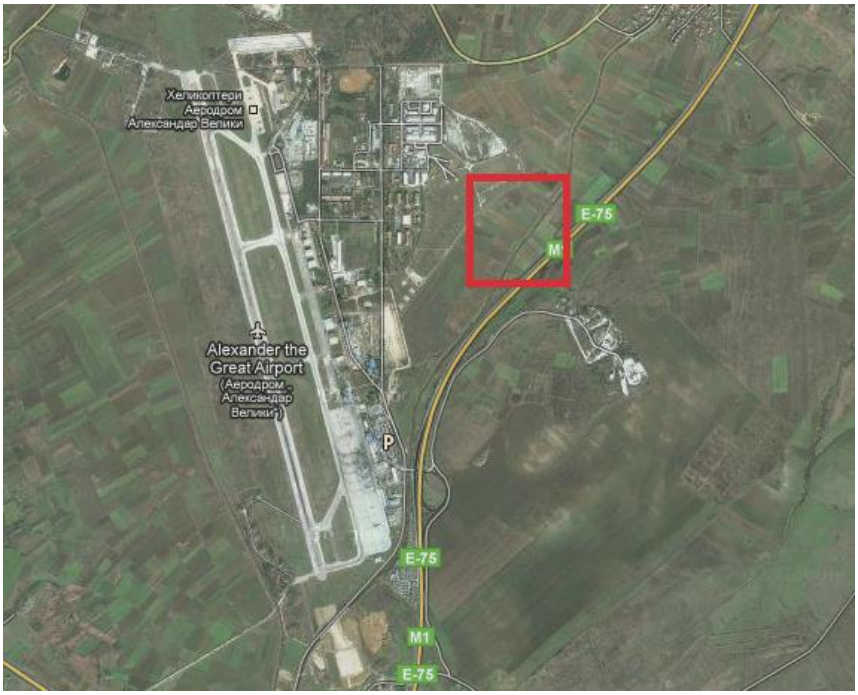
S T U D Y

Biodiversity Assessment of location at the Skopje valley and the environmental impact



Stip, 2011

CONTENT

INTRODUCTION

The richness of ecosystem types, types of habitats, communities and species placed Republic of Macedonia on the top of the list of countries with relevant Biodiversity in Europe (Hotspot). The main strategic goal of the country is the establishment of the state quality environmental protection in general and providing and improving the quality of life. Within this objective the protection of biological diversity is involved as well as its sustainable use. For this purpose, the Republic of Macedonia ratified several conventions:

- Convention for Biological Diversity, 1997;
- Convention for the Protection of wetlands of international importance as habitats for aquatic birds, 1997;
- Convention for the protection of wildlife and natural habitats in Europe, 1997;
- Convention for the protection of migratory wild animals, 1999.

These conventions are part of national legislation and a legal basis for protection of biological diversity.

According to the scientific research, it is concluded that in the Republic of Macedonia was formed more ecosystem types into seven groups: water, coastal, grassland, hills, steppes, forest and mountain ecosystems of which key elements are: water, dry grassland, and forest and mountain ecosystems. In terms of vegetation territory is divided into eight zones: 1. Area forests of kermes oak 2. Area forests of downy oak 3. Area forests of turkey oak 4. Area forests of sessile oak 5. Area of beech forest zone 6. Area mountain beech forest, 7. Area of subalpine forests, 8 Area alpine grassland. (Figure 1).

On the territory of The Republic of Macedonia set aside two bio-geographical regions: Alpine and Continental and one sub-region Sub-Mediterranean. Depending on the altitude and locations eight climate-soil-vegetation zones are separated. In Sub-Mediterranean zone are separate two areas: Mediterranean area (50-500 meters altitude) with area of 800,000 ha and continental - Mediterranean area (501-600 meters altitude) with 97,000 ha area, which represents more than one-third or 35%. In the continental zone are four separate areas: hot continental area (601-900 meters altitude) with an area of 740,000 ha (27.4%), cold continental area (901-1100 meters altitude) with an area of 342,000 ha (13.3%), continental Podgorski mountain area (1101-1300 meters altitude) with an area of 250,000 ha (9.7%) and continental mountain area (1301-1650 meters altitude) with an area of 269,000 ha (10.4%). In the alpine zone are two separate areas: subalpine region (1651-2250 meters altitude) with 97,000 ha area (3.8%) and alpine areas (above 2250 meters altitude) with 13,000 ha area (0.5%).

