

**UkrLithiumMining LLC**

**High-level Environment & Social Impact  
Assessment (ESIA) Desktop Review of the  
Greenfield Sites**

**Final Report**

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## EXECUTIVE SUMMARY

The current report is a high-level Environment & Social Impact Assessment (ESIA) desktop review of the greenfield sites, which are planned to be used in the future for lithium ore mining (Polokhiv deposit site) and an ore processing plant site, located in Mala Vyska district, Kirovohrad region, Ukraine. It focuses on the initial assessment of the current state of the environmental and social issues, identification of the available infrastructure on the sites and in the surrounding area, and defining the information gaps, which should be additionally assessed at the further project stages.

Collected and presented in the current report information can be seen as the pre-scoping stage and be useful at the main scoping stage, as well as for the design of the baseline assessment program. All data presented are found in the literature, the open websites, or google maps. The data can be used as secondary data in the future ESIA report, although it is recommended to implement the field surveys with the collection of primary data that complement, specify and support the data already collected, and fill existing information gaps.

Briefly, CDM recommends:

- To install an on-site state-of-the-art weather station for continuous monitoring of the weather data;
- To install air quality devices for continuous monitoring of air quality upwind and downwind from the Polokhiv deposit site and ore processing plant; alternatively, air testing can be organized by air sampling and laboratory testing on a monthly basis;
- To measure the ambient noise four times per year on the site, on the sanitary protection zone, and two points at a distance from the site in the residential area directions;
- To collect soil samples at the study area and test them in the laboratory (once);
- To collect groundwater samples from the monitoring wells on a monthly basis and analyze them in the laboratory;
- To collect the surface water samples on a monthly basis and analyze them in the laboratory;
- To organize seasonal biodiversity surveys by the experts in vegetation and key wildlife experts to assess the site and identify the critical habitats;
- To start the interactions with the stakeholders as early in the project stage as possible to establish good relations with the community.

## 1 INTRODUCTION

LLC “CDM Engineering Ukraine” (hereinafter referred to as CDM) was contracted by the LLC “UkrLithiumMining” (hereinafter to be referred to as the Client) to perform a high-level Environment & Social Impact Assessment (ESIA) desktop review of the greenfield sites, which are planned to be used in the future for lithium ore mining (Polokhiv deposit site) and an ore processing plant site, located in Mala Vyska district, Kirovohrad region, Ukraine.

### 1.1 Objectives and Scope

The aim of the current ESIA desktop review is the initial assessment of environmental and social conditions of the site locations’ areas with the purpose of early identification of possible constraints to the project implementation from both the environmental and social standpoint and with respect to the existing infrastructure.

The scope of the ESIA desktop review includes the following:

- initial assessment of the current state of the environment, and the physical, biological, social and economic conditions of the site areas;
- identification to the extent possible of the available infrastructure on the sites and in the surrounding area suitable for future development;
- identification of the information gaps, which should be additionally assessed during future project stages.

### 1.2 Limitations

The conclusions of this report are based on the desktop review of the available documents/reports and information from open sources. No visits to the sites were made, nor were there any contacts with the authorities and/or public or other stakeholders.

## 2 SITE DESCRIPTION

### 2.1 Site Locations and Surrounding Land Use

The Polokhiv deposit and ore processing plant sites are located on the territory of Mala Vyska United Community<sup>1</sup>, Novoukrainsky district, Kirovohrad region, Ukraine.

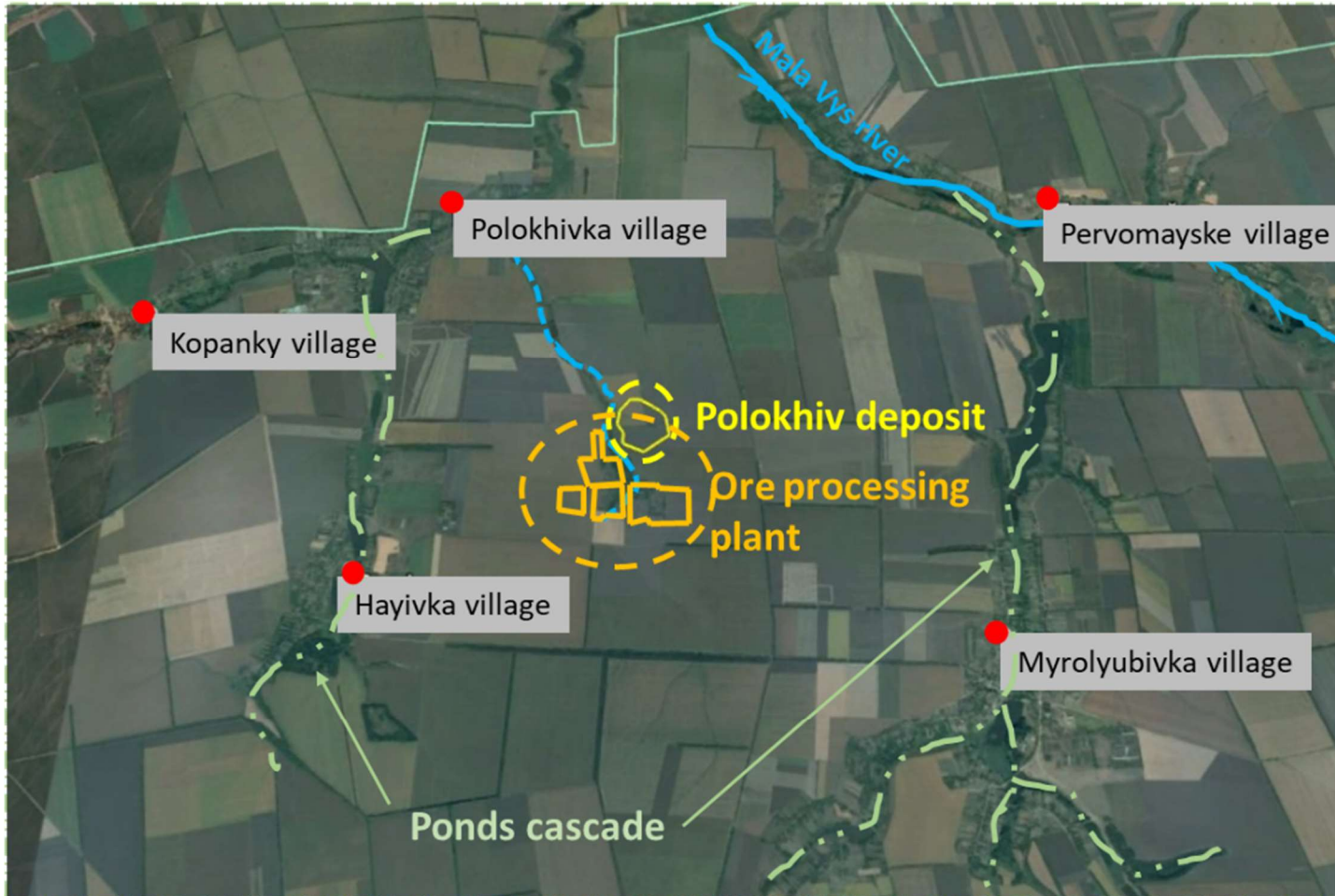
The Polokhiv deposit site and ore processing plant covers 0.24% of the total area of Mala Vyska United Community, which is 23,183 ha. The area owned by UkrLithiumMining LLC is surrounded by private property utilized for agricultural production purposes.

In accordance with the State Sanitary Rules for Planning and Development of Human Settlements, the sanitary protection zone of the Polokhiv deposit site is 100 m (“enterprises for the extraction of metal ores and metalloids by the mine method, with the exception of lead ores, mercury, arsenic and manganese”). The sanitary protection zone of the ore processing plant site is 300 m (“chemical processing of liquid metal ores to obtain salts of antimony, bismuth, lithium, etc.”). The nearest residential area is located at a distance of around 2000 m.

The surrounding land use is summarized below and showed on **Figure 1**:

<b>North</b>	<ul style="list-style-type: none"> <li>Privately owned agricultural land</li> </ul>
<b>Northwest</b>	<ul style="list-style-type: none"> <li>Residential area of Polokhivka village in 2790 m. It belongs to Smolins’ka United Community, Novoukrainsky district</li> <li>Residential area of Kopanky village in 2550 m. It belongs to Smolins’ka United Community, Novoukrainsky district</li> </ul>
<b>West</b>	<ul style="list-style-type: none"> <li>Pond at 2350 m</li> </ul>
<b>Southwest</b>	<ul style="list-style-type: none"> <li>Residential area of Hayivka village (until 2016 Lenina) 2600 m from the Polokhiv deposit (1900 m from the future ore processing plant). It belongs to Smolins’ka United Community, Novoukrainsky district</li> </ul>
<b>South</b>	<ul style="list-style-type: none"> <li>Privately owned agricultural land</li> </ul>
<b>Southeast</b>	<ul style="list-style-type: none"> <li>Residential area of Myrolyubivka village (until 2016 Kirovka) in 3780 m from the Polokhiv deposit (3000 m from the future ore processing plant). It belongs to Mala Vyska United Community, Novoukrainsky district</li> </ul>
<b>East</b>	<ul style="list-style-type: none"> <li>Privately owned agricultural land</li> </ul>
<b>Northeast</b>	<ul style="list-style-type: none"> <li>Mala Vyska river in 3625 m</li> <li>Residential area of Pervomayske village in 3770 m. It belongs to Mala Vyska united community</li> </ul>

<sup>1</sup> United community is voluntary association of residents of several villages, towns, cities, having a single administrative center (according to the Law of Ukraine " On local self-government ").

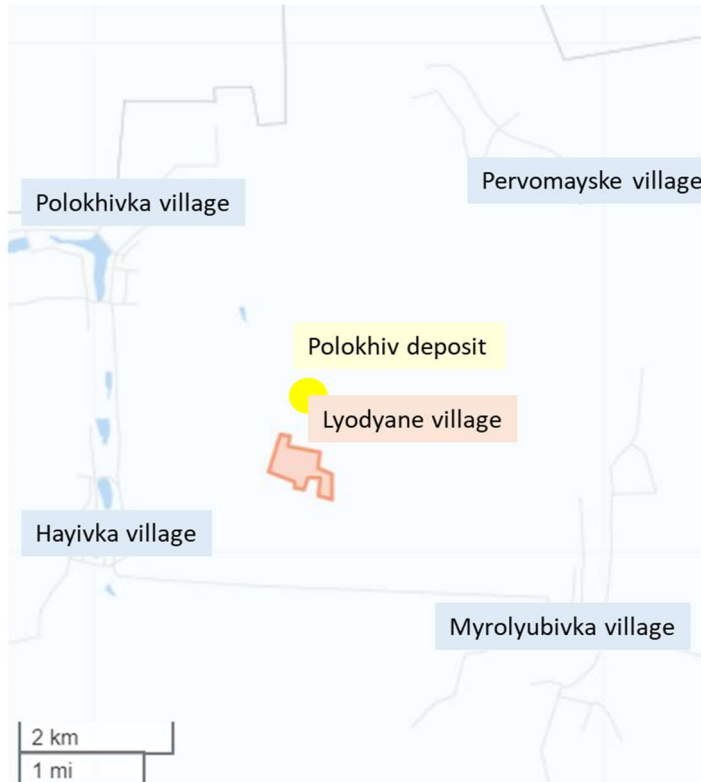


**LEGEND:**

- Villages
- Rivers
- - - Temporary watercourse
- ( ) Sanitary protection zone of the deposit
- ( ) Sanitary protection zone of the ore processing plant
- - - Ponds cascade

*Figure 1 Surrounding land use*

According to the geological report, conducted by GEO-KRATON LLC, the center of the deposit is located near (300 m) an abandoned village – Lyodyane. The village has been deregistered due to the relocation of residents based on the decision of the Kirovohrad Regional Council on 22.02.1991. The location of said village is shown in the figure below (see **Figure 2**).



**Figure 2 Former location of the abandoned Lyodyane village**

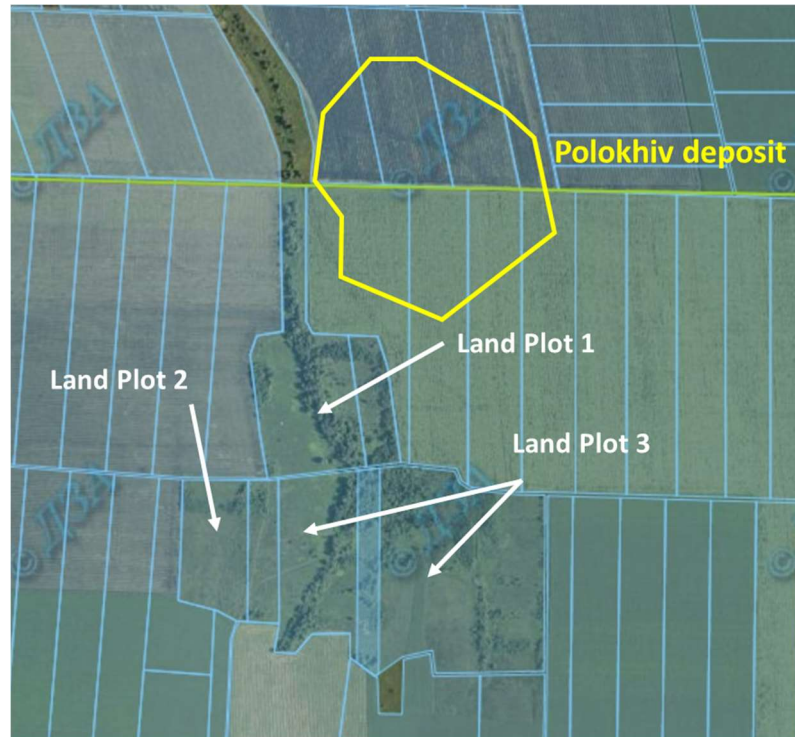
## 2.2 Land Ownership

The project is located over an area of 54.552 ha distributed as follows:

- 20.55 ha in accordance with the special subsoil use permit No.6195, issued on 3.04.2017 by the State service of Ukraine on geology and subsoil for 20 years (until 4.03.2037). Based on the public cadastral map of Ukraine, the Polokhiv deposit is located on privately owned land plots with the assigned purpose for commercial agricultural production<sup>2</sup>;
- 34.002 ha are adjacent to the licensed area from the south and southwest, with the installed purpose for placement and operation of the main and auxiliary buildings and facilities associated with subsoil use. This area consists of land 3 plots and is provided with documents certifying the ownership right of UkrLithiumMining LLC and have cadastral numbers:
  - Land plot 1 with a cadastral number 3523182400:02:001:5080 (7.999 ha);
  - Land plot 2 with a cadastral number 3523182400:02:001:5079 (4.0001 ha);
  - Land plot 3 with a cadastral number 3523182400:02:001:5078 (22.0002 ha).

<sup>2</sup> The land purpose is defined by the Order No.548 of the State Committee of Ukraine on land resources “On approval of the Classification of the purpose of land”, dated 23.07.2010

The land plot 3 has an intersection with 2 ha of private property for personal farming (cadastral number 3523182400:02:000:5166, 20.06.2017), with a total intersection area of 19996.2919 m<sup>2</sup> (National Land Cadaster, 26.05.2020). It is required to suggest a procedure to tackle this intersection issue. Introduction of an effective grievance mechanism at an early stage will be an asset. The land plot 2 is separated from the land plot 3 by a 2 ha of land (privately owned, cadastral number 3523182400:02:000:5179) with the same purpose (personal farming). See **Figure 3** for the visualization of the land plot locations, developed on the basis of public cadastral maps<sup>3</sup>.



