of the Republic of Belarus No 205-3 "On the Flora" dated 14 June 2003 (version of 18 July 2016), in case of the removal of flora objects growing on land plots, taken from the forest lands, for the use for purposes not related to forestry, the compensatory plantings or compensatory payments for the cost of the removed flora objects are not carried out. In this case, the project should take into account the compensation of losses of forestry production.

In case of necessity to remove trees and bushes growing in settlements, anti-erosion and roadside plantations, the project should determine the size and other conditions for the implementation of compensatory plantings or compensation payments for the cost of the removed flora objects in accordance with the requirements of Article 37-1 of the Law of the Republic of Belarus No. 205-3 "On the Flora".

In case of carrying out compensatory plantings, the compensation payments for the cost of the removed flora objects are not carried out.

In order to minimize the consequences of impacts on flora objects, occurring in the process of reconstruction and operation of the road section, the following measures are included: organizational, organizational-technical, forestry and agrotechnical.

The following constraints have been envisioned in the organizational and organizational-technical measures:

- it is strictly forbidden to cut trees and bushes outside the area allocated for construction work;
- the damage to all elements of plant communities (trees, bushes, ground cover) is strictly prohibited outside the area allocated for construction;

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- it is strictly forbidden to conduct fire work, in particular, burning out the territory and incineration of garbage at sites outside the area allocated for construction work and in the areas of high fire risk;
- it is not allowed to litter with construction and other garbage;
- it is strictly forbidden to arrange places for storing building material, parking special machines, etc. outside the areas designed for this purpose;
- it is necessary to carry out the improvement of roadside plantations: optimization of the road-footpath network, the equipment of recreational areas, the installation of garbage bins, etc.

Forest management activities include the following:

- carrying out sanitary felling, thinning, re-shaping, landscaping in tree stands adjacent to the road;
- cleaning of plantings from debris, as well as preventing their littering (installation of barriers, prohibiting signs, obstacles to entry into secondary forest roads, etc.);
- preventing the cluttering of allotments with felling residues at the edge of the forest in order to avoid forest fires with construction and other debris and sand;
- preventing the dusting of the root necks of the trees with soil, which can lead to weakening and shrinking of the trees within a month;
- preventing of mechanical damage to trees by working construction equipment;
- removal of wood felling residues and wood, located in the right-of-way.

Agrotechnical measures include the following:

- To prevent the spread of aggressive plant species and prevent secondary contamination of soils, the roadside mowing and harvesting of mown grass is necessary in the roadside;
- The use of spring planting only of trees and bushes in roadside.

Recommendations for minimizing the impact on wildlife

According to the requirements of Art. 23 of the Law of the Republic of Belarus No. 257-3 "On the Fauna" dated 10 July 2007 (version of 18 July 2016 No. 399-3), in case of placing, designing, erecting, reconstructing objects that have harmful effects on animals and (or) their habitats, or representing a potential danger to them, the project documentation shall provide for:

- measures ensuring the protection of wildlife and (or) their habitat from harmful effects of chemical and radioactive substances, wastes, physical and other harmful effects on them
- measures ensuring the preservation of migration routes and places for the concentration of wild animals, including through the construction and commissioning of facilities for the passage of wild animals through transport communications. The construction and commissioning of these facilities must be carried out before the erection and reconstruction of facilities that may damage the fauna and / or their habitat;
- other measures to prevent harmful effects on wildlife and (or) their habitats.

In cases where it is not possible to carry out the activities provided for in paragraphs 2 and 3 of Art. 23 of the Law of the Republic of Belarus "On the Fauna", in order to prevent possible harmful impact on wildlife objects, compensatory payments are made for harmful impact on fauna and (or) their habitat into the republican budget.

The procedure for determining the amount of compensation payments and their implementation is established by the Decree of the Council of Ministers of the Republic of Belarus No. 168 dated 07 February 2008 (version of 29 March 2016 No. 255) "On Approval of the Regulation on the Procedure for Determining the Amount of Compensation Payments and Their Implementation."

In accordance with the requirements of Article 23 of the Law of the Republic of Belarus No. 257-3 dated 10 July 2007 (version of 18 July 2016 No 399-3) and article 12 of the Regulation on the procedure for determining the amount of compensation payments and their implementation, approved by the resolution of the Council of Ministers of the Republic of Belarus No. 168 dated 07 February 2008, (version of the Council of Ministers dated 31 August 2011 No 1158, No 255 dated 29 March 2016), if the financing of construction works is carried out at the expense of the republican budget,

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In order to restore the lost habitat and fodder stations, reclamation of temporarily occupied lands with the sowing of grasses along a layer of fertile soil should be provided, which contributes to the restoration of the living ground cover, to the increase of the forage capacity of the land and, consequently, to the restoration of the population of soil invertebrates, which are included in almost all trophic chains and are the food base for many vertebrates.