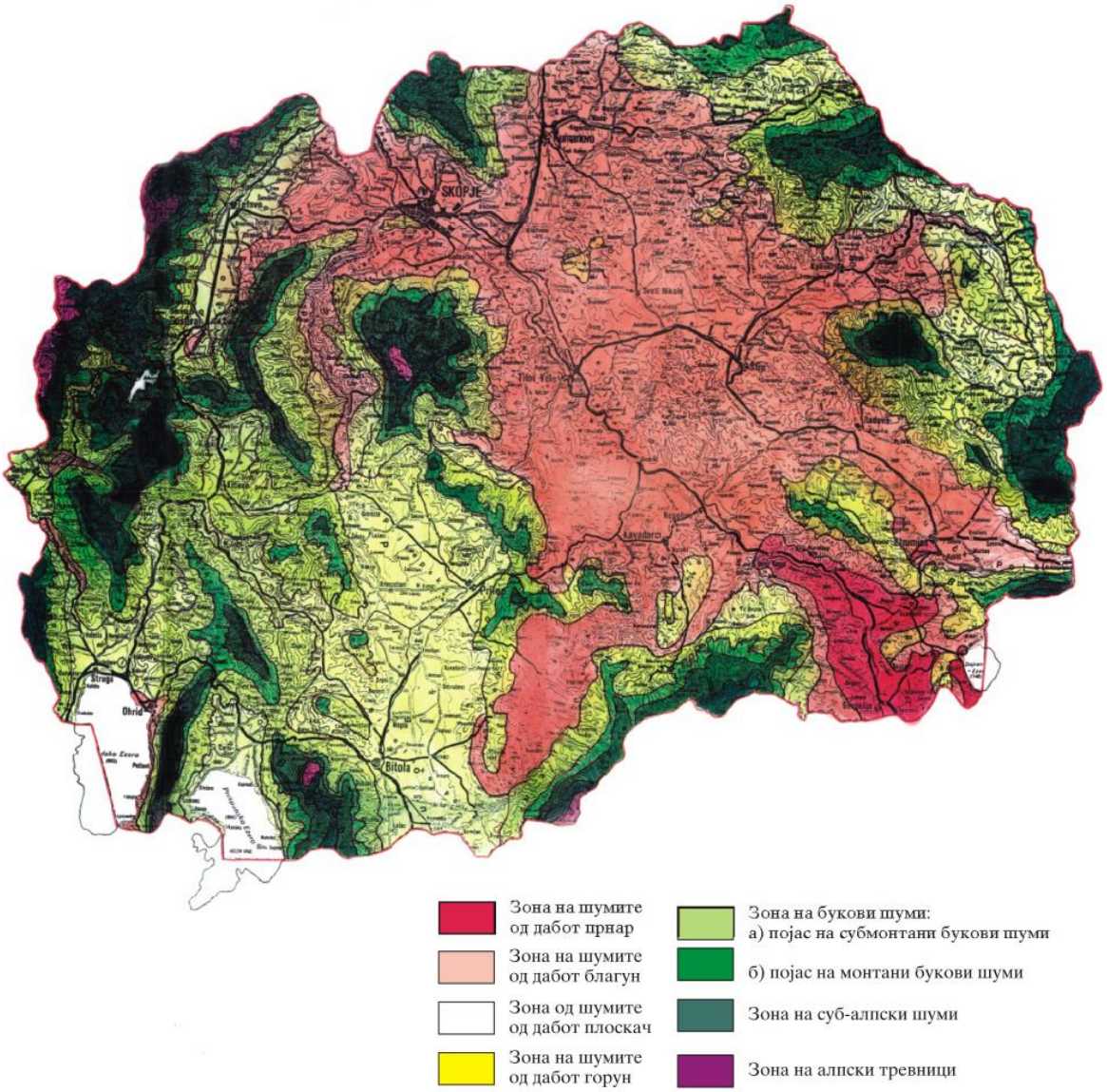


Figure 1. Climate parts of the Republic of Macedonia (Filipovski, et all 1996)

As concerns for ecosystems six types of ecosystems are separate: aquatic, coastal, grassland, steppe, forest, mountain. A special type of ecosystem is steppes, located in High Povardarie (Pepelishte-Krivolak).

On the territory of The Republic of Macedonia two types of climate are separate: change Mediterranean and moderate continental. It causes cold continental winter and wet periods and continental warm and dry Mediterranean summer periods.

The categories of protected areas planed within the Law of Protection of the Nature are: 1. Strict Natural Reserve, 2. National Park, 3. Natural Monument, 4. Natural Park, 5. Protected area, and 6. Multipurpose area.

In the Republic of Macedonia there is a legally regulated procedure for protection of locations of natural values that are categorized into 6 categories of protected natural heritage. Also there are formed CORINE biotopes with 77 corine sites and National Emerald Network of the Republic of Macedonia with 35 Emerald sites and 11 protected areas, included in the Macedonian green belt as part of the Balkan Green Belt. This National Emerald Network RM covers Emerald 35 sites covering an area of 752,223 ha or 29% of its territory (Figure 2).

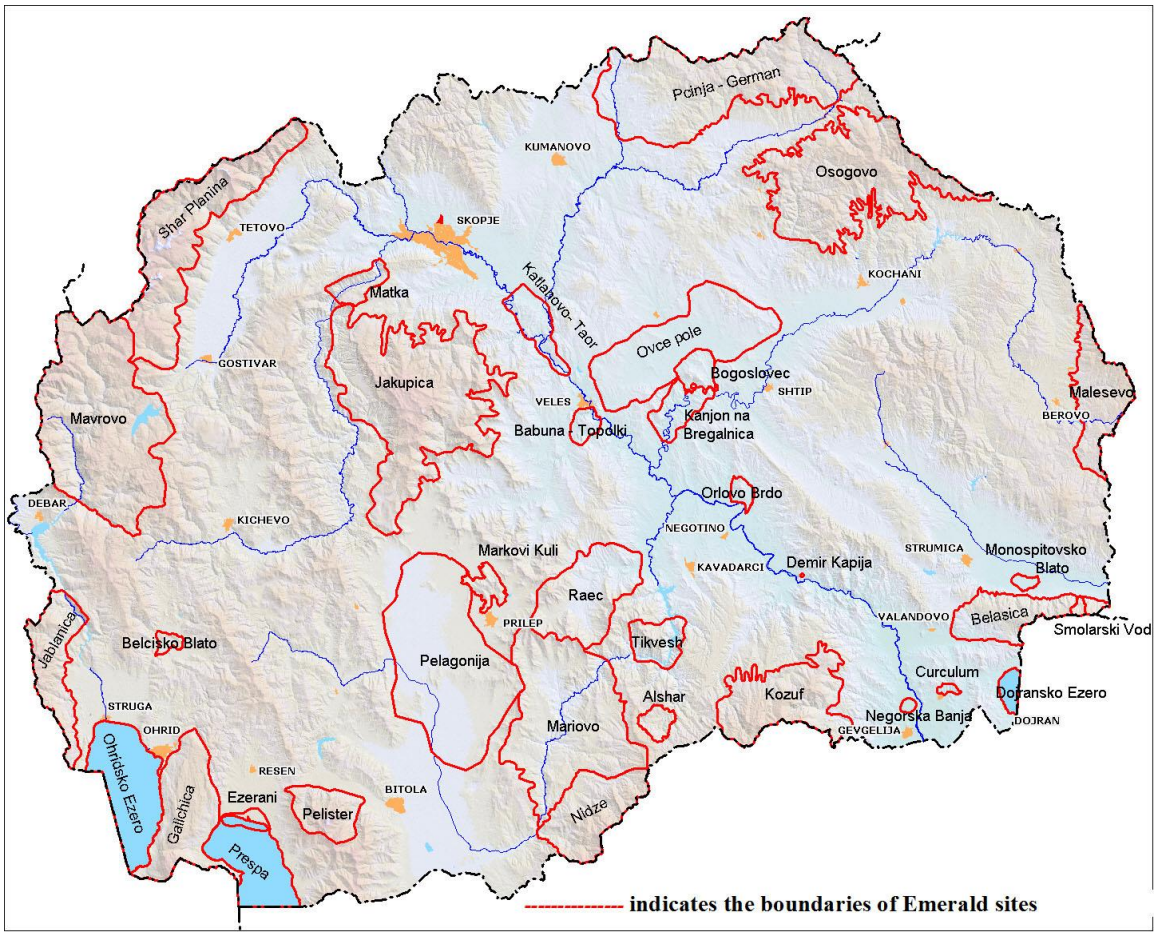


Figure 2. National Emerald Network of the Republic of Macedonia

Macedonian greenbelt includes 11 protected areas: three of them are national parks Pelister, Mavrovo and Galicica; three of them are natural lakes, which are also natural monuments of Ohrid, Prespa and Dojran Lake; strict nature reserve Ezerani located on the Prespa Lake and natural monuments Vevcani – Sources, Smolare Waterfall, Koleshino Waterfall and Majdan floristic site

The number of protected areas is an increased trend in the last decade that shows increased of the percentage of protected areas from 7.4% in 1991 to 8.7% in 2008. The surface of the protected area is 2220.5 km^2 (8.7% of the territory of the Republic of Macedonia).