**Figure 3** Land ownership according to the public cadastral map of Ukraine

<sup>3</sup> [https://map.land.gov.ua/?cc=3461340.1719504707,6177585.367221659&z=6.5&l=kadastr&bl=ortho10k\\_all](https://map.land.gov.ua/?cc=3461340.1719504707,6177585.367221659&z=6.5&l=kadastr&bl=ortho10k_all)



## 3 ENVIRONMENTAL SETTINGS OF THE SITES

### 3.1 Physical and Geographical Characteristic of the Area

Mala Vyska district is located within the Dniester-Dnieper forest-steppe region of the South-Dnieper upland forest-steppe region. Watershed slight-hilled areas with typical low-humus black soils with a humus content of 5.0% predominate in the landscape structure of the South-Dnieper upland forest-steppe region. There are also medium-humus black soils with the humus content over 5.5% and very undulating areas with black soils, podzolic soils and dark grey forest soils. They have small slopes and arable land of high potential productivity. Significant area is occupied by black soil with varying degrees of degradation. Mala Vyska district is characterized by uneven hilly terrain; there is a large number of hollows and ravines in the area<sup>4 5 6 7</sup>.

### 3.2 Geology and Hydrogeology

Kirovohrad region belongs to one of the most mineral-rich regions of Ukraine. This is due to the location of the region in the center of the Ukrainian Crystal Shield. There are more than 390 mineral deposits on the territory of the region, of which 303 deposits are taken on the state balance of Ukraine<sup>8</sup>. Tectonically, the exploration area is located in the southern part of the Central Axial Rise, which includes the Korsun-Novomyrhorod pluton, and the Novoukrainka and Kirovohrad granitoid massifs. Inhulo-Inhulets synclinorium is located to the east of the rise, and Bratsk synclinorium is located to the west of the rise. The first is composed of metamorphosed volcanic-sedimentary formations of the Spasiv and Checheliyiv Suites of the Inhulo-Inhulets series, the second is composed of sediments of the Kamiano-Kostovatska and Roshchakhiv Suites.

A range of geological surveys were conducted on the study area during the last 30 years, the first of which occurred in 1989. The most detailed surveys were conducted in recent years. In 2017-2018, UkrLithiumMining LLC conducted a detailed exploration of the Polokhiv deposit site area. During this survey, 6 deep boreholes were drilled, and a full range of geophysical surveys were conducted, including core testing with the selection of routine and composite samples. In 2019-2020, the surveys were conducted by GEO-KRATON LLC, and summarized in the “Report on the results of exploration within the Polokhiv petalite lithium ores deposit in the Mala Vyska district, Kirovohrad region in 2019-2020”. The soil profile is shown in **Figure 4** below. The figure was taken from the Report of GEO-KRATON LLC.

<sup>4</sup> <https://gromada.info/gromada/smolinska/>

<sup>5</sup> <http://invest.kr-admin.gov.ua/index.php/uk/smolinska-selyshchna-oth>

<sup>6</sup> “Complex forest zoning of Ukraine and Moldavia” / edited by S.A. Gensiruk // Kyiv: “Naukova dumka”. - 1981.

<sup>7</sup> Ecological passport of Kirovohrad region for 2019

<sup>8</sup> The Regional report on the state of the environment of Kirovohrad region in 2019 (the last one publicly available), issued in 2020 by the Department of ecology, natural resources and fuel and energy complex of Kirovohrad Regional State Administration.

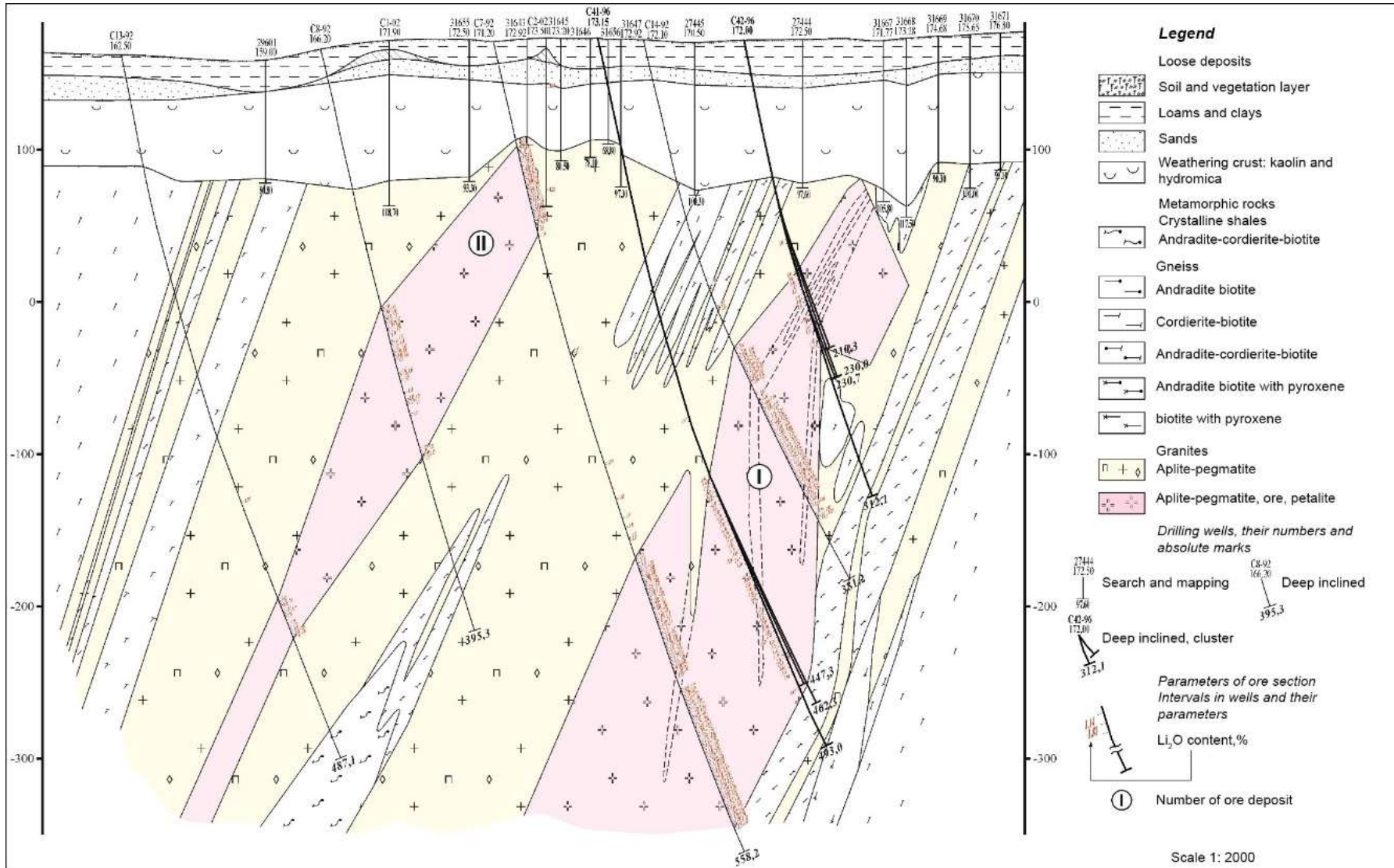


Figure 4 The soil profile and occurrence of Aplite-pegmatite and petalite ores

The hydrogeological conditions of the study area (described in the exploration report of GEO-KRATON LLC) are determined mainly by the features of its geological structure, tectonics, as well as physical and geographical factors such as climate, geomorphology and hydrography.

Four groundwater aquifers that discovered on the Polokhiv deposit site during one of the surveys (the detail information can be obtained in the mentioned geological report). See **Table 3.1** below.

**Table 3.1 Average long-term water quality indicators in the Velyka Vys River.**

No.	Aquifer	Piezometric level	Thickness, m	Description
1	Aquifer of alluvial deposits of river valleys and gullies	comes to the surface	0.1 to 5 m	The aquifer is discovered in sands and loams, it is pressure-less, and fed by precipitation, and the water of the Neogene aquifer. The filtration capacity of water-bearing rocks is low: the coefficient of permeability is 0.1-0.5 m per day. Water is hydrocarbonate and hydrocarbonate-sulfate type with the mineralization 0.5 g/dm <sup>3</sup> , and the total hardness 7.05 mg eq., pH is slightly alkaline to neutral (from 7 to 7.5). The flow rate of the horizon depends on the intensity of precipitation and snowmelt and varies from 1 to 40 m <sup>3</sup> per day.
2	Aquifer of aeolian-diluvial quaternary sediments	0.5 to 11 m	0.1 to 10 m	The aquifer is confined to the lower part of loess-like loams. The aquifer is limited by impermeable layers: dense types of loam from the top and red-brown clay from the bottom. The filtration coefficients vary from 0.09 to 1 m/day (average – 0.3 m/day). The chemical composition of water is hydrocarbonate, hydrocarbonate-sulfate, the mineralization is 0.3-0.7 g/dm <sup>3</sup> , total hardness – 4-9 mg-eq., and the reaction of water is slightly alkaline to alkaline (pH 7.1 to 8.2).
3	Aquifer of Neogene Miocene and Kyiv-Berek Paleogene deposits (combined)	5 to 10 m	up to 18.5 m	The Neogene sands are fine-medium-grained and fine-grained quartz with different degrees of clay particles. Due to the presence of water-resistant red-brown clays in the cover, the aquifer is confined (pressured). The bottom of the aquifer is lined by the kaolin weathering crust of crystalline rocks with uneven relief. The movement of groundwater is in the western direction, where a partial unloading of the aquifer is in the valley of the Lyodyana draw. The sands of the aquifer of the Neogene-Miocene sediments and the Kyiv-Berek Paleogene sediments (combined) have the properties of sand carrying, and therefore are prone to landslides.

No.	Aquifer	Piezometric level	Thickness, m	Description
				Waters are hydrocarbonate-sulphate of sodium-calcium type.
4	Aquifer of cracked waters in crystalline rocks	0 to 10-12 m	60-90 m	<p>It is the main aquifer and is widespread in the deposit. Crystalline rocks represented by granitoids and the host gneisses lie under the layer of Cenozoic sediments and weathering crust of crystalline rocks. The kaolin weathering crust is the upper waterproof rock for this aquifer. The vertical distribution of fractured waters is limited by the depth of fractured crystalline rocks development. The horizon is confined (pressured). The direction of the waters is to the western and north-western directions. The coefficient of permeability is 1.2 m/day. The aquifer of cracked waters in crystalline rocks is hydraulically weakly connected with the aquifers above.</p> <p>The aquifer waters of the fractured zone of crystalline rocks are the sodium bicarbonate type. Mineralization is from 0.5 to 0.9 g/dm<sup>3</sup>, sometimes increases to 1.3 g/dm<sup>3</sup>, pH varies from 6.6 to 8.5.</p>

### 3.3 Hydrology

The hydrographic network of Kirovohrad region consists of 1599 rivers with a total length of 7233.6 km. All rivers of the region, according to water management zoning of the territories of Ukraine<sup>9</sup>, belong to two basins: the Southern Bug and the Dnipro. Most of them in the study area, however, belong to the basin of the Southern Bug River and its tributaries – the rivers Syniukha and Inhul. The nearest rivers to the study area are Velyka Vys, Mala Vys, and Pletenyi Tashlyk<sup>10 11</sup>.

Velyka Vys is a left tributary of the Syniukha River (Southern Bug River basin). The length of the river is 166 km, the area of the basin is 2,860 km<sup>2</sup>. The valley is mostly trough-shaped, swampy in the upper reaches, and slightly meandering. It is 4 km wide and up to 40 m deep. The river has mostly snow feeding. The chemical composition of the water is hydrocarbonate (calcium-magnesium). The mineralization varies from 0.4 g/dm<sup>3</sup> during the flooding period, up to 1.0 g/dm<sup>3</sup> during the low season. The Kamyanske Reservoir is located on the river. The distance from the Polokhiv deposit site to the Velyka Vys River is 8 km to the north.

The water quality in Velyka Vys River is presented in the **Table 3.2** below.

<sup>9</sup> <http://geoportal.davr.gov.ua:81/>

<sup>10</sup> "Complex forest zoning of Ukraine and Moldavia" / edited by S.A. Gensiruk // Kyiv: "Naukova dumka". - 1981.

<sup>11</sup> Ecological passport of Kirovohrad region for 2019

Table 3.2 Average long-term water quality indicators in the Velyka Vys River<sup>12</sup>

Seasons	Components, mg/dm <sup>3</sup>															
	HCO <sub>3</sub> <sup>-</sup>	SO <sub>4</sub> <sup>2-</sup>	Cl <sup>-</sup>	Ca <sup>2+</sup>	Mg <sup>2+</sup>	Na <sup>+</sup>	K <sup>+</sup>	Total mineralization	NH <sub>3</sub>	NO <sub>2</sub>	NO <sub>3</sub>	N <sub>min</sub>	P <sub>min</sub>	P <sub>org</sub>	P <sub>Σ</sub>	Si
Spring high-water flow	376	80	46	81	33	42	33	681	1,92	0,02	0,51	1,63	0,11	0,1	0,2	2,1
Summer low-water flow	423	83	48	79	37	48	27	745	0,57	0,02	0,49	0,56	0,12	0,13	0,25	1,7
Winter low-water flow	397	84	51	81	42	49	27	731	1,15	0,02	0,51	1,03	0,12	0,07	0,19	2,5
Drinking water quality standard <sup>13</sup>	-	<250	<250	-	-	<200	-	<1000	-	<0,5	<50	-	-	-	<3,5	<10
Fishery standart		<30	<30							<0,05	<2,0				<0,5	

- components are not standardized

<sup>12</sup> Valentyn Khilchevskiy. Water resources and quality of river waters of South Bug River basin: Nika-Centre, January 2009

<sup>13</sup> DSanPiN 2.2.4-171-10 "Hygienic requirements for drinking water intended for human consumption", approved by the Order No.400 of the Ministry of Health of Ukraine on 12.05.2010

The Mala Vys is a river within the Novoukrainsky district of the Kirovohrad region. It is a left tributary of the Velyka Vys (basin of the Southern Bug River). It flows into the Velyka Vys to the east of the village of Myrolyubivka. The length of the river is 40 km, and the area of the basin is 488 km<sup>2</sup>. The valley is mostly trough-shaped, up to 2.5-3 km wide. The river is moderately meandering, up to 15-20 m wide. The runoff is regulated by small reservoirs and ponds, the largest of which is located 17 km east of the Polokhiv deposit site. The river's feeding is mixed with a predominance of snow melt. The chemical composition of the water is hydrocarbonate (calcium-magnesium). The mineralization varies from 0.3 g/dm<sup>3</sup> during the flooding period, up to 0.8 g/dm<sup>3</sup> during the low season. It is used for water supply and fish farming. The Mala Vys has small streams as tributaries. The distance from the Polokhiv deposit site to the Mala Vys River is 3625 km to the northeast.

The Kylten River, a left tributary of the Velyka Vys River, flows at a distance of about 8 km south and southwest of the site. The length of the river is 39 km, and the area of the basin is 282 km<sup>2</sup>. Several small lakes have been built on the river for fish farming and water supply for the local residents.