For the conservation of amphibian populations:

- In the development of project documentation, additional studies are needed in the spring (the last 10 days of March - the first 10 days of May) in order to identify the presence of possible migration corridors, their location and the intensity of their use by amphibians. In case of detection of migratory corridors of amphibians with intensive migration, in order to ensure their functioning and to prevent the escape of amphibians to the road, it is recommended to equip such sections of the road with passages under the road, having special guiding structures. In case of low intensity of the migrants' progress on the problem areas of the road, a temporary restriction of the speed regime for the period of March 15 - April 15 to 40 km / h may be possible, with the installation of a scheme for reducing the speed regime in combination with the sign 1.35 "Seasonal migration of amphibians".

- If possible, perform all construction work and the associated felling of tree plantations in the autumn-winter period;

- To prevent accidents involving wild animals:

- arrangement of emergency areas with guide grid structures, with the establishment of special passages for wild animals under the road to preserve their migration routes;
- designation of sections of the road characterized by one-time coming of hooved by signs or panels, warning of possible danger.

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structures.

In order to optimize financial investments, if possible, the paths can be made in combination with local (or technical) passage, crossing a watercourse, etc. Transition parameters for wild animals should be determined at the design stage, taking into account the requirements of paragraphs 4.3.14 - 4.3.18 of TCCP 02191.3.016-2008 "Recommendations for Reducing the Negative Impact of the Road Transport on Wildlife Objects".

According to the information from the district structures of the Republican State-Public Association "Belarusian Association of Fishermen and Hunters", there are sites on the P-80 road with regular deaths of wild animals. Road accidents involving wild animals were recorded on a section of km 6 - km 13 of the road, but the largest concentration of road accidents was observed at km 6 - km 7 and km 8.5, while in the other areas there were isolated cases of wild animals coming to the road.

To prevent road accidents involving wild animals, a special passage under the road for ungulates at km 5.9 is envisaged. This passage can also be used by medium sized mammals.

In order to prevent the animals' coming on the road, it is planned to install guiding mesh structures on both sides of the road. Their main goal is the creation of a closed space up to the zone of action of the special passageway, i.e. the ensuring its functioning.

When designing grid guides, the following approaches should be used:

- ways to the forest roads must be equipped with sliding gates, with latches locking their closed position;

- when crossing with ways to remote settlements on the one side of the road, to provide for a rupture of the guides on the opposite side, as well as the approach of the guides for 10-15 meters onto the secondary road. Discontinuities should be marked with a warning sign 1.25 "Wild animals";

- the beginning and the end of the run of the net guides shall be marked with the warning sign 1.25 "Wild animals".

In order to inform road users about the possibility of the appearance of wild animals on the carriageway in the areas characterized by occasional comings of wild animals on the road, it is recommended to install warning signs 1.25 "Wild animals" and signs of additional information (plates) 7.2.1 that indicate the length of the dangerous area of the road, marked with warning signs.

Hunting farms located in the area of reconstruction of the P-80 road should:

- ensure that the actual number of wild ungulate animals is brought to the optimal level, and take measures to prevent in the future the exceeding of the actual number of these animals over the optimal number;

- if possible, remove biotechnical structures, especially feeding grounds, solonetzes, etc. from the indicated road.

Recommendations for the summer maintenance of the road for the conservation of soil insect populations

- to improve the structure of communities of invertebrates and soil microflora in the roadway, use long-term grasses for sowing roadsides. This will maximize the microflora of the soil and hamper the penetration of ruderal vegetation, since ruderal vegetation serves as a place for the development of undesirable sucking species (aphids, bedbugs) and leaf-eating insects (beetles, butterfly caterpillars, and sawfly larvae). Among these insects, the appearance of pests of agricultural crops and forest species is also possible;

- to mow down the grass at the roadsides in the last 10 days of June, and to prevent this event from happening in the last 10 days of May, in the first 10 days of June and in the first 10 days of July. This will allow to avoid mass deaths and undesirable migrations of the larvae and adults of herpetobiontic coleopterans;

- to exclude possible unauthorized extension of the roadway, and to monitor the implementation of this.

It should be taken into account that the impact of roads causes long-term damage to species, populations and communities, and dynamic processes in ecosystems can be of a directed transformation with irreversible changes in the structure of phytocenoses. There can also be a short-term and reversible response of biota to impacts, the distinguishing criteria of which can only be established via long regular monitoring observations.