1. CHARACTERISTICS OF THE LOCATION
1.1Topography

Skopje valley is surrounded by high mountains Skopska Crna Gora on the north 1.626 m, on the west are mountains Zeden 1.254 m and Osoj 1.369 m, mountain Jakupica 2.540 m south and the Katlanovo hill of the east. Skopje valley lie on the direction north-west to south-east, with a length of 47 km. The width varies from 28 to 50 km, and the surface is 2.100 km. The lowest part of the valley is from 175 m altitude and the highest peak of Mount Jakupica is 2.540 m altitude.

The natural predisposition of physical and geographical aspects, as well as configuration of the terrain, show that the Skopje valley has very good transport and communications position that exceeds the current level of exploitation.

The location which is subject of this study project is located east at the Skopje valley, 17 km southeast of the capital of Republic of Macedonia, Skopje directly next to the Alexander the Great Airport Skopje at the municipality Ilinden. The coordinates of the location are at latitude of 41º 57'40''N and longitudes of 21º37''37, E (Figure 3 and 4). The highest place of location is 256.80 meters altitude and 243.02 meters altitude. Location which is under construction of road intersection is 44.000 m^2.

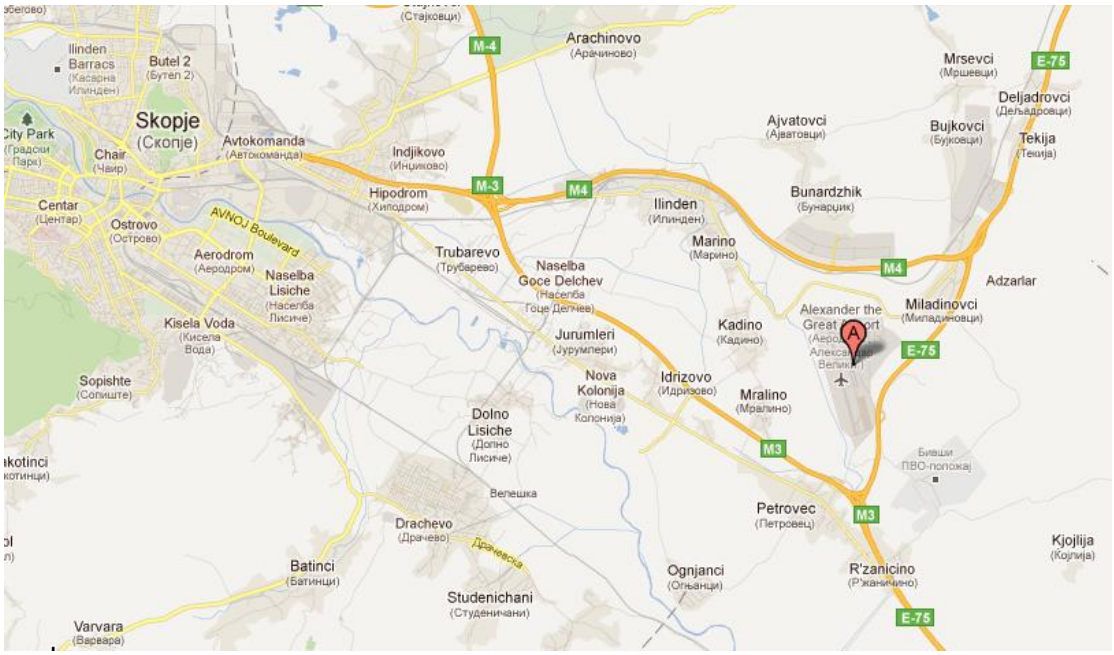


Figure 3. Project location at the map of Republic of Macedonia

The location is next to the northern boundary of the Emerald Zone Katlanovo - Taor (Fig. 5), which is a protected area Katlanovo bog, and on the northwest of the project location are Arboretum, Ostrovo and Ezerce, areas which are declared as protected monuments of nature.

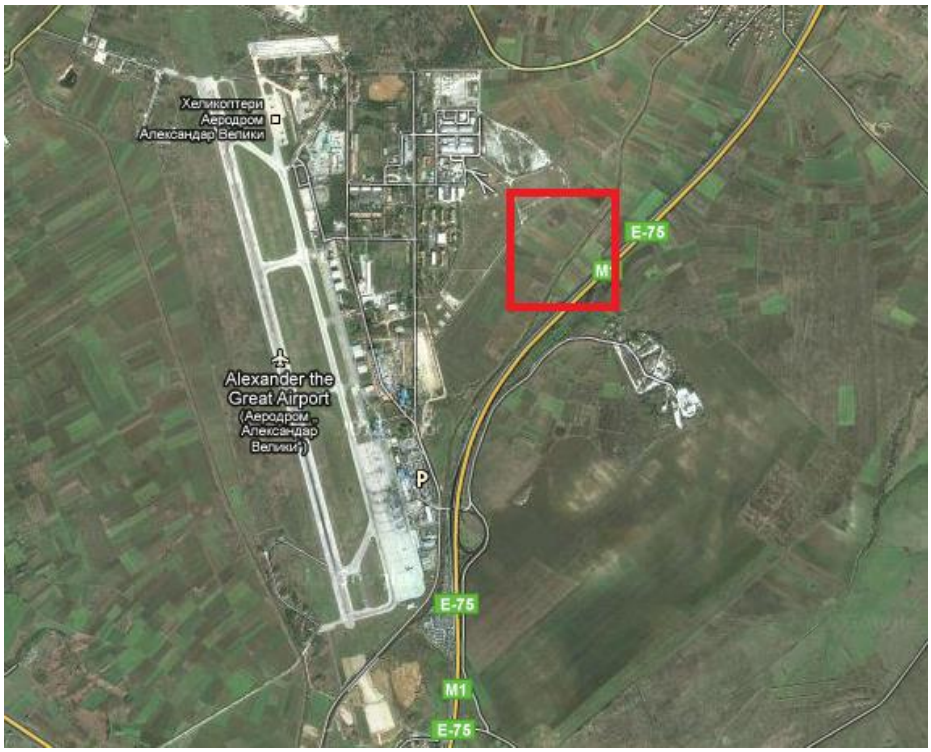


Figure 4. Satellite image of the place designated for the construction of the intersection to connect the Alexander the Great Airport Skopje to Main Street M-1