The Pletenyi Tashlyk River is a left tributary of the Syniukha River (Southern Bug River basin). The length of the river is 135 km, the area of the basin is 405 km<sup>2</sup>. The valley is mostly trough-shaped, up to 6 km wide. The floodplain is up to 200 meters wide. The chemical composition of the water is typical for the region – hydrocarbonate (calcium-magnesium), and the mineralization varies from 0.7 g/dm<sup>3</sup> during the flooding period, up to 1.8 g/dm<sup>3</sup> during the low season. The river is moderately meandering and very meandering in the lower reaches. The territory of the basin is elevated, relatively poorly dissected by hollows and ravines. The distance from the study area to the Pletenyi Tashlyk River is 20 km to the southeast.

In the immediate vicinity of the area of the Polokhiv deposit site and the ore processing plant there is a temporary watercourse (flowing along the south-western and western borders of the Polokhiv deposit and generally directed to the northwest), and a pond on the border with the licensed area. The mentioned reservoirs are fed by snow and rain. The reservoirs are currently overgrown with wetland vegetation. In addition, 3 kilometers to the east is a cascade of nameless ponds, which are probably used to irrigate the surrounding agricultural fields.

To summarize, there is very limited information available about the quality of water in the surface water bodies flowing in the area. For future needs of the ESIA study, it is recommended to develop and implement a monitoring program for the relevant water bodies to check the quality of the water, as well as its changes depending on the season. It is proposed to sample water on a monthly basis and analyze the samples in the laboratory. The laboratory results can be compared with the state standard DSanPiN 2.2.4-171-10 "Hygienic requirements for drinking water intended for human consumption", approved by the Order No.400 of the Ministry of Health of Ukraine on 12.05.2010.

### 3.4 Climate

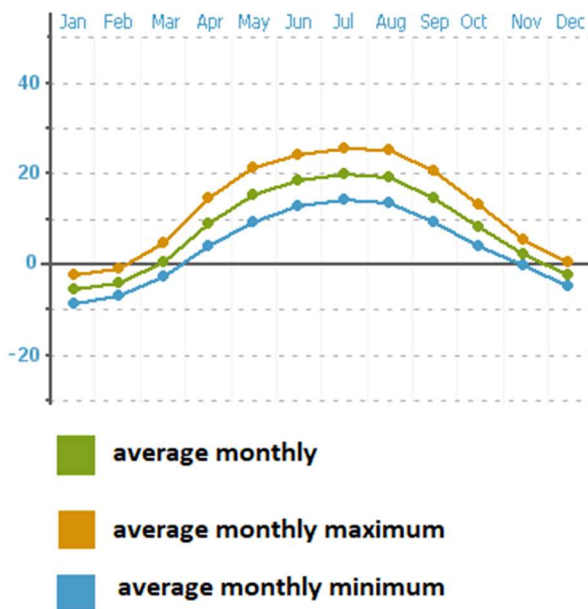
The climate of the Kirovohrad region is moderately continental. Winters are mild, with frequent thaws, and summers are hot and dry. The region experiences anticyclone type of weather with high temperatures up to +38°C and prolonged droughts often occurring in the second half of summer. Dust storms and dry winds up to 25-30 m/s are frequent in the region. Precipitation most often falls in summer and autumn in the form of rain.

According to the average wind speed in January as taken from the map of zoning of Ukraine, the district belongs in the IV zone<sup>14</sup>. The prevailing wind direction in January is north, with the average speed of 3.1 m/s, in July – northern winds prevail too, but the average speed is lower – to 2.1 m/s. The average annual wind speed is 2.7 m/s.

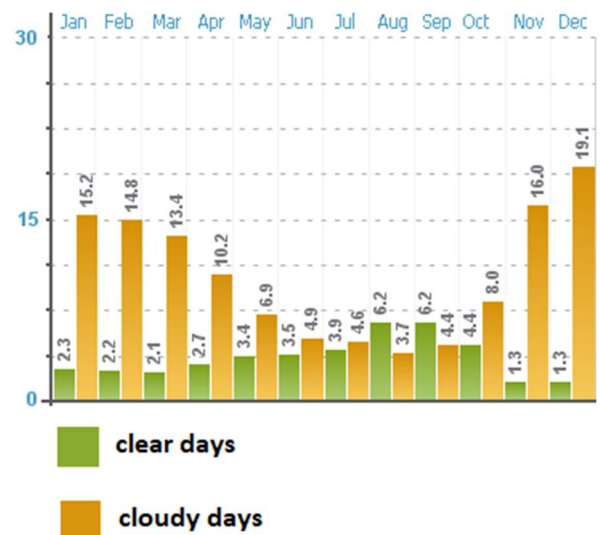
Climatic data are recorded at 7 meteorological stations in Kirovohrad region: in Bobrynets, Hayvoron, Dolynska, Znamyanka, Kropyvnytskyi, Novomyrhorod, Pomichna. The nearest station to the study area is in Novomyrhorod city, which is in around 22 km northeast from the Polokhiv deposit site.

The following figures summarize and visualize the received climate data at Novomyrhorod meteorological station for the period from 1899<sup>15</sup>.

*Average monthly temperature*



*Number of clear and cloudy days*

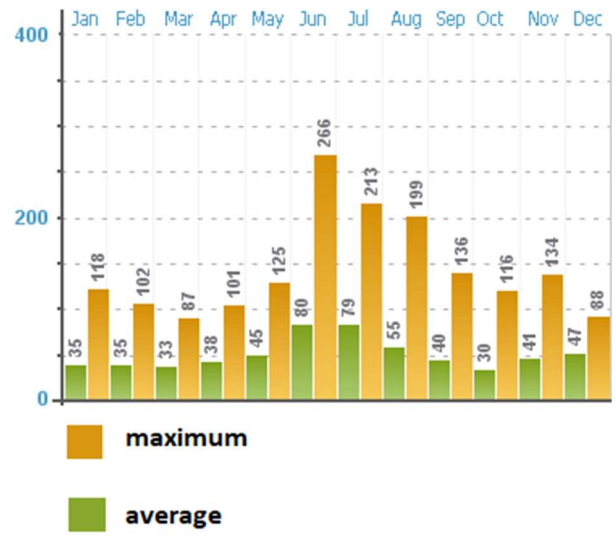
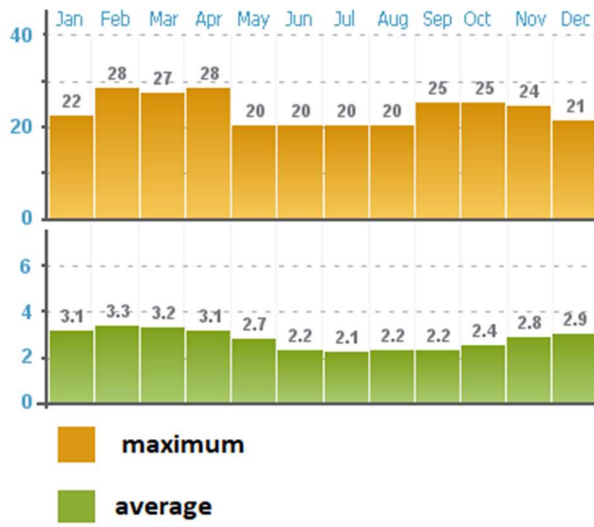


*Average monthly and maximum wind speed*

*Average monthly and maximum precipitations (mm)*

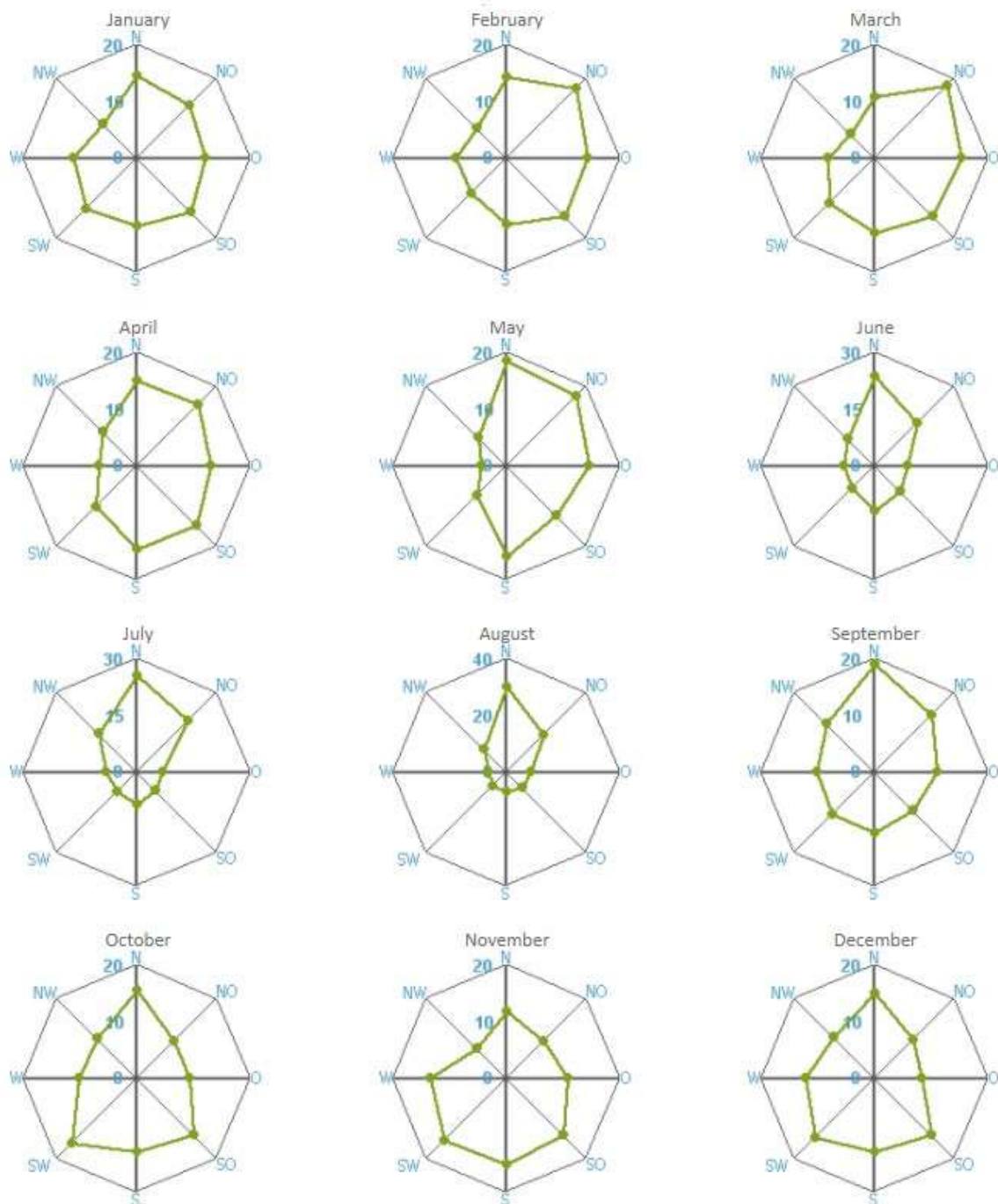
<sup>14</sup> According to the national construction standard DSTU - N B V.1.1-27: 210 (Construction Climatology), the territory of Ukraine is divided into 5 zones based on the average wind speed in January: I – more than 6.1 m/s, II – from 5.1 to 6 m/s, III – from 4.1 to 5.0 m/s, IV – from 3.1 to 4.0 m/s, V – less than 3.0 m/s.

<sup>15</sup> [https://meteo.gov.ua/en/33345/climate/climate\\_stations/97/16/](https://meteo.gov.ua/en/33345/climate/climate_stations/97/16/)





*Monthly wind rose*



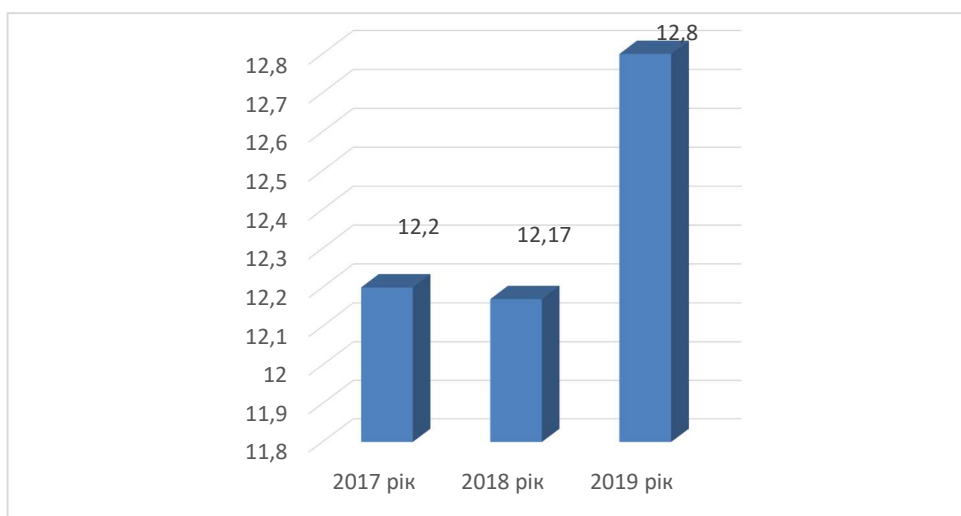
**Figure 5: Summary of the received climate data at Novomyrhorod meteorological station for the period from 1899**

For future needs of the ESIA study, it is recommended to install on-site state-of-the-art weather stations for continuous monitoring of the weather data.

### 3.5 Ambient Air Pollution

Kirovohrad region has a highly developed industrial sector, which causes a significant man-made load on the environment and specifically to air quality. The main polluters of the region are enterprises engaged in metals production, which emit 3406.0 tons of different substances annually. Comparatively, production of oil and animal fats produce 1552.5 tons of emissions; and pipeline transport – 1889.3 tons.

According to the Main Department of Statistics in Kirovohrad region, in 2019 the air basin of the region received from stationary emissions sources of enterprises and organizations 12.8 thousand tons of pollutants, which is 0.63 thousand tons more than in 2018.



**Figure 6: Emissions of pollutants into the atmosphere from stationary sources of pollution (thousand tons) in Kirovohrad region** (source: The regional report on the state of the environment of Kirovohrad region in 2019).

Air quality control in residential areas is carried out by the Laboratory for Atmospheric Pollution Monitoring of the Kirovohrad Center for Hydrometeorology<sup>16</sup>. Dust, sulfur dioxide, nitrogen dioxide, nitrogen oxide, soot, carbon monoxide, soluble sulfates, and formaldehyde are monitored at the stationary air quality monitoring posts in Kropyvnytskyi. Dust, sulfur dioxide, nitrogen dioxide, soot, and dissolved sulfates are monitored in Olexandriya. The state of air pollution in Svitlovodsk is monitored by the Svitlovodsk Laboratory for Atmospheric Pollution Monitoring of the Kirovohrad Center for Hydrometeorology for the following substances: dust, sulfur dioxide, dissolved sulfates, carbon monoxide, nitrogen dioxide, nitric oxide, and formaldehyde.

In Kropyvnytskyii, observations are conducted at three stationary posts, in Olexandriya – at one post, and also one post in Svitlovodsk. The laboratory of the State Institution “Kirovohrad Regional Laboratory Center of the Ministry of Health of Ukraine” carries out atmospheric air testing in the city of Kropyvnytskyi. Atmospheric air is studied for dust, soot, nitrogen dioxide, sulfur dioxide, and carbon monoxide.