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6. ALTERNATIVES

As part of the environmental impact assessment, two alternatives have been compared: "Implementation of the project solution for the reconstruction of the P-80 road Sloboda-Papernya, 0.000 km - 14.770 km " and "Zero" alternative - "Refusal to implement the project solution for the reconstruction of the P-80 road Sloboda-Papernya, 0,000 km - 14,770 km". Both positive and negative factors in the implementation of project solutions have been identified.

The rationale for selecting a priority option is given in Table 34.

Table 34.

	1st alternative: "Implementation of the project solution for Reconstruction of the road P-80 Sloboda-Papernya, 0.000 km - 14.770 km "		"Zero" alternative: "Refusal to implement the project solution for the reconstruction of the P-80 Sloboda-Papernya road, 0.000 km - 14.770 km "	
	Positive factors	Negative factors	Positive factors	Negative factors
Natural environment: atmospheric air	Improving the operational characteristics of roads and traffic conditions will lead to a reduction in emissions of pollutants from cars into the air.	Temporary pollution of the natural environment with exhaust gases of construction machinery used in the construction process. Pollution due to the operation of engines of vehicles and products of wear of tires and road surfaces in the process of traffic flow and transport of building materials.	Absence of negative consequences of the implementation of the 1st alternative.	A large number of emissions of pollutants into the atmosphere during braking-acceleration of vehicles and low speed of traffic, due to the unsatisfactory state of the roadway cover and low capacity of the existing road.
Acoustic impact	Taking into account the implementation of noise protection measures - the normalization of the acoustic situation in the residential area			The existing noise levels in the adjacent residential area exceed the permissible levels. Possible increase in the potential noise load is expected.
The natural environment: soils, land resources, surface and groundwater, vegetation	The use of the latest building technologies allows to minimize the amount of chemical and mechanical pollutants from the road to the adjacent land and water bodies.	Removal of a part of the land. Significant pressure on land and water bodies during construction. Removal of vegetation in the right-of-way.	Absence of negative consequences of the implementation of the 1st alternative.	Further receiving of pollutants from vehicles in large quantities.
Social-economic sphere	Decrease in the number of road accidents. Development of road-side service, business opportunities. Creation of new jobs in the field of road maintenance. Improve in social and economic indicators of the region.			Loss of profit from the cancelling of the project.

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	1st alternative: "Implementation of the project solution for Reconstruction of the road P-80 Sloboda- Papernya, 0.000 km - 14.770 km "		"Zero" alternative: "Refusal to implement the project solution for the reconstruction of the P-80 Sloboda-Papernya road, 0.000 km - 14.770 km "	
	Positive factors	Negative factors	Positive factors	Negative factors
Transport conditions	Increase in the volume of cargo traffic. Reduction of transport-operational costs (fuel, lubricants, spare parts and maintenance, depreciation, drivers' salaries, overhead costs, etc.).	Deteriorating transport conditions during construction.	Absence of negative consequences of the implementation of the 1st alternative.	Expenses for repair works on the road.

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7. PROPOSALS FOR THE LOCAL MONITORING PROGRAM OF THE ENVIRONMENT

The influence of roads causes long-term damage to species, populations and communities. The dynamic processes in ecosystems can be of directed transformation with irreversible changes in the structure of phytocenoses. They can also have short-term and reversible biota response to impacts. The consequences of such impacts can only be established if long regular monitoring observations are carried out

Monitoring of the state of the environment is the most important tool for ensuring compliance with the requirements of environmental legislation and minimizing the impact of economic activities on the environment and human health, needed to support environmental safety.

When performing integrated monitoring, it is recommended to conduct in-situ studies of the most significant characteristics of anthropogenic impact on the environment (the content of pollutants in the atmospheric air, the noise level at the border of the nearest settlements, etc.) and ensure compliance with environmental quality standards, based on small, simple and inexpensive parameters, used to assess regional trends and trends in the development of ecosystems in the zone of influence of the object. The practical purpose of the work is the regular collection of data on the acoustic regime and the state of atmospheric air, surface and groundwaters, soils, components of flora and fauna, the degree and intensity of damage to natural ecosystems by abiotic, biotic and anthropogenic factors, and the dynamics of these factors. Taking into account the need of monitoring the state of the main components of the natural environment and the biological diversity of natural complexes, it is necessary to organize integrated monitoring of ecosystems. Each of the above-mentioned components of the habitat has its own specifics and patterns of development and, therefore, requires an individual approach to the study and monitoring method.

The purpose of monitoring is to assess the impact of the constructed road on the adjacent territories, for the provision of the information support for the adoption of management and project solutions based on the monitoring of the level of pollution of the components of the natural environment and to assess the state of natural and plant complexes, the animal world, their dynamics and the development forecast.