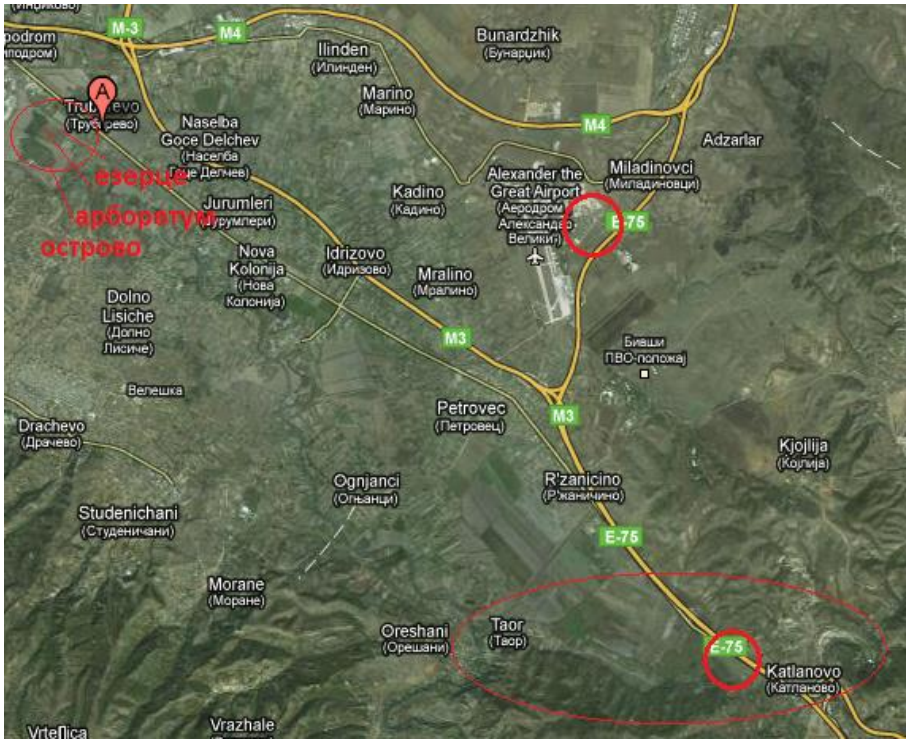


Figure 5. Location of the project site in relation to protected areas that are near (Ostrovo, Arboretum and Ezerce in the northwest region and Katlanovo - Taor, south of the project location)

1.2 Geology of soil

Primary geological environment of widespread Skopje region consists of neogene-pliocene sediments and quintuple-alluvial deposits. The basic rocks are massive pliocentic lakes sediments which are on 700m covered with quintuple-most alluvial terrace sediments. Quintuple characteristics of sediments of the upper layers are defined by layers of gravel, sand and clay up to the surface of the ground. This genesis is associated with alluvial flow of the river Vardar, as well as with the flooded surrounding sediment from watershed areas. Paleozoic complex includes: shale, marble and quartzite, which are together prevalent along from the north-east to south-west.

From seismic and tectonic aspect the region belongs to the Vardar seismic zone, where epicenter area of Skopje is most affected by the devastating quake struck. The seismic of Skopje basin together with tectonic processes cause severe, even catastrophic earthquakes in the past.

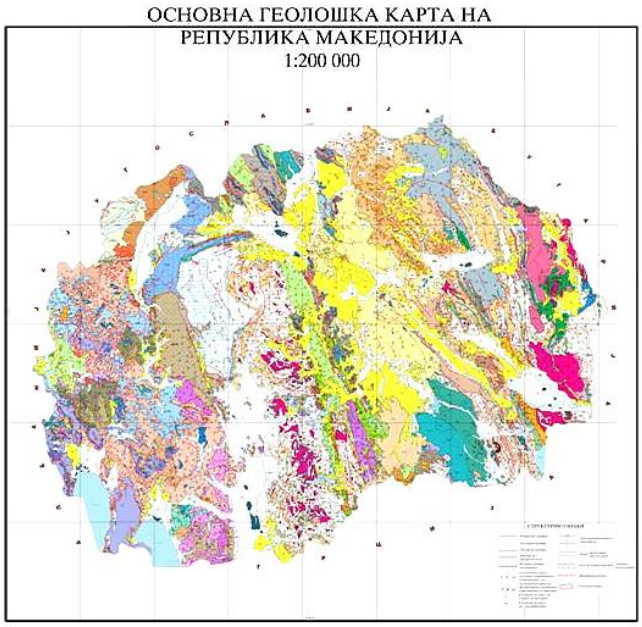


Figure 6. Basic geological map of the Republic of Macedonia

1.5 Climate and meteorology

Skopje valley is the ultimate point that touches the warm air that circulates from the Aegean Sea, and as such constitutes a distinct thermal valley area in which climate affects the temperature regime. From the other point of view the Skopje valley is surrounded by high mountains, which maintain direct influence of Mediterranean climate from the south, while from the north and north west penetrate free movement of continental air, which in winter resulting especially with low temperatures. The configuration of the basin has an impact on reducing these air currents, so that years with extremely low temperatures were registered.

During the summer months when this area is influenced by high air pressure the air temperatures are very high.

Climate data for the Skopje valley and the Skopje City originate from two meteorological measuring stations Skopje-Petrovec and Skopje-Zajcev rid, but because of the proximity of the project location to the meteorological measuring station Skopje-Petrovec in this study are presented only the data from station Skopje-Petrovec.

Table 1. Monthly average and annual air temperatures

measuring station	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	annual
Skopje-Petrovec	0.2	3.0	7.4	12.2	17.2	21.3	23.5	23.2	18.8	12.6	5.9	1.3	12.2

Source: National Hydrological and Meteorological Service (1971-2000)

Table 2. Absolute maximum monthly and annual air temperature

measuring station	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	annual
Skopje-Petrovec	16.0	24.3	28.0	34.8	36.1	39.4	42.4	43.2	36.8	32.8	24.5	19.8	43.2

Source: National Hydrological and Meteorological Service (1971-2000)

Table 3. Absolute minimum monthly and annual air temperature

measur. station	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	annual
Skopje-Petrovec	-25.6	-21.2	-10.8	-4.5	-1.2	1.2	6.2	7.0	-2.3	-6.4	-12.2	-18.6	-25.6

Source: National Hydrological and Meteorological Service (1971-2000)

Temperature inversions occur in the air each month, however most common are during the winter. The lowest temperatures during those days when temperature inversions are present are registered in the low part of the valley and the high temperatures registered in the higher parts. The temperature difference in terms of inversion between low parts of the valley and surrounding high areas may be greater than 10 º C during winter and dependent on the intensity of inversion.