All monitoring data described are not publicly available, however, it can be obtained on request.

<sup>16</sup> The Regional report on the state of the environment of Kirovohrad region in 2019, issued in 2020 by the Department of ecology, natural resources and fuel and energy complex of Kirovohrad Regional State Administration

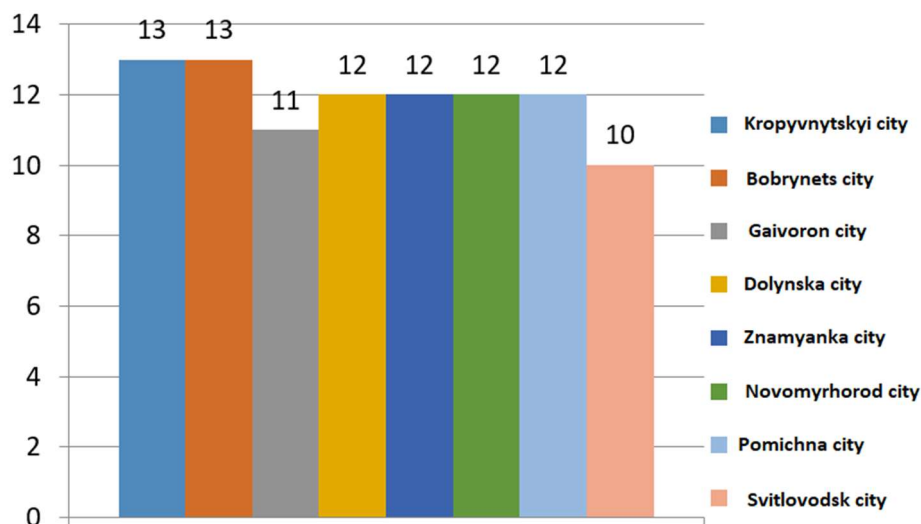
The assessment of atmospheric air in January 2021 in Kropyvnytskyi was carried out on the basis of 8 priority pollutants (see **Table 3.3**).

**Table 3.3** The level of air pollution in January 2021 in Kirovohrad region

Pollutant	Maximum Allowable Concentrations (MAC) <sup>17</sup> , mg/m <sup>3</sup>	Average monthly concentration, mg/m <sup>3</sup>
Dust	0.15	0.15
Sulfur dioxide	0.05	0.02
Carbon monoxide	3	1.2
Nitrogen dioxide	0.04	0.03
Dissolved sulfates	-	0.01
Formaldehyde	0.03	0.03
Nitrogen oxide	0.06	0.02
Soot	0.03	0.05

The average concentration of soot exceeds the MAC (0.05 versus 0.03), the concentrations of dust and formaldehyde were observed at the level of MAC, and for the other pollutants – below the level of MAC.

The measurement of gamma radiation exposure dose rate in the air is performed at 8 stationary posts in Kirovohrad region and collected by the Kirovohrad Regional Center for Hydrometeorology. The following chart shows the average monthly value of gamma radiation background in different cities/towns of the region in January 2021<sup>18</sup>.



**Figure 7:** Average monthly value of gamma radiation background, µR/h

<sup>17</sup>According to the Order No.52 of the Ministry of Health Of Ukraine of 14.01.2020 “On approval of hygienic regulations of allowable content of chemical and biological substances in the air of residential areas”.

<sup>18</sup> The report on the state of the environment in the region, developed by the Department of ecology, natural resources and fuel and energy complex of Kirovohrad Regional State Administration, January 2021.

Maximum values reached 12-15  $\mu\text{R/h}$ , and the average monthly radiation level was 10-13  $\mu\text{R/h}$ , which is twice lower than the background value for Ukraine. The control level of the natural gamma background (exposure dose rate) is 25  $\mu\text{R/h}$ .

Since no data on air pollution is available and no studies have been conducted on and in the nearest vicinity of the Polokhiv deposit site, it is recommended to install air quality devices for continuous monitoring of air quality upwind and downwind from the Polokhiv deposit site and ore processing plant. Alternatively, air testing can be organized by air sampling and laboratory testing on a monthly basis.

### 3.6 Sources of Ambient Noise

The Polokhiv deposit is surrounded by agricultural fields, thus the only possible ambient noise source is the machinery that used for field cultivation and harvesting. The noise levels cannot be high due to the seasonal pattern of the works and the scattering of operated machinery on large areas of fields. No other sources of noise were found during the high-level desktop assessment in the vicinity of 3 km.

To assess the ambient noise at zero scenario, measurement can currently be done at different locations of the study area.

### 3.7 Soil and Groundwater Contamination

The status of the soil and groundwater contamination of the Polokhiv deposit site and its vicinity is unknown. Soil and/or groundwater investigations of the area has not been found in open sources. There is no register of the potentially contaminated sites in Ukraine.

Since the territory of the Polokhiv deposit site and all adjacent lands are used for agricultural purposes, soil contamination with fertilizers and pesticides cannot be excluded.

To confirm the presence or absence of soil pollution, it is recommended to sample the soil at the study area and test it in the laboratory.

## 4 BIODIVERSITY PROFILE OF THE SITES

### 4.1 Vegetation

Spatial differentiation of vegetation is affected mainly by the condition of soil moisture, because it is the key factor that determines differences in plant communities. Climatic factors, uneven ravines and hollow reliefs of the territory, and soil features have produced the predominance of meadow-steppe vegetation on the studied area. Plant communities are formed on typical low-humus black soil.

Despite the significant dominance of agrocenosis in the Mala Vyska district (wheat, rye, barley, corn, millet, buckwheat, sugar beet, and sunflower are grown on the territory adjacent to the Polokhiv deposit site), natural vegetation is also present. The natural vegetation of the district (meadow, meadow-steppe, petrophilous, and forest) is growing in the river valleys on the slopes of steep banks, and ravines. In some places, meadow steppes are found, in others – steppes and bush steppes are preserved.

Steppe vegetation is represented by perennial grasses (forbs), cereals: bluegrass (*Poa pratensis*, *Poa angustifolia*), the couch grass (*Elymus repens*), the Volga fescue (*Festuca valesiaca*), the Timothy (*Phléum pratense*), the feather grass (*Stipa capillata*), the brome grasses (*Bromus inermis*), the cornflower (*Centaurea cyanus*) and others.

Among the flowering steppe plants, the following can be distinguished: the spring pheasant's eye (*Adonis vernalis*), the lesser periwinkle (*Vinka minor*), the Eastern pasqueflower (*Anémone pátens*), the yellow iris (*Iris pseudacorus*), spurge (*Euphórbia*), chamomile (*Matricaria*), etc. In the wet cracks of the rocks small ferns grow: the northern spleenwort (*Asplenium septentrionale*), the maidenhair spleenwort (*Asplenium trichomanes*), and the brittle bladder-fern (*Cystopteris fragilis*). Several species of the dog rose also grows.

Meadow and swamp vegetation is common in floodplains and temporary wetlands. Swampy meadows are associated with low floodplains and excessive moisture, on which form plant communities of the acute sedge (*Carex acuta*), the creeping bentgrass (*Agrostis stolonifera*), the reed canary grass (*Phalaris arundinacea*), the fowl bluegrass (*Poa palustris*), the floating sweet-grass (*Glyceria fluitans*).

Swamps are rare in the region. More typical are floodplains, valleys, old-flowing bogs belonging to lowland eutrophic bogs, with a predominance of grassy bogs-high-grass and sedge. Typical wetland groups represent plant communities of the lesser pond-sedge (*Carex acutiformis*), the acute sedge (*Carex acuta*), the greater pond sedge (*Carex riparia*), and the common reed (*Phragmites australis*). Locally on the periphery of grassy bogs are represented by bush bogs.

Aquatic vegetation is characterized by the predominance of coastal water groups over true aquatic vegetation. Typical groups are formed as follows: the broadleaf cattail (*Typha latifolia*), the narrowleaf cattail (*Typha angustifolia*), the common reed (*Phragmites australis*), the lesser duckweed (*Lemna minor*), the broad-leaved pondweed (*Potamogeton natans*), the lakeshore bulrush (*Schoenoplectus lacustris*), the yellow water-lily (*Nuphar lutea*), the white water lily (*Nymphaea alba*). The flora includes **145 rare species** of higher vascular plants (*Tracheophyta*), which are at the level of international, state or regional protection.

**Rare and endangered plants found in the Mala Vyska district:** the milkvetch (*Astragalus dasyanthus*), the feather grass (*Stipa capillata*), the grass leaved iris (*Iris graminea*), the smallest Spuria iris (*Iris pontica*), the martagon lily (*Lilium martagon*), the snowdrop (*Galanthus nivalis*), the greater

pasque flower (*Pulsatilla grandis*), the lesser periwinkle (*Vinka minor*), the garden valerian (*Valeriana officinalis*), the perforate St John's-wort (*Hypericum perforatum*), the lily-of-the-valley (*Convallaria majalis*), and the yellow flax (*Linum flavum*).

Mala Vyska district is experiencing a shortage of forests. The main forest-forming species are oak (*Quercus*) (up to 84% of the total forest area); there is also ash tree (*Fraxinus*), linden (*Tilia*). Common among shrubs are the dog rose (*Rosa canina*), hawthorn (*Crataegus*), the blackthorn (*Prunus spinosa*), the Siberian peashrub (*Caragana arborescens*), and the common hazel (*Corylus avellana*).

The area of the Polokhiv deposit site and the ore processing plant is almost forestless. The location of the Polokhiv deposit is an undulating plain with a gradual slope to the north, most of the territory is made up of agrocenosis. In the north-eastern part of the site there is a clear thalweg on arable lands, which is adjacent to the ravine-hollow complex. The latter extends along the western border of the licensed territory in the northern direction. The ravine complex is covered with tree and shrub vegetation and overgrown with reed vegetation in wetlands. A narrow forest protection zone with woody vegetation runs in the latitudinal direction in the central part of the licensed territory. Wood vegetation is represented by the alder (*Alnus glutinosa*), the silver poplar (*Pópulus álba*), ash tree (*Fraxinus*), and linden (*Tilia*).

## 4.2 Fauna

Despite the significant economic development of the territory, the fauna remains relatively rich. In the territory of Mala Vyska district, there are the wild boar (*Sus scrofa*), the roe deer (*Capreolus Gray*), the brown hare (*Lepus europaeus*), the red fox (*Vulpes vulpes*), the common pheasant (*Phasianus*), the raccoon dog (*Nyctereutes procyonoides*), the badger (*Meles meles*) in ravines, as well as migratory birds and other animals typical for this physical-geographical province.

A significant diversity of birds is also present. In terms of species, the largest group of birds are from the order sparrow (*Passeriformes*), which includes sparrows (*Passer*), starlings (*Sturnus*), tits (*Paridae*), swallows (*Hirundo*), goldfinches (*Carduelis*), bullfinches (*Pyrrhula*), as well as crows (*Corvus*) and magpies (*Pica*). The largest member of this group is the raven (*Corvus corax*), and the smallest is the Eurasian wren (*Troglodytes troglodytes*), the goldcrest (*Regulus regulus*). Prey birds are common, most of them belong to the category of **rare animals**. These are the northern goshawk (*Accipiter gentilis*), the common buzzard (*Buteo buteo*) and the merlin (*Falco columbarius*). Also typical waterfowl appear during seasonal migrations: the northern lapwing (*Vanellus vanellus*), the common redshank (*Tringa totanus*), the black-tailed godwit (*Limosa limosa*) and the little ringed plover (*Charadrius dubius*). Quite a diverse group of birds is represented of the order of ducks (*Anatidae*). The latter belong to the wetland complex inhabitants. The most numerous members of the group – the mallard (*Anas platyrhynchos*), the garganey (*Anas querquedula*), the northern shoveler (*Anas clypeata*). Lots of herons are there: there are grey heron and the purple heron (*Ardea cinerea*, *Ardea purpurea*), the black-crowned night heron (*Nycticorax nycticorax*), the great bittern (*Botaurus stellaris*) and the little bittern (*Ixobrychus minutus*). A group of rails birds (*Rallidae*) is distinguished by the next species: the common coot (*Fulica atra*), the common moorhen (*Gallinula chloropus*), the spotted crake (*Porzana porzana*), and the water rail (*Rallus aquaticus*). In some places there is the corn crake (*Crex crex*), which listed in the Red Book of Ukraine. Owls (*Strigiformes*) are quite a diverse group: the brown owl (*Strix aluco*), the long-eared owl (*Asio otus*) and the short-eared owl (*Asio flammeus*), the little owl (*Athene noctua*), the Eurasian eagle-owl (*Bubo bubo*), the barn owl (*Tyto alba*) (the last two are listed in the Red Book of Ukraine).

According to the Atlas of migration birds of Ukraine, 2016<sup>19</sup> and the bird maps<sup>20</sup>, the territory of the district is the migration route of the black stork (*Ciconia nigra*), and the western osprey (*Pandion haliaetus*).

Among amphibians the most numerous are the marsh frog and the pool frog (*Pelophylax ridibundus*, *Pelophylax lessonae*), as well as the fire-bellied toad (*Bombina bombina*). In wooded areas the grass frog (*Rana temporaria*) predominates, the moor frog (*Rana arvalis*) and the European tree frog (*Hyla arborea*) occur, the common toad (*Bufo bufo*) is rare, and the garlic toad (*Pelobates fuscus*) and the green toad (*Pseudepidalea viridis*) are common in some places.

Among reptiles there is the sand lizard (*Lacerta agilis*), in some places – the green lizard (*Lacerta viridis*). The group of common species includes the grass snake (*Natrix natrix*), the viviparous lizard (*Zootoca vivipara*), and the European pond turtle (*Emys orbicularis*). There are **rare and very rare** species: the former includes the water snake (*Natrix tessellate*), the smooth snake (*Coronella austriaca*), the Caspian whipsnake (*Dolichophis caspius*) and the steppe viper (*Vipera renardi*), and the second – the Aesculapian snake (*Zamenis longissimus*).

**Rare animals and birds found in the Mala Vyska district:** the badger (*Meles meles*), the wild boar (*Sus scrofa*), the brown hare (*Lepus europaeus*), the hedgehog (*Erinaceus europaeus*), the roe deer (*Capreolus Gray*), the chaffinch (*Fringilla coelebs*), the blackcap (*Sylvia atricapilla*), the blackbird (*Turdus merula*), the thrush nightingale (*Luscinia luscinia*), the great tit (*Parus major*), the red-backed shrike (*Lanius collurio*), the robin (*Erithacus rubecula*), the yellowhammer (*Emberiza citrinella*), the grey heron (*Ardea cinerea*).

### 4.3 Objects of the Nature Reserve Fund

There are several objects of the nature reserve fund are located near the area of the planned activity. A total of 223 territories of the nature reserve fund are in the Kirovohrad region, with a total area of 101312.79 ha. In total, in the Mala Vyska district there are 12 territories of the nature reserve fund with a total area of 273.4 ha<sup>21</sup>. The objects of the nature reserve fund of general state significance are absent on the territory of Mala Vyska district, but there are several game reserves of local importance (see **Figure 8** below)<sup>22 23 24 25 26</sup>.

**The "Floodplain of Mala Vys"** ("Zaplava of Mala Vys") is an ornithological game reserve of local importance. The object is located in the Mala Vyska district of the Kirovohrad region, near the village Krasnopilka. The area is 2 ha;=, and was granted status in 1996. The approximate distance from the planned activity area to this game reserve is 11 km to the east.