It is recommended that the program of work will include:

- creation of a representative network of local monitoring in the area affected by the road
- air quality assessment;
- assessment of acoustic regime;
- assessment of the degree of pollution of the roadside with anti-ice reagents and technogenic emissions, accounting for the amount of introduced substances on the carriageway and the zone of their subsequent distribution in the roadside;
- assessment of the state of populations of terrestrial invertebrates in the road impact zone;
- assessment of the status of amphibian populations in the road impact zone;
- analysis of the number and location of accident sites involving wild animals (according to GAI reports and hunting farms);
- assessment of the status and counting of populations of protected plant species of the Red Book of the Republic of Belarus;
- assessment of the state of forest ecosystems in the roadside zone;
- assessment of the state of wetland ecosystems – via the set of criteria based on bioindication indicators;
- assessment of the effectiveness of environmental protection measures;
- forecast of the dynamics of the status of the most valuable objects of flora and fauna according to the results of monitoring observations;
- development of recommendations for the adoption of managerial and project decisions with respect to the operation and impact of the road to the adjacent territories;
- accumulation of monitoring results and their provision to interested government bodies, scientific organizations, the public, etc.

The list of indicators should be optimal, ensuring the control of the sanitary-hygienic and ecological situation with the minimal time, financial and labor costs. The system of indicators should include

the physical, chemical and sanitary-hygienic parameters of the environment established in accordance with the current legislation, an assessment of the state of flora and fauna in the zone of influence of the road.

According to the instruction on the application of the "Method of analytical (laboratory) control of pollutants in the ambient air at the border of the sanitary protection and residential zone" No. 005-0314 dated 25 March 2014 [30], it is recommended to include in the list of substances which are subject to analytical (laboratory) control the following items:

- pollutants, the emissions of which are more than 15% of the gross release of pollutants into the air;
- pollutants and summation groups whose calculated maximum concentrations, determined on the basis of the calculation of the dispersion of pollutants in the ambient air, at the border of the sanitary rupture and / or the residential area are equaled to 0.5 or more fractions MPCs.t.;
- pollutants for which temporary standards of permissible emissions of pollutants into the atmosphere are established.

The list of pollutants subject to analytical (laboratory) control by the amount of pollutant emissions is given in Table 35.

Table 35.

Name of pollutant	Emissions, t / year	Share of the emission by substance (%)	Name of pollutants the emissions of which count for more than 15% of the gross emission of the facility
Carbon oxide (CO)	237,551	49,50	Carbon oxide
Nitrogen oxides (NO _x)	109,699	22,86	Nitrogen (IV) oxide
Volatile organic compounds (VOC)	39,482	8,23	-
Methane (CH ₄)	2,234	0,47	-
Particulate matter (PM)	4,257	0,89	-
Non-methane volatile organic compounds (NMVOC)	37,248	7,76	-
Sulfur dioxide (SO ₂)	2,905	0,61	-
Cadmium (Cd)	3,39·10 ⁻⁵	7,06·10 ⁻⁶	-
Chrome (Cr)	1,69·10 ⁻⁴	3,52·10 ⁻⁵	-
Copper (Cu)	5,75·10 ⁻³	1,19·10 ⁻³	-
Nickel (Ni)	2,37·10 ⁻⁴	4,93·10 ⁻⁵	-
Selenium (Se)	3,39·10 ⁻⁵	7,1·10 ⁻⁶	-
Zinc (Zn)	3,38·10 ⁻³	7,04·10 ⁻⁴	-
Ammonia (NH ₃)	3,055	0,64	-
Nitrogen dioxide (N ₂ O)	2,901	0,60	-
Indeno (1,2,3-cd) pyrene	6,72·10 ⁻⁵	1,4·10 ⁻⁵	-
Benzo(k)fluoranthene	7,22·10 ⁻⁵	1,5·10 ⁻⁵	-
Benzo(b)fluoranthene	9,69·10 ⁻⁵	2,02·10 ⁻⁵	-
Benzo(ghi)perylene	1,45·10 ⁻⁴	3,03·10 ⁻⁵	-
Fluoranthene	1,24·10 ⁻³	2,58·10 ⁻⁴	-
Benzo(a)pyrene	3,79·10 ⁻⁵	7,9·10 ⁻⁶	-
Dioxins	4,78·10 ⁻⁷	9,97·10 ⁻⁸	-
Furans	1,00·10 ⁻⁶	2,08·10 ⁻⁷	-
Alkane	9,389	1,96	-
Alkenes	8,252	1,72	-
Alkynes	2,350	0,49	-
Aldehydes	1,609	0,34	-
Ketones	0,119	0,02	-
Cycloalkanes	0,328	0,07	-
Aromatic hydrocarbons	18,544	3,86	-

Carbon oxide (49%) and nitrogen oxides (23%) occupy the main share in the structure of emissions of pollutants into the atmospheric air.