Precipitations are unevenly distributed throughout the year (monthly and seasonal). Abundantly precipitations occur in May and November. The smallest values recorded in January and August. Precipitation occurs at any time of day or night so that the distribution of precipitation in this period with different values and frequency of occurrence. According ombrographic measurements in Skopje valley precipitations are more frequent and heavier in the afternoons compared to that in the mornings. During the summer period of the year is the emergence of heavy (strong) rains with varying intensity and duration.

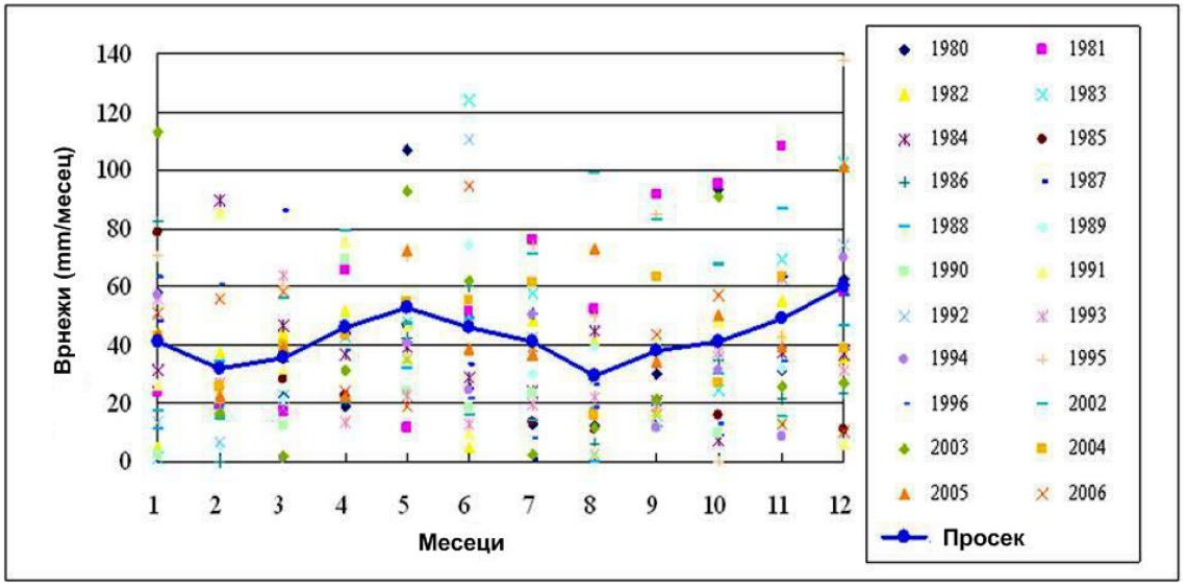
Middle amount of precipitation for the entire country is about 733 mm (for the period 1961-1990), while in the watershed of the Vardar River at about 700mm. From Table 4 can be

seen that the annual rainfall ranging from 400mm to 700mm, while the average annual amount of precipitation is 512mm/year.

Table 4. Values of monthly precipitation for the City of Skopje

year	monthly precipitation (mm)												annual
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	(mm)
2002	17	15	56	79	47	16	71	99	83	67	15	156	722
2003	113	16	2	32	93	62	2	12	21	91	26	17	497
2004	43	26	40	44	55	55	61	16	63	27	63	38	532
2005	44	23	39	23	72	38	37	73	34	50	39	102	575
2006	51	56	58	24	19	95	39	29	43	57	13	10	495

Source: National Hydrological and Meteorological Service: "Study on Integrated Water Resources Development and Master Plan for Water Management in the Republic of Macedonia", 2002-2006



Source: National Hydrological and Meteorological Service (1980-2006)

Figure 7. Variations of the monthly amount of precipitations in Skopje (1980-2006)

Middle amount of precipitation in the Skopje valley for the period 1971-2000 measured at station Skopje-Petrovec is 499 mm, (Table 5) while the station Skopje-Zajcev rid is registered value of 441 mm.

Table 5. Monthly average and annual rainfall in mm

measur. station	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	annual
Skopje-Petrovec	35.3	36.1	35.6	43.2	56.0	45.1	36.8	28.7	38.2	43.9	54.4	78.8	499.3

Source: National Hydrological and Meteorological Service (1971-2000)

In Skopje valley very common are wind air flows from the south and west quadrant. However orographic features have the greatest impact on the direction of the wind. Table 6 is given monthly average and annual wind speed.

Table 6. Monthly average and annual wind speed m/sec

measur. station	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	annual
Skopje-Petrovec	1.2	1.6	1.8	1.8	1.6	1.6	1.7	1.5	1.4	1.2	1.1	1.1	1.5

Source: National Hydrological and Meteorological Service (1971-2000)

Rose of the winds for Skopje - Petrovec (Figure 8) shows that wind speed and direction are typically allocated to a particular location. Shown in a circular form, the wind rose shows the frequency of winds blowing from a certain direction.

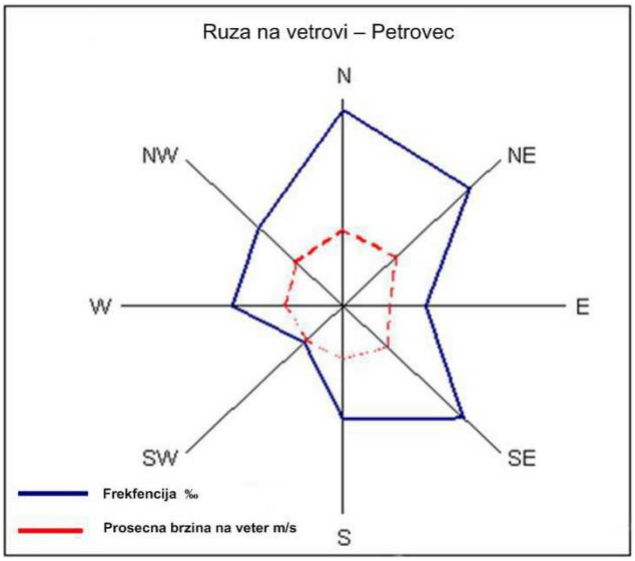


Figure 8. Rose of the winds for Skopje - Petrovec

In the open eastern part of Skopje valley wind regime is quite different from that in the city of Skopje. Most frequent are the northern winds with 142 ‰/yr. average speed and annual average speed of 3.9 m/sec. The wind is present throughout the whole year, but its frequency is highest in July - 210 ‰ average speed 4.6 m/sec, and the lowest frequency in May - 109 ‰, and average speed of 1.8 m/sec. After the north wind, most frequent occurrence is the wind that blows from the north-east direction with an average frequency 120 ‰ and average speed of 3.3 m/sec. That wind is present during the hole year but most frequent is in March -154 ‰ with an average speed of 3.1 m/sec, and least frequent in October and November with 95 ‰ and 98 ‰, and average speed of 3.3 m / sec.