High-grass communities are represented by the reed thickets 2.6-3.0 m high, and are dominated in the vegetation cover of the "Floodplain of Mala Vys". They are monodominant in the more waterlogged central part. Reed groups are surrounded by a narrow strip of meadow. A strip of marshy

<sup>19</sup> <http://mail.izan.kiev.ua/atlas%20of%20bird%20migration-ua-2016.pdf>

<sup>20</sup> <https://birdmap.5dvision.ee/RU>

<sup>21</sup> <http://ekolog.kr-admin.gov.ua/diialnist/pryrodno-zapovidnyi-fond-kirovohradskoi-oblasti>

<sup>22</sup> <http://lis-kr.gov.ua/inf/oblasna-programa-quot-lisi-kirovogradshini-quot>

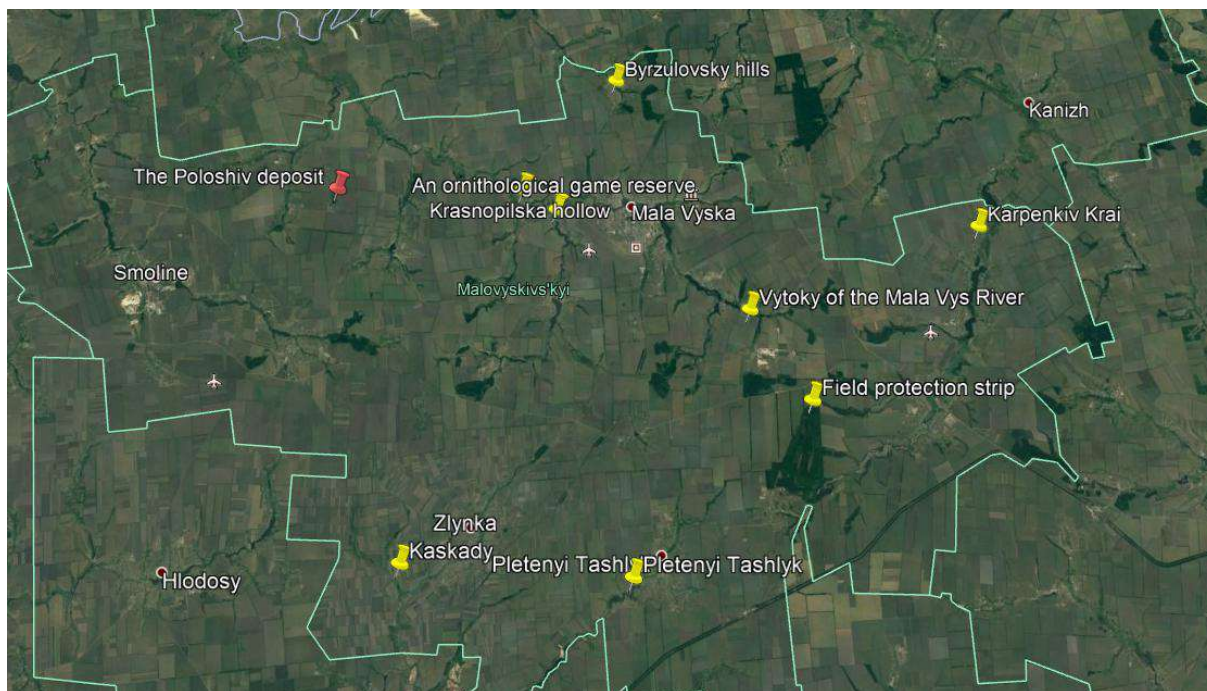
<sup>23</sup> <http://ekolog.kr-admin.gov.ua/diialnist/pryrodno-zapovidnyi-fond-kirovohradskoi-oblasti>

<sup>24</sup> <https://pzf.land.kiev.ua/pzf-obl-11.html>

<sup>25</sup> The region on the border of forest-steppe and steppe: Nature reserves and landscape corners of Kirovograd region.- Kirovograd: IMEX-LTD, 2007.-32p.

<sup>26</sup> Ecological passport of Kirovohrad region for 2019ю

meadows with a predominance of the meadow horsetail (*Equisetum pratense*) is located above the shore. The territory of game reserve has many such meadow-swamp species, such as the gypsywort (*Lycopus europaeus*), the common comfrey (*Symphytum officinale*), the yellow iris (*Iris pseudacorus*), the geranium (*Geranium palustre*). There are large thickets of a valuable medicinal plant - the elecampane (*Inula helenium*) – in this area.



**Figure 8: Localization of the objects of the nature reserve fund**

Fauna is typical for the floodplains of the rivers of the South-Dnieper upland forest-steppe region. A multi-species colony of herons can be found there. The mute swan (*Cygnus olor*), the mallard (*Anas platyrhynchos*), the garganey (*Anas querquedula*), the common pochard (*Aythya ferina*), the western marsh harrier (*Circus aeruginosus*), the common coot (*Fulica atra*) and the common moorhen (*Gallinula chloropus*) also nests. Ordinary for the territory are the great reed warbler (*Acrocephalus arundinaceus*), the river warbler (*Locustella fluviatilis*), the bearded tit (*Panurus biarmicus*). In small numbers are the great bittern (*Botaurus stellaris*), the marsh warbler (*Acrocephalus palustris*), the Savi's warbler (*Locustella luscinioides*). During migrations, this is a stopping place for wetland birds.

Among other animals, the muskrat (*Ondatra zibethicus*), the red fox (*Vulpes vulpes*), the European pond turtle (*Emys orbicularis*), and the marsh frog (*Pelophylax ridibundus*) have been noted. The most numerous fish are carp, perch, pike, and gossips.

In general, this is a typical and well-preserved section of the river floodplain of the South-Dnieper upland forest-steppe region with a common predominance of high-grass vegetation. This territory has a typical flora and valuable avifauna.

Other objects of the nature reserve fund located near the Polokhiv deposit site are landscape and botanical game reserves.

**The “Sources of the Mala Vys River”** (“Vytoky of the Mala Vys River”) is a landscape game reserve of local importance. The object is located in the Mala Vyska district of the Kirovohrad region, near the



village of Lutkyvka. The area is 2.5 ha and was granted status in the year 2000. The approximate distance from the Polokhiv deposit site to this game reserve is 20 km to the east.

This is a large expansive hollow in the upper reaches, where in fact there are the sources of the Mala Vys River. The natural vegetation is well preserved here. On the slope of the north-eastern exposition, a deciduous forest consisting of oak with an admixture of linden, elm and ash has been preserved. A well-preserved area of the steppe was found on the slope of the south-western exposition. The community of the junegrass (*Koeleria cristata*) is dominated in the upper part of the slope, and in the lower part – the Volga fescue (*Festuca valesiaca*). The typical core of the steppe species of the forest-steppe is well represented here. In the steppe area, there is the downy flax (*Linum hirsutum*), which is widespread and protected in the Kirovohrad region. Also, there is a large population of a rare steppe species – sea-lavender (*Limonium platyphyllum*).

The core of the avifauna in the forested part of the hollow consists of typical forest-steppe species of the dendrophilous complex, such as the European turtle-dove (*Streptopelia turtur*), the tree pipit (*Anthus trivialis*), the red-backed shrike (*Lanius collurio*), the European greenfinch (*Carduelis chloris*), the European goldfinch (*Carduelis carduelis*), and the yellowhammer (*Emberiza citrinella*). Quantitatively, the common chaffinch (*Fringilla coelebs*) dominates. Among the bird representatives of the ancient forest-steppe complex, the common buzzard (*Buteo buteo*) and the common magpie (*Pica Pica*) nest here. On open slopes adjacent to the forested area, the whinchat (*Saxicola rubetra*) is common. The European bee-eater (*Merops apiaster*) and the barn swallow (*Hirundo rustica*) constantly hunt here.

**The “Byrzulovsky hills” (“Birzulovsky holmy”)** is a complex natural monument of local importance. The object is located in the Mala Vyska district of the Kirovohrad region, near Zapovydne village. The area of the game reserve is 1.7 ha and was granted status in 1971. The approximate distance from the Polokhiv deposit site to this game reserve is 16 km to the northeast.

**The “Karpenkiv Krai”** is a landscape game reserve of local importance. It is located in Novomyrhorod and Mala Vyska districts of the Kirovohrad region, between the villages of Arsenyvka and Maryanyvka. The area is 250 ha, and was granted status in 1995. The territory of the game reserve occupies part of the floodplain and the root bank of the Velyka Vys River. The approximate distance from the planned activity area to this game reserve is 32 km to the east.

**The “Pletenyi Tashlyk”** is a botanical game reserve of local importance. The object is located in the Mala Vyska district of the Kirovohrad region, near the village Pletenyi Tashlik. The area is 5 ha, and was granted status in 1996. There are numerous granite outcrops in the form of stone slabs or large rocks on the territory of the game reserve. The petrophytic plant community is identified at the granite outcrops well. The approximate distance from the planned activity area to this game reserve is 25 km to the southeast.

There are four botanical natural monuments located in the Mala Vyska district of the Kirovohrad region, on the territory of the State Enterprise “Onykiyevsky Forestry”<sup>27</sup>. The approximate distance from the planned activity area to this game reserve is 27 km:

- **The Field protection strip No.1** is a botanical natural monument of local importance. The area – 14 ha; the status granted in 1968;
- **Field protection strip No.2** is a botanical natural monument of local importance. The area – 16 ha; the status granted in 1968;

<sup>27</sup> <http://lis-kr.gov.ua/inf/oblasna-programa-quot-lisi-kirovogradshini-quot>

- **Field protection strip No.3** is a botanical natural monument of local importance. The area – 9.4 ha; the status granted in 1968;
- **Field protection strip No.4** is a botanical natural monument of local importance. The area – 4.1 ha; the status granted in 1968.

The “**Kaskady**” is a geological natural monument of local importance. The object is located in the Mala Vyska district of the Kirovohrad region, southwest of the Zlynka village, in the valley of the Buki River (right tributary of the Pletenyi Tashlyk). The area is 2.5 ha; the status was obtained in 1971. This territory is one of the few places where natural waterfalls spread on the Dnieper Upland and the plains of Ukraine as a whole. The tract is an example of typical plain forest-steppe Eastern European landscapes of river valleys of the forest-steppe zone preserved in its natural location. The approximate distance from the planned activity area to this game reserve is 19 km to the southeast.

The “**Krasnopilska hollow**” (“**Krasnopilska balka**”) is a landscape game reserve of local importance in the Mala Vyska district of the Kirovohrad region, near the Krasnopilka village. The area is 50 hectares; the status was obtained in 1996. The hollow is preserved well, with steppe slopes and a wide bottom occupied by hydrophilic vegetation. The hollow fauna has a typical composition for the south right-bank forest-steppe region. Its core is formed by dendrophiles and representatives of the meadow-steppe complex. Among vertebrates, birds predominate both quantitatively and species wise. The approximate distance from the planned activity area to this game reserve is 10 km to the east.

#### 4.4 The Red List species typical for the study area

Total species plants listed in the Red Book of Ukraine growing in the Kirovohrad region are 73. Among them are: vascular plants – 57; moss-like – 2; algae – 3; lichens – 3; mushrooms – 2.

Among vascular plants growing in the Kirovohrad region there are 57 species listed in the Red Book of Ukraine (**Table 4.1**).

**Table 4.1 List of Red Books plants species of Ukraine on the territory of Kirovohrad region**

N	Species name (Latin)	Red Book of Ukraine	European red list	The IUCN Red List
1	<i>Allium ursinum</i>	+		
2	<i>Allium sphaeropodum</i>	+		
3	<i>Astragalus dasy anthus</i>	+	+	+
4	<i>Astragalus ponticus</i>	+		
5	<i>Astragalus odessanus</i>	+		
6	<i>Astragalus henningii</i>	+		
7	<i>Adonis vernalis</i>	+		
8	<i>Adonis wolgensis</i>	+		
9	<a href="#"><i>Anacamptis palustris</i></a>	+		
10	<a href="#"><i>Anacamptis laxiflora</i></a>	+		

11	<i>Bulbocodium versicolor</i>	+		
12	<a href="#"><u>Carex secalina</u></a>	+		
13	<i>Crocus reticulates</i>	+		
14	<a href="#"><u>Crambe tataria</u></a> Sebeyk	+		
15	<a href="#"><u>Cypripedium calceolus</u></a>	+		
16	<a href="#"><u>Cymbochasma borysthenica</u></a>	+		
17	<i>Dianthus hypanicus</i>	+		
18	<a href="#"><u>Dactylorhiza maculata</u></a>	+		
19	<a href="#"><u>Dactylorhiza incarnata</u></a>	+		
20	<a href="#"><u>Dactylorhiza majalis</u></a>	+		
21	<i>Euonymus nana</i>	+		
22	<i>Epipactis palustris</i>	+		
23	<i>Epipactis hellebori</i>	+		
24	<i>Epipactis atrorubens</i>	+	+	
25	<a href="#"><u>Elytrigia stipifolia</u></a>	+		
26	<i>Fritillaria ruthenica</i>	+		
27	<a href="#"><u>Fritillaria meleagroides</u></a>	+		
28	<a href="#"><u>Gladiolus tenuis</u></a>	+		
29	<i>Iris pontica</i>	+		
30	<a href="#"><u>Iris pineticola</u></a>	+		
31	<i>Iris sibirica</i>	+		
32	<i>Lilium martagon</i>	+		
33	<a href="#"><u>Listera ovata</u></a>	+		
34	<a href="#"><u>Ornithogalum boucheanum</u></a>	+		
35	<i>Orchis militaris</i>	+		
36	<a href="#"><u>Orchis mascula</u></a>	+		
37	<i>Platanthera bifolia</i>	+		
38	<a href="#"><u>Platanthera chlorantha</u></a>	+		
39	<i>Pulsatilla nigricans</i>	+		
40	<a href="#"><u>Pulsatilla pratensis</u></a>	+		
41	<a href="#"><u>Paeonia tenuifolia</u></a>	+		
42	<i>Stipa capillata</i>	+		

43	<i>Stipa tirsia</i>	+		
44	<i>Stipa lessingiana</i>	+		
45	<i>Stipa pulcherima</i>	+		
46	<i>Stipa pennata</i>	+		
47	<i>Stipa dasyphylla</i>	+	+	
48	<i>Stipa ucrainica</i>	+		
49	<a href="#"><u>Salsola mutica</u></a>	+		
50	<a href="#"><u>Scrophularia vernalis</u></a>	+		
51	<a href="#"><u>Scopolia carniolica</u></a>	+		
52	<a href="#"><u>Securigera elegans</u></a>	+		
53	<a href="#"><u>Scutellaria verna</u></a>	+		
54	<a href="#"><u>Trapa natans</u></a>	+		
55	<i>Tulipa quercetorum</i>	+		
56	<i>Tulipa hypanica</i>	+		
57	<a href="#"><u>Utricularia minor</u></a>	+		

List of plants species of the Red Book of Ukraine detected on the territory of Mala Vys district near the planned activities:

- *Astragalus dasyanthus*;
- *Stipa capillata*;
- *Iris pontica*;
- *Lilium martagon*;
- *Pulsatilla nigricans*.