An indicative list of pollutants subject to laboratory control in terms of the maximum

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(calculated) concentration is given in Table 36.

Table 36.

Name of pollutant	Amount of pollutants		The amount of pollutants, maximum concentrations of which are equal to 0.5 MPCs.t. / EFC and more		The list of pollutants, maximum concentrations of which are equal to 0.5 MPCs.t. / EEFCBC and more
	With background	Without background	With background	Without background	
Cadmium and its compounds	Calculation makes no sense Z S / MPC <0.01				
Nickel	Calculation makes no sense Z S / MPC <0.01				
Chromium (VI)	Calculation makes no sense Z S / MPC <0.01				
Zinc and its compounds	Calculation makes no sense Z S / MPC <0.01				
Copper and its compounds	4,3·10 ⁻⁴	4,3·10 ⁻⁴			
Nitrogen (IV) oxide	0,18/0,22	0,06/0,07	—	—	—
Ammonia	0,25/0,25	0,005/0,005	—	—	—
Sulfur dioxide	0,07/0,37	0,00/0,00	—	—	—
Carbon oxide	0,13	0,007	—	—	—
Selenium amorphous	Calculation makes no sense Z C _M / MPC <0.01				
Hydrocarbons of extreme aliphatic series C1-C10	Calculation makes no sense Z C _M / MPC <0.01				
Methane	Calculation makes no sense Z C _M / MPC <0.01				
Aromatic hydrocarbons	0,04	0,04	—	—	—
Benzapyrene	0,02	0,004	—	—	—
Formaldehyde (methanol)	0,61	0,01	0,60	0,01	Formaldehyde – surrounding contribution – 98%
Hydrocarbons of extreme aliphatic series C11-C19	7,9·10 ⁻³	7,9·10 ⁻³	—	—	—
Particulate matter	0,23/0,70	0,00/0,01	—	—	—

The main contribution to the formation of maximum surface concentrations of pollutants is made by the background level of atmospheric air pollution.

In the list of pollutants subject to laboratory control, it is advisable to include:

- nitrogen (IV) oxide;
- carbon oxide.

Laboratory research on the quality of atmospheric air should be carried out by laboratories accredited for the performance of this type of work in accordance with the procedure established by the legislation of the Republic of Belarus.

The frequency of air sampling should provide the possibility of obtaining data on the quality of atmospheric air, taking into account the seasons of the year. Sampling of atmospheric air is carried out taking into account the direction of wind, and at no less than in 2 control points. The posts for monitoring the quality of atmospheric air must be at the border of the residential area closest to the reconstructed object.

According to the instruction on the application of the "Measurement and hygienic noise estimation in populated areas" No. 108-1210 dated 24 December 2010 [31], it is recommended to measure noise levels in winter and summer. The frequency of control of noise levels is 2 times a year. Measurements of noise levels should be carried out in accordance with GOST 23337-2014 "Noise. Methods for Measuring Noise in a Residential area and in Residential and Public Buildings" [32] at no less than in four points located outside the sonic shadow at a distance of no more than 50 m from each other and at an altitude $(1.2 \pm 0.1) \text{ m} \div (1,5 \pm 0,1) \text{ m}$ above the surface of the territory.

Measurement of noise levels should be carried out by specialized laboratories accredited in accordance with the legislation of the Republic of Belarus, allowing to measure noise in residential area.

The posts to observe acoustic situation should be at the border of the residential area closest to the object.

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According to GOST 23337-2014, if an all-weather microphone is not included in the measuring equipment set, noise measurements in the territory should not be carried out during precipitation, in fog, at the levels of temperature and humidity not corresponding to the passport data of the equipment, and at a wind speed of more than 5 m/s. At a wind speed from 1 to 5 m/s, a windproof device recommended by the manufacturer should be used. The values of other meteorological parameters (air temperature, humidity, atmospheric pressure) during the measurements should not exceed the limits specified in the technical documentation for the relevant measuring equipment.

During the noise measurement, the operator conducting measurement must be at least 0.5 m away from the measuring microphone to reduce unwanted reflections of the sound. There should be no people between the measuring microphone and the source of noise or extrinsic objects (especially bulky items).