In the eastern part of the valley north wind has the highest average speed regardless of the month - 3.5 m/sec, followed by wind from the north-east 3.3 m/sec and wind from the south-

east at a speed of 1.8 m/sec. South-west, north-east and west wind direction are with a speed of 2.7 m/sec, while the south is a speed of 2.2 m / sec. Maximum wind speed is in February and March - 4.6 m/sec. Winds in the Skopje valley has its own determination and direction throughout the day. In the mornings, dominated winds are from the western and north-westerly side, while the emergence of south-east winds is rare.

1.4 Other climate parameters

To obtain a clear and comprehensive picture of the climate in the project area four parameters were analyzed, it is a: number of sunny days expressed in hours, appearance of fog expressed in days, cloud expressed in tenth and maximum cover thickness of snow expressed in cm. All data for these climatic parameters are taken from the measuring station Skopje-Petrovec.

The maximum number of sunny days, expressed in hours was recorded in July and August, while annually more sunlight hours (2226.2) are registered at the station Skopje-Zajcev rid. Average monthly distribution of sunlight hours is shown in Figure 9.

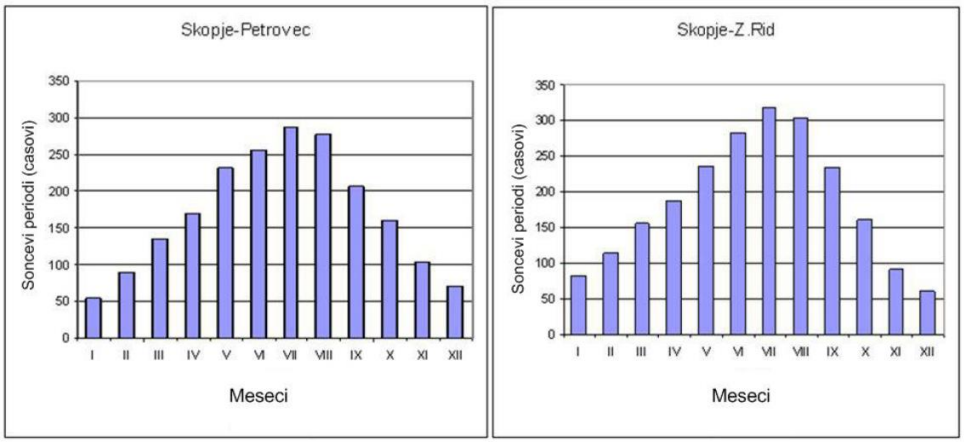


Figure 9. Average monthly distribution of sunlight hours from measuring stations Skopje-Petrovec and Skopje-Zajcev rid

The appearance of fog is typical for winter, from October to May. The average 27 days with fog were registered at the measuring station Skopje-Petrovec. Average monthly and annual cloud covers are presented in the table 7, data provides form measuring station Skopje-Petrovec.

Table 7. Average monthly and annual cloud covers (expressed in tenths)

measuring station	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	annual
Skopje-Petrovec	6.5	5.8	5.6	5.5	5.1	4.0	3.1	2.9	3.7	4.7	6.1	6.7	5.0

Source: National Hydrological and Meteorological Service (1971-2000)

Location of the project area is characterized by hydrographic network represented by the Vardar River and irrigation canals that run through the project site.

1.5 Anthropogenic environment

Project location is surrounded by rural areas at a distance of 3 up to 10 km as follows: Marino village northwest of the location, the village Miladinovci northeast, on the north is located technical industrial zone Bunardzik, on the west are located the villages Kadrino and Mralino, southwest is township Petrovec and south from the location is the village Rzanichano.

Agriculture is the most important economic activity in the respective region. The agriculture production is characteristic of intensive agriculture cultivation of crops and production of industrial crops. Agriculture is the main economic activity for the population in rural settlements in the highway corridor. According by the ownership of land, one part of the land belongs to the public sector and the rest is privately owned land. The most important are the fields and gardens, while the orchards are presented with negligible surface.

Commonly grown cultures are corn, especially wheat and grains. Livestock breeding activity is less common in rural areas in the region.

1.6 Quality of water, air and soil

Water, air and soil are considered to be unpolluted (in natural areas) or medium polluted (in settlements and agricultural land, and in the locations directly to the airport). Agricultural land covers a considerable area in the Skopje valley, along the Vardar River. Most agricultural land is represented by fields. An irrigation channel provides this intensive agricultural production, and that one of them passes through the project location.

Figure 10. Canal for irrigation/drainage in the project location (because of the project construction the existing canal is attached to the temporarily excavated channel)

According to the "Regulation on Classification of Waters (Official Gazette of RM 18/1999 year.)" five classes of quality of surface waters, watercourses, natural and artificial lakes and underground water were Identified:
- Class 1 Very clean, oligotrophic water, which in its natural state or possible disinfection can be used for drinking, manufacturing and food processing and is a substrate for spawning and rearing of precious fish - salmonids.
- Class 2 Slight polluted water, with mesotrophic character, which in its natural state can be used for bathing and recreation, water sports, production of other species, or that the appropriate treatment methods (coagulation, filtration, disinfection, etc.) can be used for drinking, production and processing of foodstuffs
- Class 3 Medium eutrophic water, which under natural conditions may be used for irrigation, followed by appropriate treatment can be used as technical water for industrial purposes.
- Class 4 Strong eutrophic, contaminated water, which in its natural state can be used only when appropriate will be purified.
- Class 5 High contaminated, hypertrophic water, which in natural conditions can be used for other purposes.

For project needs an analysis of the quality of water in channel flow through project location, shown on the pictures number 10 and 12, was done. Water is treated as surface water and a chemical and bacteriological analysis of channel water was made. Detailed analysis of the result is given in Annex I Figure 1. Test report of the health safety of surface waters was made at the "Institute for Health Care" - Strumica. The microbiological examination shows that the water contains coliform bacteria with total number of 30.000 nr.bac./L, and bacteria from fecal coliform origin with total number of 20.000 nr.bac./L. The total number of aerobic mesophilic bacteria was 30.000 nr.bac./L. Fecal bacteria from streptococci origin are also determined in the water in the channel with a total presence of 30.000 nr.bac./L.