As can be seen from the above, the region is quite rich in biodiversity. It is recommended to make a detail seasonal biodiversity survey on site at the ESIA stage (specifically on baseline assessment stage) to get the primary data and confirm or refute the above described secondary data. After this a biodiversity management plan should be developed to avoid, minimise, manage or offset the potential impacts both direct and indirect on protected species and natural, manmade or critical habitat.

## 5 SOCIAL AND ECONOMIC PROFILE OF THE SITES

Mala Vyska united community is situated over a total area of 231.83 km<sup>2</sup> (23,183 ha) and had 13,354 inhabitants in 2018. The community was formed on 14.08.2015 and includes 10 settlements as follows:

- 1 city (Mala Vyska is the administrative center of the united community);
- 7 villages (Vesele, Krasnopilka, Novomykolayivka, Oleksandrivka, Paliyivka, Pervomayske, Tarasivka);
- 2 hamlets (Vishneve and Zapovidne).

The regional center is Kropyvnytskyi (until 2016 Kirovohrad), which is located at a distance of 80 km to the east by road. The district center, Novoukrainka, is located at a distance of about 44 km west of the deposit by road.

### 5.1 Demography of the Area

Mala Vyska United Community is one of 13 communities<sup>28</sup> belonging to Novoukrainsky district of Kirovohrad region after the district enlargement in 2020. Novoukrainsky is the third largest district of the region:

<i>District</i>	<i>No. of inhabitants, thousands (2020)</i>
Kropyvnyts'ky	448.1
Oleksandriys'ky	229.8
<b>Novoukrainsky</b>	<b>142.7</b>
Holovanivsky	124.8

The population density in the region is 37.9 persons/km<sup>2</sup>. The density significantly decreased during the last 25 years in comparison to other regions of Ukraine (-20.2%).<sup>29</sup>

### 5.2 Economic Characteristics

82.7% of the territories of Kirovohrad region are agricultural lands. Its economy focuses on the following sectors:

72.4%	production and processing of agricultural products (meat, milk, sugar, fruits and vegetables) and building material;
6.9%	ore mining and processing industry;
19.2%	production of electricity by hydropower and thermal power plants;
1.5%	provision of communal services (waste management, fresh water and discharges).

<sup>28</sup> Communities of Novoukrainsky district: Hannivska, Glodoska, Dobrovelichkivska, Zlynska, Malovyskivska, Maryanivska, Novomyrhorodska, Novoukrainska, Pishchanobridska, Pomichna, Rivne, Smolinska, Tyshkivska.

<sup>29</sup> State Statistics: Programme "uafrontier"

The unemployment rate in Kirovohrad region is higher than average in Ukraine: <sup>30</sup>

Year	Kirovohrad region	Ukraine
2018	11.5%	9.1%
2019	10.8%	8.6%
2020	12.3%	9.7%

The medium salary in Kirovohrad region is lower than that in Ukraine for the same period:<sup>31</sup>

Year	UAH (USD)	Difference
01.2019	7279 (263)	-21.1%
01.2020	8677 (348)	- 19.1%
01.2021	9780 (347)	- 20.7%

### 5.3 Stakeholder Information and Engagement to Date

The EIA procedure according to the Law of Ukraine “On Environmental Impact Assessment”, No.2059-VIII, dated 23.05.2017 has already been started and has included the following activities:

1. Publication of the Announcement on the planned activity in the Unified Register on Environmental Impact Assessment on the website of the Ministry of Environmental Protection and Natural Resources of Ukraine (dated 19.04.2019). No information is available about printed sources.
2. Provision of 20 days for receiving comments and suggestions regarding the planned activity from community members. No comments or suggestions have been received based on the Letter from Department of Ecology and Natural Resources at Kirovohrad State Administration (No.26-15/2172/0.26 dated 22.05.2019).

Other stages of the EIA process have not been passed yet.

Information on the works carried out at the Polokhiv deposit is regularly updated on the UkrLithiumMining LLC web-site (<http://ukrlithium.com/uk>). However, no information regarding a grievance mechanism is available from the web-site.

### 5.4 Project Social and Economic Benefits

The client will make a contribution to the national and local community budgets<sup>32</sup> as a business itself through direct employment and contracts resulting in tax revenue, including land use and subsoil use fees.

<sup>30</sup> web site of Ministry of Finances of Ukraine <https://index.minfin.com.ua/labour/unemploy/register/> and Kirovohrad State Administration <http://kr-admin.gov.ua/start.php?q=News1/Ua/2020/22012008.html>

<sup>31</sup> web site of Ministry of Finances of Ukraine <https://index.minfin.com.ua/labour/salary/average/kropivnickiy/>

<sup>32</sup> The budget of the united community accumulates:

60% personal income tax

100% property tax

100% of the social tax

5% excise tax on retail trade (tobacco, alcohol, petroleum products)

It is expected to create 813 new working places, as follows:

Engineers and technical workers	47
General purpose workers	347
Office staff	12
Low qualified workers	407

Most of new working places are for local employees. The Company will organise transportation to collect both production people and office staff.

In addition, the project will trigger further economic benefits:

- Rehabilitation of infrastructure in the community;
- Support of local small-scale business activities.

Currently, 73 special permits have been issued for the development of deposits of various types of minerals in the Kirovohrad region. The area of the project is pro-mining. Community well-being depends to a large extent on the operation of mines. Both community infrastructure as well as development of small-scale private business initiatives will benefit from development of the Project.

It is expected that the current mine, which is located in the village of Smoline (12 km from Polokhiv deposit) will stop operation by the time of commissioning of Polokhiv deposit. Most new working places are for local employees, and thus local employees will be able to apply their skills and knowledge there. The Company took a responsibility to provide housing and organise a bus to transfer its employees.

All employees will be provided with compulsory labour social guarantees according to the national law. Besides, additional social guaranties and benefits can be included in the Collective Agreement between the management and the labour collective. This is a good practice for the mining industry and can be recommended.

It could be recommended to develop an in-house Community Investment Program in cooperation with Mala Vyska United Community and publicize it to follow good practice for companies doing businesses in emerging markets. The Community Investment Program may provide a Company with an effective channel to enhance development impacts in “higher risk” contexts of extraction projects, where basic needs and expectations for benefits are high.

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100% income tax of communal property institutions

100% of payments for administrative services

25% environmental tax

## 6 CULTURAL HERITAGE

There are no cultural heritage objects on the territory of the Polokhiv deposit site or ore processing plant, and none in the direct vicinity.

At the same time, there are a number of heritage sites of local value on the territory of the Mala Vyska united community. According to the “List of monuments of town-planning, architecture, garden and park art of national and local value and the found monuments in the Kirovograd area”, approved by the order of the head of the Kirovograd regional state administration on 28.12.2004 (No.792-p), the following cultural heritage objects located in the area (see **Table 6.1**):

**Table 6.1 List of Cultural heritage objects in Mala Vyska district**

<i>Object name</i>	<i>Year of construction</i>	<i>Location</i>
The main building of the sugar factory	19 century	Mala Vyska
The estate of the landlady Kudasheva	1889	Mala Vyska
St. Nicholas Church	1912	Myrolyubivka village
Church of Saints Constantine and Helena	1857	Kopanky village
The building of the former school where Protsenko M.E. studied – the active participant of Odessa defense	1933 -1935	Mala Vyska
Tomb of the colonel Ryezhanov A.M.	1944	Mala Vyska
Mass grave of Soviet soldiers	1944	Mala Vyska
The place of battles of the cavalry brigade under the command of Kosovsky G.I.	1919	Mala Vyska
The premises of the sugar factory where Kondratyuk Yu.V. worked, the famous future theorist of interplanetary flights	1921 – 1925	Mala Vyska
The house where the famous Ukrainian playwright Tobilevych I.K. worked	1859	Mala Vyska
Mass grave of civilians’ victims of fascism	1941	Mala Vyska
Mass grave of civilians	1941	Mala Vyska
Monument to fellow soldiers	1941 -1945	Myrolyubivka village
Mass grave for Soviet soldiers and a memorial to fellow soldiers	1941-1945	Kopanky village
Mass grave of Soviet partisans	1943	Kopanky village



<i>Object name</i>	<i>Year of construction</i>	<i>Location</i>
Mass grave of the victims of the Austro-German occupiers	1918	Hayivka village
Tomb of a Soviet soldier	1944	Hayivka village
Mass grave of Soviet soldiers	1944	Hayivka village
Mass grave of Soviet soldiers, a monument to fellow soldiers	1944 -1945 p	Pervomayske village
Mass grave of Soviet soldiers	1942	Pervomayske village
The school building where the command office of the partisan unit under the command of Major General Naumov was located	1943	Pervomayske village

The Law of Ukraine “On Protection of Cultural Heritage”, No.1805-III, dated 8.06.2000 specifies the actions that should be taken in case of discovery of cultural heritage objects or their parts during the exploration and extraction actions, as well as construction activity.

It is recommended to take into account the mentioned above objects while planning the works on site and selection of transportation routes for construction materials and other goods delivery. In case one of the heritage objects would be located on the transport route, it is advisable either plan a detour of the object, or at least implement the measures to avoid the heritage damage.

## 7 AVAILABLE INFRASTRUCTURE

### 7.1 Water Supply and Wastewater Discharge Options

#### *Water supply options*

Currently, the volume of water needed for the operation of the future mine and the ore processing plant is not yet known, as well as future water quality requirements.

It is only known that potable water must meet the standard requirements of the State sanitary rules DSanPiN 2.2.4-171-10 “Hygienic requirements for drinking water intended for human consumption”, approved by the Order No.400 of the Ministry of Health of Ukraine on 12.05.2010<sup>33</sup>.

The review of the Polokhiv deposit site location (available maps and geological report provided by the Client) resulted in identification of options that can be considered for the future water supply. The following **Table 7.1** lists the options available and provides some comments on the suitability of each of them based on known information.

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<sup>33</sup> <https://zakon.rada.gov.ua/laws/show/z0452-10#Text>

*Table 7.1 Options for future water supply*

Type of the water source	Surface water bodies		Groundwater		Imported water	
Name of the water body	Mala Vys river	Cascade of nameless ponds	Temporary water course	The shallow aquifer	Deep aquifer	In tanks or bottles (for drinking needs)
<b>Distance from the Polokhiv deposit</b>	3.625 km to the east	3 km to the east	Along the south-western and western borders of the Polokhiv deposit	On the site	On the site	Considerable distance
<b>Water quality</b>	<b>Medium</b> Most likely need to be pretreated to reach the required quality.	<b>Low</b> The source can be significantly polluted by organics and suspended particles.	<b>Low</b> The source can be significantly polluted by organics and suspended particles.	<b>Medium</b> The quality usually is not very high.	<b>High</b> The deep aquifers are usually protected by the impermeable soil layers (like clays) from the pollution.	<b>High</b> Water of required quality can be selected before supply. Can be the source of potable water.
<b>Volume of water that can be obtained</b>	<b>Medium to High</b> The source most likely will cover the needs.	<b>Low</b> The abstraction volume can be limited.	<b>Low</b> The abstraction volume can be limited due to the low water flow rates.	<b>Low to medium</b> The abstraction volume can be limited.	<b>High</b> The source most likely will cover the needs.	<b>Any</b>

### Wastewater discharge

As no infrastructure is available in the nearest vicinity, the options for wastewater discharge include:

1. The construction of water tanks for collection of the wastewaters with the further transportation of them for the treatment to the nearest treatment facilities (Smolino mining complex);
2. To build the pipeline to the Smolino mining complex;
3. To build treatment facilities on site and discharge treated water to one of the surface water bodies in the vicinity (Mala Vys river, cascade of nameless ponds, or temporary water course). The discharging facilities need to be constructed in such a way to prevent soil erosion.

There are a number of possible water sources, as well as options for wastewater discharge that can be used by the future mine and processing plant. Each of the water supply options should be investigated in more detail at further project stages as per the availability of the needed water volumes at the source, the willingness to lay pipelines from the source to the site, and the water quality in the source. As for the wastewater discharge, the option selection will depend on the design decisions made at the project design stage.

## 7.2 Waste Management Options

Among the different waste streams that will be generated in the process of mining and ore processing are the waste tailings, which will be produced at a volume much higher than other likely waste streams.

In the total amount of waste generated in 2018<sup>34</sup> in Kirovohrad region, the largest share (96.0%) was mining waste and waste from ore processing. This type of waste is usually classified as IV hazard class (the least hazardous). The majority of accumulated wastes of hazard class IV are located at five tailing facilities/disposal sites. The information of the tailing facilities, their location and ownership, as well as their respective distance from the Polokhiv deposit site is provided in **Table 7.2** below, and corresponding routes are illustrated on the **Figures** below.

**Table 7.2 Characteristics of mining waste storage facilities**

No.	Waste storage facility	Owner	Waste types	The storage type	Distance by roads
1	Petrivsky quarry, Petrove township	PJSC "Central Mining and Processing Complex"	waste of iron ore mining	Disposal site	180 km
2	"Shcherbakivska" beam, Petrove village	State Enterprise "Shid GZK"	waste of ore processing (including sludge and "tailings") and briquetting of uranium and thorium ores	Tailing facility	200 km

<sup>34</sup> The Regional report on the state of the environment of Kirovohrad region in 2019 (the last one publicly available), issued in 2020 by the Department of ecology, natural resources and fuel and energy complex of Kirovohrad Regional State Administration.