The recommended frequency of assessment in respect of objects of flora and fauna and contamination of the roadside will be as follows:

- the degree of pollution of the roadside by anti-icing agents and technogenic emissions - annually in snow (February-March), in soil - 2 times a year (April-May, October-November) and plants (June-August) (BeldorNII);

- state of amphibian populations - annually during the first 5 years, then - once in 2 years (SDPC "Scientific and Practical Center of the National Academy of Sciences of Belarus for Bioresources");

- recording of road accidents with wild animals - every year for the first 5 years, then - every 2 years (SDPC "Scientific and Practical Center of the NAS of Belarus on Bioresources", according to the reports of the road police and hunting farms);

- the state of forest, marsh ecosystems - every year for the first 5 years, then - every 3-5 years (IEE NASB).

There will be the following users of the information received within the framework of the program implementation:

- public administration bodies of the Republic of Belarus: Ministry of Transport and Communications; Ministry of Natural Resources and Environmental Protection, Ministry of Forestry, Inspection for the protection of flora and fauna under the President of the Republic of Belarus, district and regional inspections for natural resources and environmental protection;

- land users who are engaged in economic activities in the vicinity of the road;

- scientific organizations that provide scientific and methodological support for monitoring observations;

- non-governmental organizations.

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8. PROGNOSIS FOR THE APPEARING OF PROBABLE EMERGENCIES AND BEYOND THE PROJECT ALERT SITUATIONS

When implementing the planned activity, the potential risk of emergencies and beyond the project alert situations is characterized as low.

Possible emergency consequences for the environment during the reconstruction and operation of the facility include emergency situations associated with road accidents, accompanied by spilling and flaring of oil products and other pollutants. This aspect is mainly related to the fire safety measures and is regulated by the Law of the Republic of Belarus No. 2403-XII "On Fire Safety" dated 15 June 1993.

Measures for the operation of the facility should be aimed at creating safe conditions for the carriage of goods and passengers during the specified period of its service by:

- ensuring the safety of the facility under the influence of transport, operational, natural-climatic and other factors;
- organization of traffic using a complex of technical means;
- carrying out works to maintain the operational condition of the carriageway in order to guarantee safe and uninterrupted traffic;
- timely elimination or reduction of the risk of road accidents;
- timely informing road users about changes in the organization of the traffic;
- ensuring the availability of information on the permissible weight and overall parameters of vehicles;
- protection of road sections from snowdrifts, preventing the formation of snow crust and ice on the snow cover, facilitating the cleaning of snow and ice deposits and eliminating the winter slipperiness of road surfaces;
- introduction of permissible weight and overall parameters of vehicles to ensure the safety of the operated facility;
- introduction of temporary traffic restrictions in order to ensure traffic safety in hazardous natural phenomena or the threat of their occurrence, in emergency situations on the roads, during the road emergency and recovery operations.

The location of the construction site is defined in accordance with the requirements of the technological regulations in the field of fire safety regulations. The maintenance and equipment of sanitary facilities should correspond to the number of people working on the construction site, taking into account the movement of labor, the number of shifts, and the nature of work.

The employer is obliged to ensure the observance of protection measures for employees when working outdoors in the cold and warm seasons of the year in accordance with the technological regulations, of the microclimate in the workplace, as well as by organizing work and rest regimes.

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9. EVALUATION OF POSSIBLE SIGNIFICANT HARMFUL TRANSBOUNDARY EFFECTS

Taking into account the criteria established by the Convention on Environmental Impact Assessment in a Transboundary Context, signed in Espoo on 9 February 1991, the planned activities for the reconstruction of the P-80 road Sloboda-Papernya, 0.000 km - 14,770 km, will have no transboundary impact.

10. EVALUATION OF THE PROBABILITY OF POSSIBLE CONSEQUENCES OF THE IMPLEMENTATION OF PLANNED ACTIVITIES

The main sources of uncertainty in the assessment of planned activities for the environment and public health are as follows:

- use of analogous indicators of the planned types of work at the stage of justifying investments in the reconstruction of the facility in the course of alternative (variant) studies;
- uncertainties associated with the establishment of the reference level of the impact of the object within the republican landscape reserve "Prilepsky";
- the uncertainty associated with the formation of the initial sample (the presence / absence of sources of domestic and drinking water supply and their sanitary protection zones, surface water bodies used for recreational purposes, cattle cemeteries, biothermal pits and other burial sites for animals that died from Siberian ulcer, other zones of planning restrictions);
- exposure models, screening parameters used in assessing the existing acoustic pressure in residential areas -- in the area where the facility is located;
- screening prospective assessment of potential levels of atmospheric air pollution in the area of object reconstruction;
- extrapolation to the equivalent concentration for a person of the calculated concentrations of pollutants for which EBC is not developed.

The criterion of accuracy of predictive levels of impact on the environment and public health of the planned activity (in case there are no significant changes) can be assessed as good.