According to the examined physical - chemical indicators (Annex I, Figure 1) and in accordance with the Regulation on the classification of water Official Gazette of RM no. 18/1999 and Regulation on categorization of water streams, lakes, reservoirs and groundwater, Official Gazette of RM no. 18/1999 and 71/1999 year, analyzed sample of water corresponding to the I class.

Because of the presence of coliform bacteria and streptococci from fecal origin water is not potable. In natural conditions may be used for irrigation of grass areas, alleys, parks, flowers, lawns and ornamental plants around the airport, but is not recommended for irrigation of food products which are not subject to thermal processing (fruits and vegetables for fresh consumption).

1.7 Hydrological characteristics

Municipality of Ilinden has modest hydrograph because of their natural territory has no permanent water courses. The only river in the municipality of Ilinden is Suva Reka. Suva Reka is formed from two tributaries, one of which passes the settlements Buchinci, Mrshevci Bujkovci and a length of 6,000 meters and the other one passes through the settlements

Deljadrovci, Teki Miladinovci and a length of 4,000 meters and continues to Petrovec a length of 5,000 meters, drainage these areas.

This channels change state with the surface water drainage the high groundwater also used for irrigation. There are two main channels and several smaller side channels for drainage areas whose total length is 60 km.

There is also a small artificial accumulation of Suva Reka nearby town Buchinci with an area of about 2 ha and depth 3-4 meters used to collect waters from the slopes of Skopska Crna Gora and protection from flooding of inhabited places in the watershed of the river Suva Reka (Mrshevci, and Bujkovci Miladinovci). It is also used for irrigation in the area. During a long lasting period of drought this accumulation dries too.

1.8 Demographic characteristics

Within the Municipality of Ilinden includes 12 inhabited places, including: Ilinden, Marino, Kadino, Mralino Ajvatovci, located, Miladinovci Bujkovci, Mrshevci, Buchinci, Teki and Denjadrovci. According to the census of 2002, the total population is 15,894 living in 4,298 households or an average of 3.7 members per household. Population density of 150 zhiteli/km2. Last 5 years the natural population growth averages 1% per year.

According to the nationality, in the Municipality of Ilinden, predominantly is Macedonian Orthodox population with the number of 13,959 inhabitants (87.82%), 912 Serbs (5.73%), Roma 428 (2.69%) Albanians 352 (2.01%); Turks 17 (0.10%) and other nationalities 226 (1,41%). According to the gender representation men has 8.180 or 51.5%, and 7.714 are women or 48.5%. According to the educational structure 95.7% of the population aged over 10 years and is literate.

The structure of the population aged over 15 years, according to educational attainment is as follows: no education - 655, incomplete primary education - in 1771, primary education - 3774, secondary education - 6157, college degree - 120 degree - 174, post-graduate studies - 2.

The total working population, aged over 15 years, is 12,639 citizens, of which 6486 are active and 6153 citizens are working inactive. The unemployment rate is 34.6%. From the total working population, the employment rate is 17.7%. Most employees are in construction (by 50%), followed by industry (35%) in non-economic activities (5%), agriculture (5%) and others. Gross domestic product (GDP) per capita is 11,964 US $.

Primary education is conducted in 3 primary schools from 1-8 grade and 5 local schools from 1-4 grade in which a total of 1900 students attend the classes. Primary health care of the population is performed by 3 national healthcare stations, and 6 private general practice healthcare stations; 2 public and 2 private dental clinics and 1 public and 1 private laboratory.
Veterinary care is performed in 3 private veterinary stations.

2 BIODIVERSITY IN THE WIDRE AREA OF THE PROJECT LOCATION (ECOSYSTEMS AND SPECIES)

The richness and the heterogeneity of species and ecosystems are the basic features of the biodiversity in the Republic of Macedonia. This situation is the result of a specific geographical location, climate, geological, geomorphologic, hydrographical, and other pedagogical features, and changes that have occurred in past geological periods. All this has left specific notch on existing flora, fauna and fungi for which evidence numerous relict species and ecosystems. According to information that currently are available that richness of species can be shown from over 18,000 taxa of flora, fauna and fungi, of which over 900 are Macedonian. Although a relatively small area of Macedonia (25 713 km2 of which 1.9% is water surface) has a great diversity of ecosystems within which registered some 260 plant communities.

The location of the project site, its small area of only 4.4 ha, immediate and direct to the airport "Alexander the Great" impact of influenced on the dynamics of biodiversity. The impact of airport noise, frequency of automobile traffic, exhaust fumes from cars are more common and thicker frequency of vehicles and people certainly have influenced on the reduction of the overall biodiversity of the location. At the time when project activities are performed (August 2011) also is observed such poor vegetation, which is due as a result of global warming, but as long due to all the above mentioned factors.

Figure 11. Vegetation of the project location at the time of project analysis

2.1 Biomes

According to all above mentioned the characteristics of this remarkable little valley location in Skopje, the impact of having airport runway next to the project site several decennia, increasing the volume of traffic and other factors influence to this location that cannot speak

of typical or characteristic ecosystem or biome. Footprints of the past left their mark on the biodiversity of this particular place and as such will be characterized as more typical mix of biomes, which, by appropriate signs refer to the project location.

From the botanical point of view can be generally concluded that it is an area which in the past lost many of its indigenous flora, vegetation values. It is due to the fact that in the past, primarily due to the change of the bed of the river Vardar, changed the level of underground water, fires, inappropriate afforestation, and the impact of the airport and made frequent traffic significantly anthropogenic influence has led to a change in overall ecological relationships, which resulted in a change of indigenous flora, vegetation specifications. It certainly resulted in a reduction of the fauna and fungi of this area.

According to the presence of vegetation this area in the Skopje valley belongs within the zone of oak downy forests, while according to the location and altitude (from 243.02 to 256.80 meters) location area belongs to the Sub-Mediterranean area (50-500 meters), shown in the picture 1. Broader area of location in the Skopje valley is represented by several interrelated types of biomes. Therefore, several biomes characteristic beyond the Skopje valley will be described. For the municipality of Ilinden as well as for the location cannot be said that has a typical characteristic biome and habitat.

Assessment of plant diversity
Floristic diversity and diversity of habitats on the site are represented by the most common types of habitats, plant communities (vegetation) and specific types of plants (flora). Valorization of global and national values of biological diversity is made according to international criteria:
• IUCN Red List of threatened plant species (Walter and Gillet 1998),
• Directive for habitats protection 92/43EEC,
• Convention for protection of wild flora and fauna and natural habitats in Europe (Bern),
• Directive on the protection of habitats,
• CORINE,
• EMERALD,
• IPA (Important plant areas),
• CITES - Convention on International Trade in Endangered animal and plant species.