No.	Waste storage facility	Owner	Waste types	The storage type	Distance by roads
3	Inhul'ska mine, Neopalymivka village	State Enterprise "Shid GZK"	waste of uranium and thorium ores mining	Disposal site	90 km
4	LLC "Zavalivsky graphit", Zavallya township	LC "Zavalivsky graphit"	wastes from graphite processing	Disposal site	190 km
5	LLC "Pobuzhsky Ferronickel Plant", Pobuzke township	LC "Pobuzhsky Ferronickel Plant"	nickel slags	Disposal site	150 km

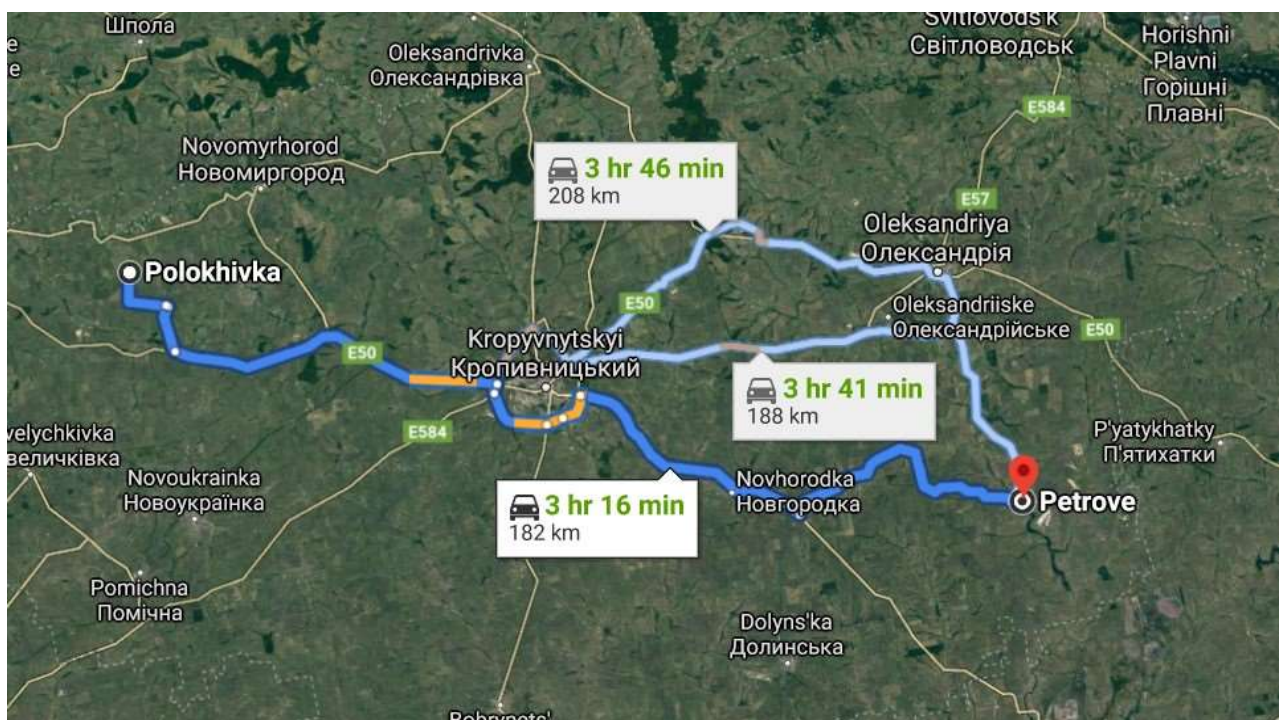


Figure 9 Petrivsky quarry, Petrove township

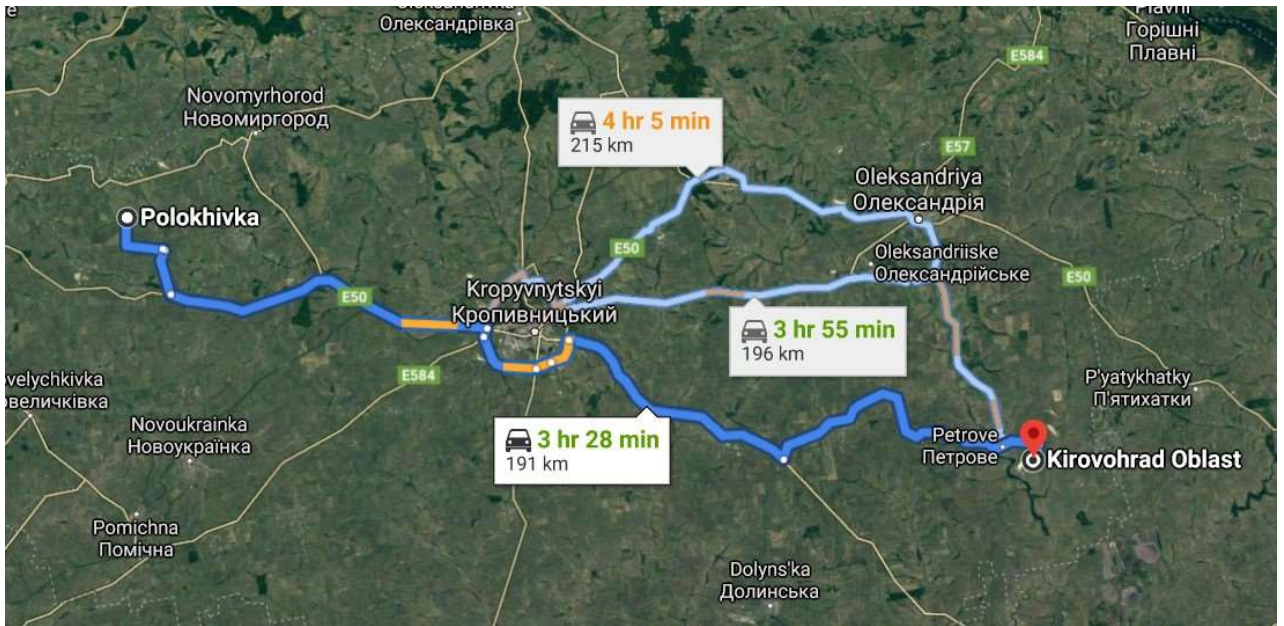


Figure 10 “Shcherbakivska” beam, Petrove village

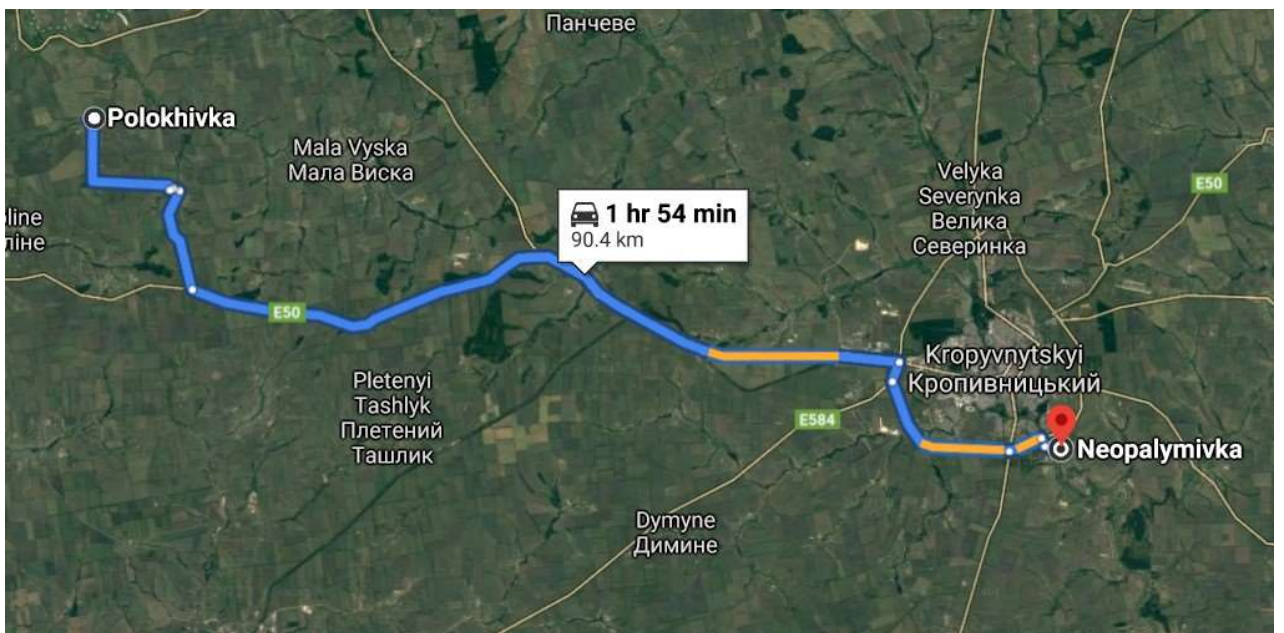


Figure 11 Inhul'ska mine, Neopalymivka village

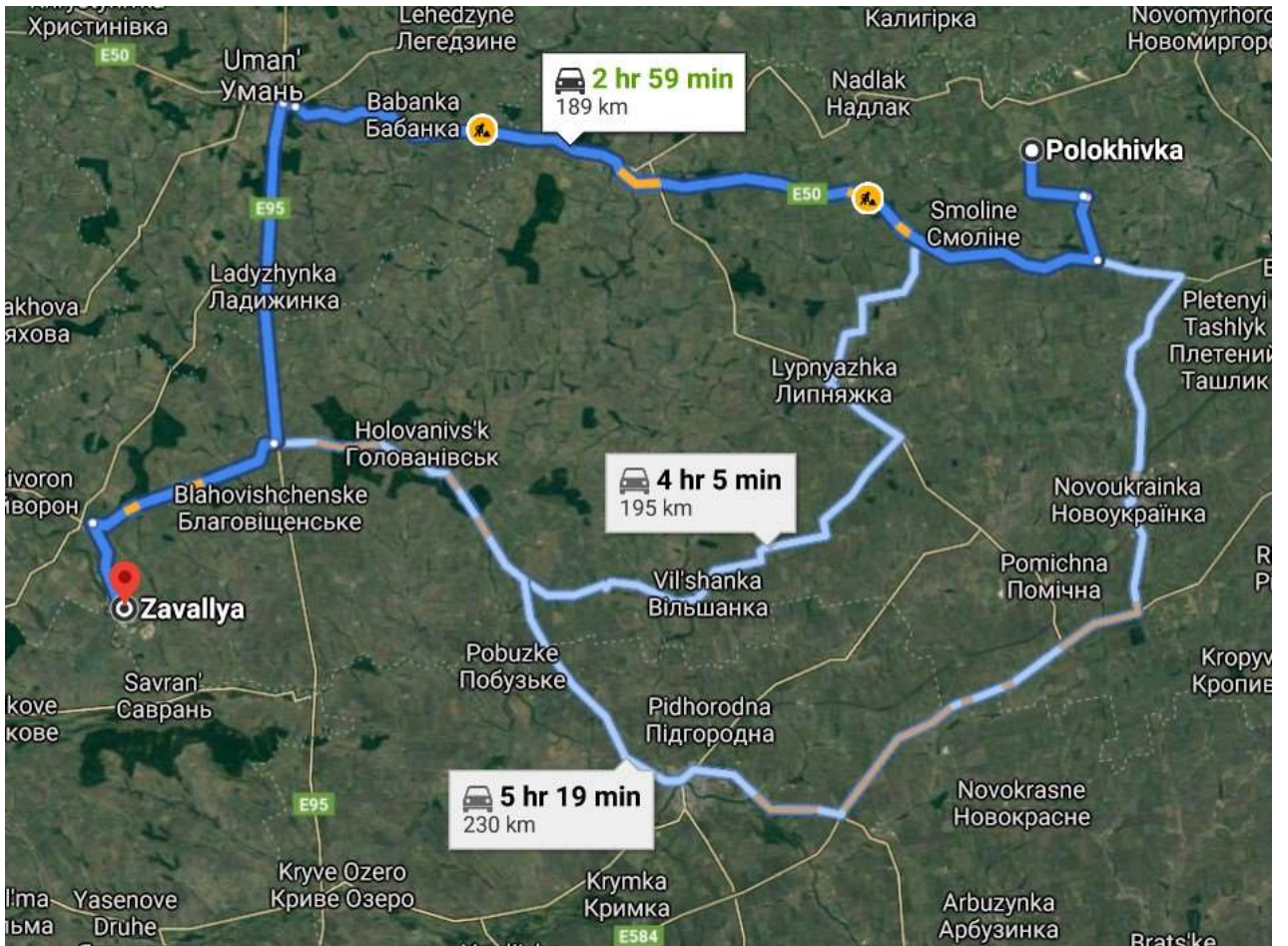
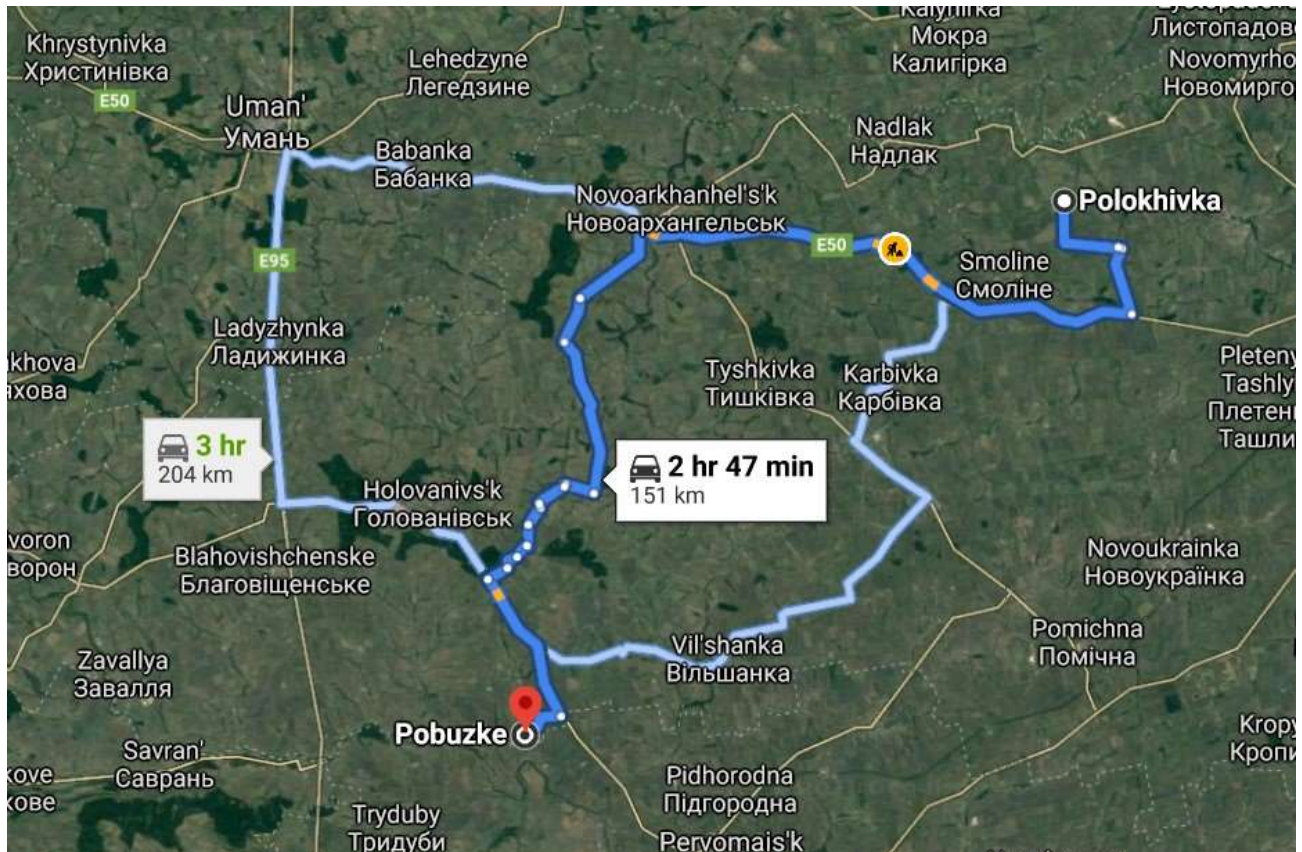


Figure 12 LLC "Zavalivsky graphit", Zavallya township



**Figure 13** LLC “Pobuzhsky Ferronickel Plant”, Pobuzke township

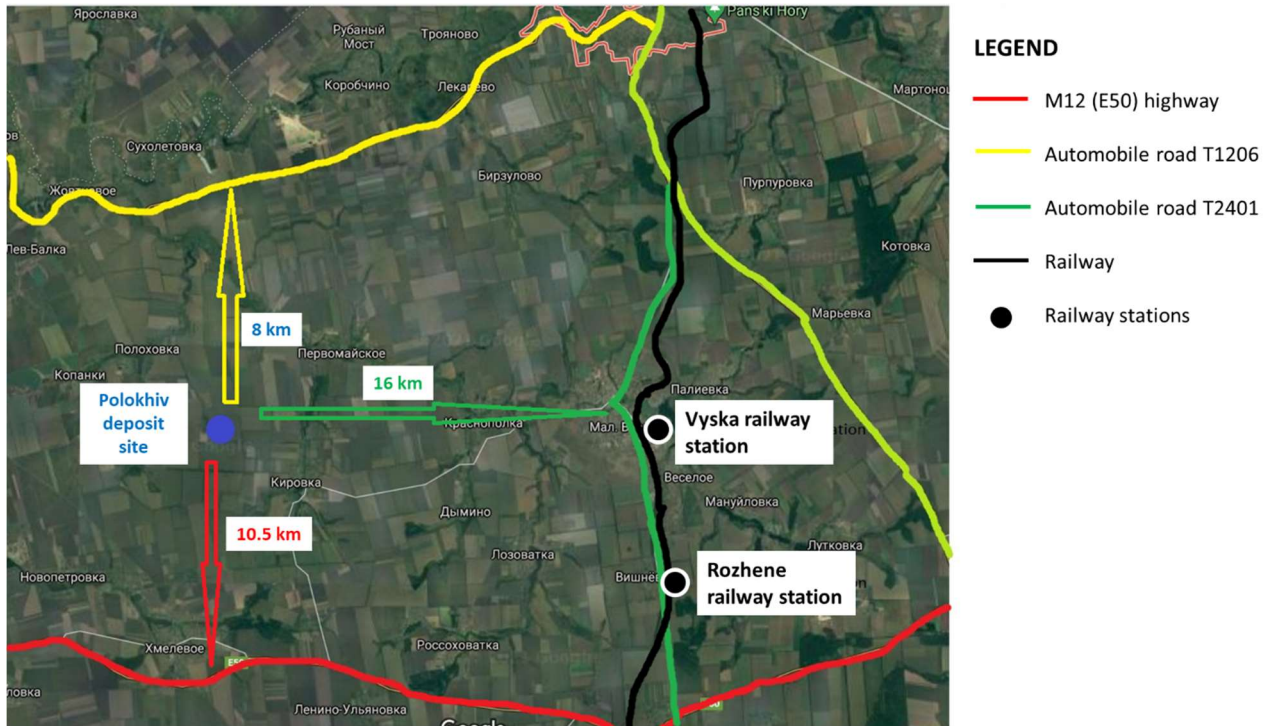
During 2018, only 0.05% of generated waste of hazardous class IV in 2018 were recycled and/or treated.