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CONCLUSION

The reconstruction of the P-80 road Sloboda-Papernya, 0.000 km - 14.770 km, is planned according to the parameters I-c of technical category.

The projected section of the road 0.000 km - 14.770 km is located in the Smolevichi and Minsk districts of the Minsk region.

Bearing in mind that any economic activity represents a potential environmental hazard, an environmental impact assessment [EIA] of the reconstruction of the P-80 road Sloboda-Papernya, 0.000 km - 14.770 km, was carried out.

The environmental impact assessment of the projected facility was carried out by the specialists of the department of technical, economic and environmental studies of the State Enterprise 'Belgiprodor'.

During the implementation of the EIA, the results of a full-scale assessment of the biological diversity of the location area of the proposed activity were used, as well as the monitoring carried out by "BeldorNII" within the framework of the R&D "Organizing observations of the complex impact of highways on the state of the environment". The monitoring was carried out within the framework of the National Monitoring System of the environment in the Republic of Belarus. The additional theoretical calculations were also made, and the planned project solutions were analyzed. The data obtained provided information basis for assessing the environmental impact of the project and developing recommendations for minimizing the consequences of the project's impact on the environment, including both general requirements and local object-oriented activities.

The EIA is based on forecasts of environmental impacts, which are caused by environmental changes resulting from the construction and operation of the road.

Possible impacts of the projected facilities on the environment are related to:

- construction works;
- functioning of facilities as engineering structures;
- operational impacts.

The impacts associated with the construction works are, as a rule, temporary, while the operational impacts will be manifested during the whole period of the operation of the facility. The main technical and economic indicators of the projected facility are as follows:

- category of road -- I-c;
- parameters of the transverse profile - in accordance with TKP 45-3.03-19-2006;
- the load on the single most loaded axle of a two-axle vehicle is 11.5 tons;
- type of pavement - capital.

During the reconstruction of the P-80 road Sloboda-Papernya, 0.000 km - 14.770 km, the following is planned:

- improvement of transport and operational qualities of the road due to changes in cross-sectional profiles of the road and improvement of the quality of pavement;
- taking measures for traffic safety;
- installation and improvement of bus stops;
- taking noise protection measures (including, if necessary, installation of the noise protection screens), in cases when the road passes near residential areas;
- development and improvement of recreational areas;
- reconstruction of the technological platform with the construction of a covered warehouse for storage of anti-ice materials on the LRD-411 (Selishche);
- the arrangement of transport interchanges at different levels, intersections with local roads, junctions in one level;
- recultivation of temporarily disturbed lands

When developing the project rationale for investments in the reconstruction of the P-80 road

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- construction of 10 structures;
- reconstruction of 2 buildings;
- lengthening of 1 structure.

One of the criteria for environmentally safe operation of roads is the quantitative indicators of atmospheric air pollution, determined by sanitary norms, rules, standards, and environmental conditions.

An important role in reducing emissions is played by the type and technical conditions of the road surface. The project solutions opted for a capital type road, which will also minimize dust generation.

In the immediate vicinity of the reconstructed section of the P-80 Sloboda-Papernya road, the republican landscape reserve "Prilepsky" is located. The border of the reserve passes along the right-of-way of the P-80 road on the south side in the following sections: km 12.1 - km 13.4, km 11.6 - km 11.9, from km 7.9 to the administrative border of Minsk rayon (km 4, 4).

The calculated maximum values of expected surface concentrations of pollutants at the border of the territory of the republican landscape reserve "Prilepsky", taking into account the background level of air pollution and the prospective growth in traffic, will not exceed the ecologically safe concentrations of pollutants in the ambient air.

An overall indicator of atmospheric air pollution "P" on the territory of reconstructed object meets the permissible degree of atmospheric pollution.

According to the preliminary results of acoustic calculations, the potential values of the calculated sound levels at the calculated points on the territory of residential area, closest to the projected facility, can exceed the established permissible levels.

In order to reduce the impact of traffic noise on the adjacent residential area and normalize the acoustic situation, it is proposed at the subsequent design stages to consider the use of the largest possible range of measures aimed at providing acoustic comfort, taking into account the specific conditions of the existing construction, technical and economic requirements, the expected dynamics of traffic increase, changes in the qualitative and quantitative composition of the traffic in the future.

The provision of a rational transverse profile of the roadbed and designing a line of longitudinal profile, taking into account the natural terrain, based on the conditions for ensuring the optimal driving regime, will significantly reduce the noise level from the traffic.

The construction (if necessary) of the noise shields should ensure the reduction of traffic noise levels penetrating the adjacent residential area to the permissible values regulated by sanitary norms, rules and hygienic standards in the "Noise in Workplaces, Vehicles, Residential, Public Buildings and on the Territory of Residential Buildings" No 115 approved by the Resolution of the Ministry of Health of the Republic of Belarus dated 16 November 2011.

The complex of technological processes associated with the construction of the roadbed usually causes the greatest damage to the environment. In case of the strict compliance with the boundaries of the right-of-way for construction and reconstruction of the road, the damage to the environment will be minimal.

To prevent damage to the soil cover during road reconstruction, provision should be made for the removal of the fertile soil layer in all areas of facilities and works, and its further use for restoring the

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fertility of reclaimed lands and landscaping.

All structural elements of the road must be done with the understanding of necessity to prevent erosion.

The temporarily disturbed lands are subject to recultivation.

The project will provide measures to minimize possible impacts of the construction and operation of the road on the geological environment, terrain, soil cover and land.

To prevent pollution and depletion of water bodies, the project should provide for a set of measures in accordance with the requirements of the Water Code of the Republic of Belarus No. 149-3 dated 30 April 2014, technological regulations in the field of environmental protection ensuring sanitary and epidemiological safety of the population. The implementation of all project solutions and compliance with basic environmental standards, both by construction organizations and individuals operating this road in the future, will allow to minimize the anthropogenic pressure on water bodies, to guarantee their ability to self-purification and self-repair.

The implementation of the planned activities will have a positive effect for the social and economic development of the region at large. The reconstruction of the road in accordance with I-c category standards will promote the growth of cargo and passenger transportation, roadside services, business opportunities, and, accordingly, the creation of new jobs in road maintenance. All this will lead to increase in socio-economic indicators of the region, and the increase in the well-being of the population.

Improving road performance and traffic conditions will reduce the number of road accidents.

The route of the reconstructed road will be laid with the maximum combination of the projected route with the existing road with a partial removal (alienation) of land during the construction of the roadbed, man-made structures and utilities.

The reconstruction of the section of the P-80 Sloboda-Papernya road, 0.000 km - 14.770 km, does not in general affect the rare component of the flora of this region. From the point of view of the impact on the flora of the study area, the reconstruction of the road is permissible and does not contradict the preservation of floral diversity.

In the immediate vicinity of the reconstructed section of the P-80 Sloboda-Papernya road, the republican landscape reserve "Prilepsky" is located. The border of the reserve passes along the right-of-way of the P-80 road on the south side in the following sections: km 12.1 - km 13.4, km 11.6 - km 11.9, from km 7.9 to the administrative border of Minsk rayon (km 4, 4).

According to the preliminary data, the broadening of the roadbed during the reconstruction of the P-80 road is planned, mainly, to the right.

In the area of the planned works on the reconstruction of the road section, the protected plant and animal species, as well as rare biotopes and natural landscapes that are of environmental value are absent; therefore, the minimal impact is expected on the reserve territory.

The reconstruction of the P-80 road will not affect the valuable part of the 'Prilepsky' reserve, and the planned operations will not entail significant changes in its ecosystem.

Forests, falling into the zone of permanent afforestation, are quite representative of the plantations along the reconstructed section of the road.

In order to reduce the negative impact on the plant communities of the region, the removal of flora objects should be taken in minimum.

In the area of planned economic activity, there are no areas with plants and habitats of animals listed in the Red Book of the Republic of Belarus.

From the flora and fauna point of view, the forthcoming project and construction works for the reconstruction of the P-80 road are permissible and do not contradict to the conservation of the biodiversity of this territory.

In order to minimize the potential adverse effects of the projected facility on the plant and animal world, a set of measures is proposed, including measures to prevent accidents with wild animals and preserve their migration routes.

If the set of environmental measures stipulated in this EIA is complied with, the impact of the reconstruction of the road will not be critical for the animal populations. The implementation of the proposed recommendations will allow minimizing the negative anthropogenic impact, and the conducted environmental measures will restore the existing biological diversity. Influence on the flora

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and fauna of the studied region will be insignificant - within the permissible limits, not exceeding the ability of the components of the vegetable and animal world to self-repair.

All recommended measures to reduce the negative impact on the environment will help to improve the environmental conditions of the area of the road.

Developed as a result of the EIA, the conditions for projecting facility in order to ensure the environmental safety of the planned activities, taking into account the possible consequences in the field of environmental protection and rational use of natural resources and associated socio-economic and other consequences of the planned activity for the environment and public health, are presented in Annex 4.

Thus, based on the planned project solutions for the reconstruction of the P-80 Sloboda-Papernya road section, 0.000 km - 14.770 km, with the implementation of the specified environmental measures and strict environmental control, no negative impact on the environment is expected. The state of the natural components will not change significantly and will remain within acceptable limits.

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