In this situation, industrial waste generated from mining and ore processing on site should be either transported to one of the above-mentioned storage facilities or stored on site. The storage facility on site should be built with a hard surface that prevents hazardous waste leakages to the soil and groundwater. The nearest company engaged in the utilization of household waste is the Municipal Enterprise “Mala Vyska Vodokanal”, which serves the Mala Vyska district.

### 7.3 Transport infrastructure

The transport infrastructure in the area of Polokhiv deposit site is not well developed – the automobile roads in the immediate vicinity are rural/field roads with no status granted by the state. The nearest road of local importance is T1206 road located 8 km north. Two other roads in the vicinity are M12 (E50) of international importance in 10.5 km south, and T2401 of local importance in 16 km east (see **Figure 14** below).





**Figure 14 Existing routes and railway**

The roads characteristics are specified below:

- |   |   |
|---|---|
| <p>M12 (E50) highway<br/><b>(Figure 15)</b></p>                               | <p>The two-line M 12 highway is a highway of international significance on the territory of Ukraine, it passes through Stryy - Ternopil - Kropyvnytskyi - Znamyanka. It passes through the territory of Lviv, Ivano-Frankivsk, Ternopil, Khmelnytsky, Vinnytsya, Cherkasy and Kirovohrad regions. The highway coincides with part of the European route E50 (Brest - Paris - Prague - Uzhgorod - Kropyvnytskyi - Donetsk - Rostov - Makhachkala).</p>           |
| <p>Automobile road T1206<br/><b>(Figure 16)</b></p>                           | <p>The automobile road (most likely two-line) of local significance in the Kirovohrad region. Passes through the territory of Novoarkhangelsk and Novomyrhorod districts through Novoarkhangelsk - Petroostrov - Novomyrhorod.</p>  |
| <p>Automobile road T2401<br/>'Horodyshe Ustynivka'<br/><b>(Figure 17)</b></p> | <p>The two-line automobile road of local significance in Cherkasy and Kirovohrad regions. The road starts in the city of Horodyshe at the intersection with the highway H01, passes through the settlements of Horodyshe and Shpola districts of Cherkasy region, as well as Novomyrhorod, Malovyskovsky, Novoukrainsky, Bobnyivskiy districts of Kirovohrad region till the intersection with automobile roads T 1216 and T 1210 in the Ustynivka village.</p> |

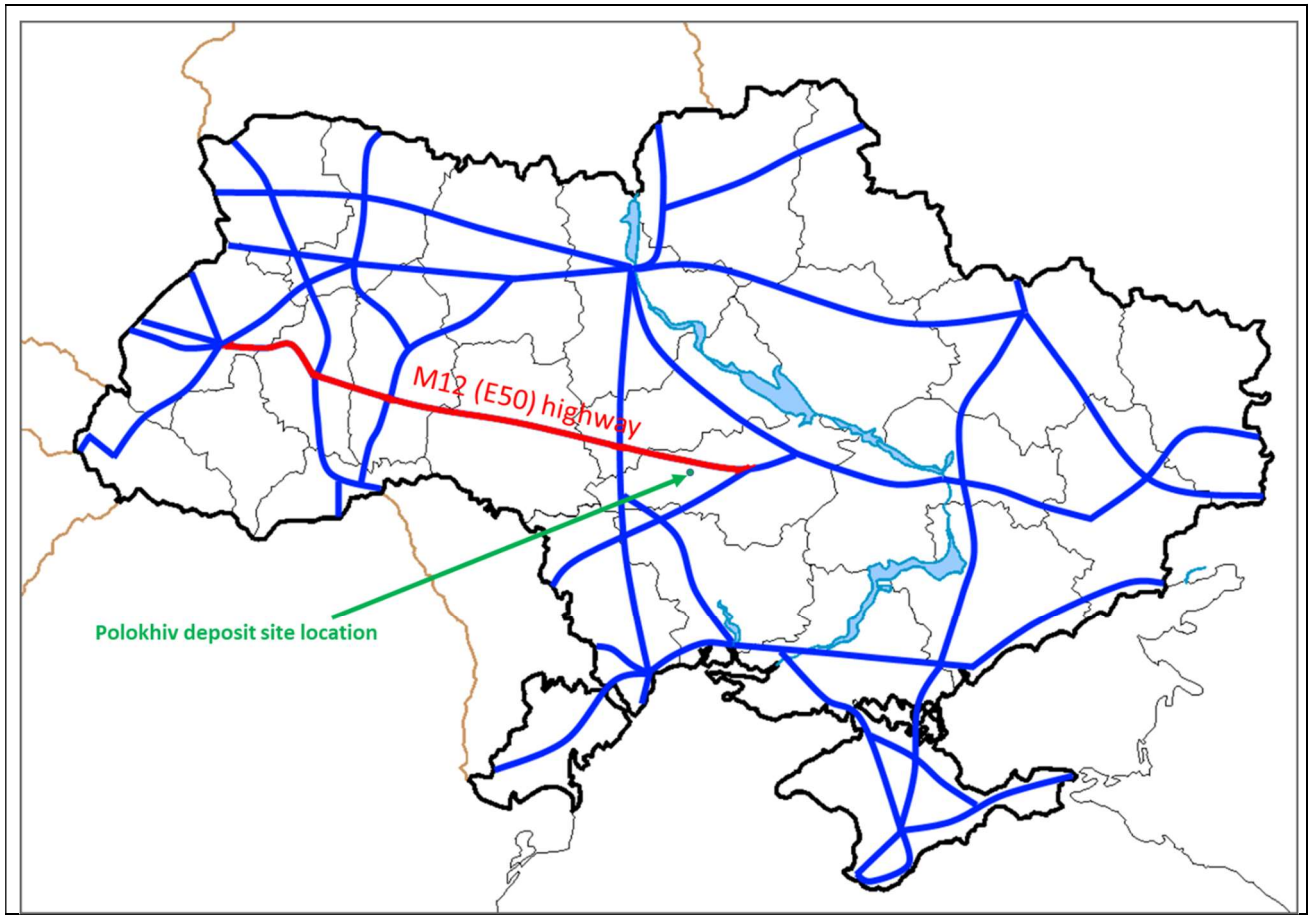


Figure 15 M12 (E50) highway

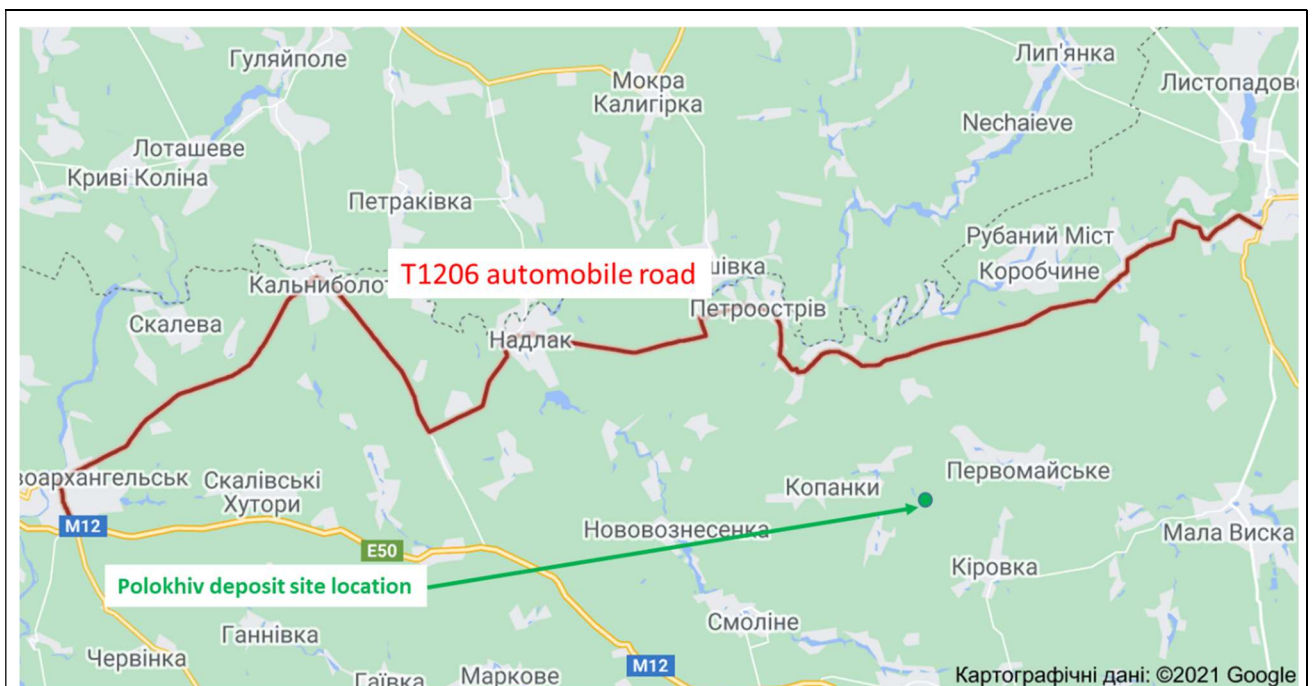
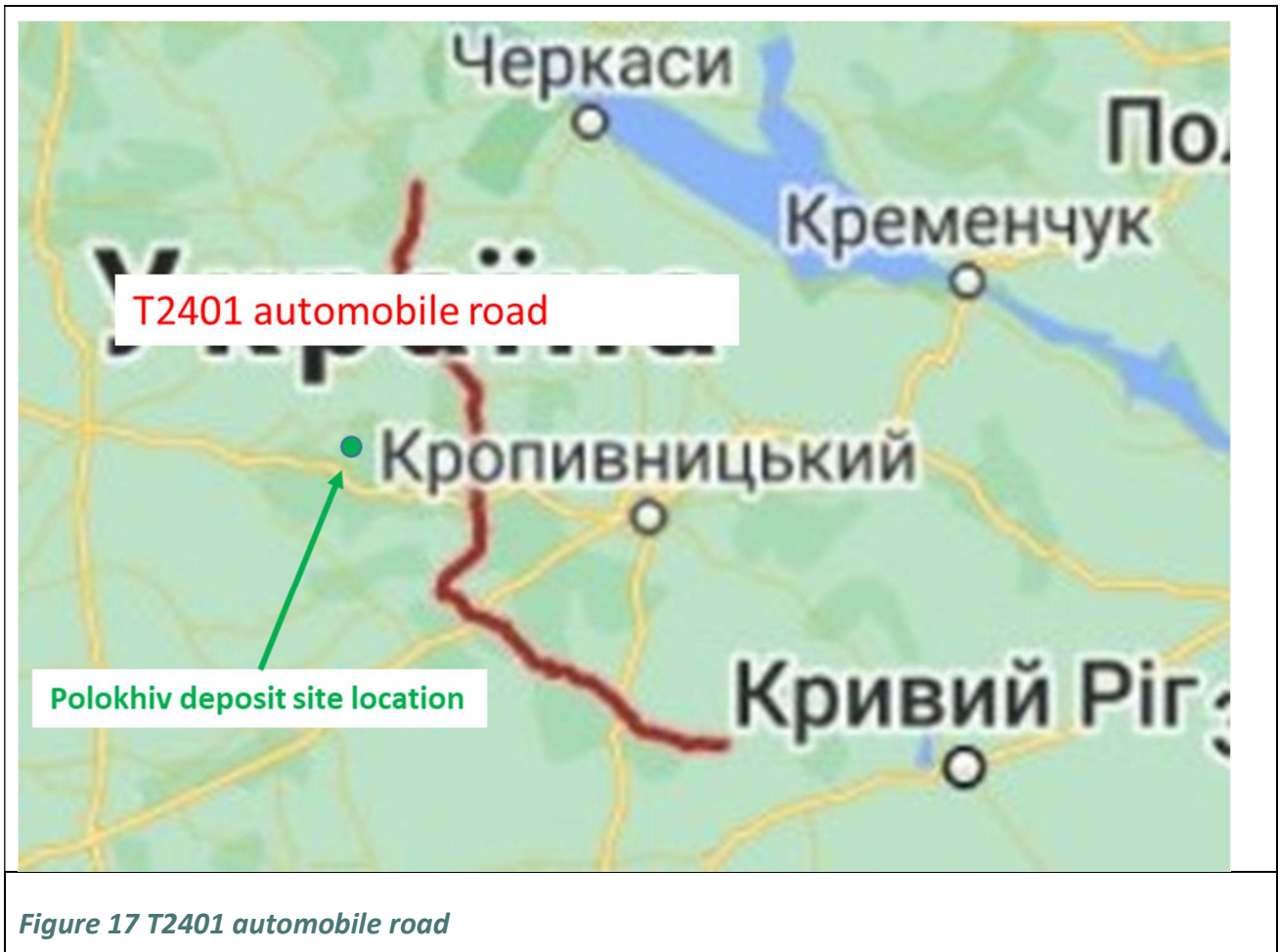


Figure 16 T1206 automobile road



*Figure 17 T2401 automobile road*

The nearest railway line is in 17 km west. There are two stations – Vyska and Rozhene railway stations. Vyska is freight and passenger railway station located in Mala Vyska town. It consists of 5 tracks and 2 platforms. Rozhene station is a passenger railway station located near Manuilivka village Malovyskivsky district.

To summarize, the transport infrastructure in the vicinity of the Polokhiv deposit site is not very well developed. The nearest roads are located in 8-16 km, whereas the immediate vicinity is covered by a net of undeveloped rural roads, most likely with the poor hard pavement. Vyska railway station is designated for the processing of the freights, although whether it fits for the Client’s purposes should be additionally assessed when the project detail will be available.