In data assessing used are owned by the author, as well as data from "Study on the state of biodiversity in Macedonia-the first National Report (2003). Strategy and Action Plan for Biodiversity in Macedonia (2004).

2.1.1 Biomes with forest vegetation (coastal river forest)

The forest that is presents today in the Skopje valley is remnant from former rich native vegetation that extends along the coast of the river Vardar, before the direction flow changes and the riverbed of the river Vardar and before the irrigation measures in the wetlands included in the Skopje valley. Once the forest represented one of the rarely places for stay for migratory birds in low-lying parts of the Skopje valley, near Skopje.

Considering the current state of the environment in this area, an analysis of the presence of flora – vegetation was done. From the results of the analysis can be concluded that forest vegetation undergone tremendous changes in terms of species represented in the past and now. Besides changing the direction of flow of the river Vardar, the overwhelming impact of the change in the representation of the species had: the change in hydrological regime, reducing the level of ground water, fires that appeared in the past, inappropriate afforestation, global climate change and others. Therefore, the presence of vegetation can no longer be considered as typical coastal river forest vegetation. In other words, it is a mixture of species, where the prevailing artificially planted species of American maple (*Acer negundo*), *Amorpha fruticosa, Robinia pseudoacacia*, and scattered single trees of *Populus alba, Salix alba, Salix fragilis, Ulmus laevis* (*U. effusa*) and others.

2.1.2 Prairies of anthropogenic origin

Most of the grasslands in the highway corridor are from anthropogenic origin. Similar to the grasslands of natural origin, these cover small areas, because most of the agricultural land normally is arable.

2.1.2.1 Abandoned fields (Unplanted fields)

Reference form Directive of habitat: No specific reference
Reference of Palaeraktici habitats 87.1 Unplanted fields

The most important features of this biotope are the dominancy of grass and ruderal plant species than typical for communities of prairies. Vegetative cover is less or less closed, thus showing that the fields were abandoned many years. Grass species *Cynodon dactilon*, *Lolium* spp., *Bromus* spp., *Hordeum vulgare*, etc., form the plant cover. *Andropogon ishemum* often enters the Prairie natural areas. Other plant species (mostly grasses) characteristic of the hot and dry climate as *Tribulus terrestris* is characteristic of this habitat as well. Higher plants such as *Arctium lappa, Hyosciamus niger, Datura stramonium, Cichorium intybus, Xantium spinosum, Onopordon* spp., *Cirsium* spp and others can be found.

Vertebrate animals
Mammals - Common species of mammals in this habitat are: Eastern European hedgehog (*Erinaceus concolor*), badger (*Meles meles*), European mole (*Talpa europea*), European ground squirrel (*Spermophilus citellus*), wolf (*Canis lupus*), weasel (*Mustela nivalis*), etc.

Amphibians - are also rare in this habitat type, but is more common European toad (*Bufo bufo*). Other species probably are coming from neighboring dwellings.
No vertebrate animals
Earth ground beetles are represented by species that are characteristic of agricultural land and hilly pastures. Most common are *Amara aenea, Harpalus distinguendus, Harpalus serripes, Harpalus triseriatus* and *Zabrus incrassatus*.

Distribution: Leaving of arable soil is fairly common process in Republic of Macedonia. For that reason abandoned fields and meadows are common in Macedonia. It is similar in the whole area of distribution, but differs in many special features about the community of

species derived from different prairie communities that bordering the biotope in different areas.

Figure 12. Abandoned fields near the road project intersection

2.1.3 Agricultural land

Agricultural habitats in the project area near by the road are mainly represented by individual plots from the surrounding villages, from different types of fields, and meadows. Although most of the plots are with small area, there is no presence of fences. Large-scale monocultures plantations of maize and wheat are also represented.

2.1.3.1 Fields and farms

Reference form Directive of habitat: No specific reference
Reference Palaeraktici habitats: 82nd agricultural crops

Fields, farms and plantations in the area of the projected road intersection are mainly represented by grains and crops (Fig. 13). Industrial plants are seldom cultivated, with the exception of some fields and fields of tobacco.

An important feature of the area of interest is that the climate allows the cultivation of two crops per year. The most common crop rotation is between wheat fields and vegetable gardens. Changing the two, although similar biotopes in the same place, has no important role in the value of biodiversity of species, but there is great economic values. There are some characteristic species of mushrooms of various types of agricultural land, such as: Agaricus hortensis, Coprinus spp., *Anelaria semiovata, Volvariella speciosa* and so on. The composition of the species is identical for all types of agricultural land. Animal species of agricultural habitats are represented by species that are common for these biotopes in many other regions of Macedonia.

Vertebrate animals
Mammals - the species composition is identical as in unplanted agricultural land. Birds - some bird species (Calandra lark *Melanocorypha calandra*, *Galerida cristata*, Wheater *Oenanthe oenanthe*) can often be found in such habitats. Many other species used for laying.

Reptiles - This habitat is also rich in species of reptiles and species are similar to those in dry pastures and unplanted fields.
Amphibians – European toads (*Bufo bufo, Bufo viridis*) are the most common species of amphibians in this habitat.

2.1.3.2 Areas of arable land crops

Along the border the project site from all four sides is surrounded with alluvial layers are converted into agricultural farmland, which included mostly cereals, corn and barley. However, not all land is used for agricultural production. Parts of the land which are not quite suitable for agricultural production remained unplanted. In these parts richly are developed ruderal and weeds vegetation. This type of vegetation (ass. Geranio-Sylibetum mariani) is a significant part of the overall diversity of flora, vegetation in this area.

Figure 13. Surrounding of project location with farmland and rural settlements - villages Kadino and Mralino

2.1.3.3 Rural settlements – villages

Reference form Directive of habitat: No specific reference
Reference Palaeraktic habitat: 84.4 Rural mosaics
87.2 Ruderal Communities

Villages along the highway are characterized by a feature of rural. By default, the houses in these villages are surrounded by small gardens and fruit trees in their central part. In this situation many wild animal species are adapted for living near human presence.

Peripheral parts of the villages in the area are often characterized by distributed small houses with meadows, prairies and rare trees around. The presence of natural vegetation is high. Besides cultural and ornamental species, vegetation is mainly represented by elements of the neighboring biotopes and ruderal forest species.

Ruderal vegetation ass. Geranio-Silybetum mariani Oberd. 1954 is represented by typical

representatives: *Silybum marianum, Onopordon acanthium, Xanthium spinosum Carduus picnocephalus, Erodium ciconium, Conyza canadensis, Sambucus ebulus, Hordeum murinum, Papaver rhoeas, Sonchus oleraceus* and others.

2.1.4 Water and wetland habitats

2.1.4.1 Channels

Reference form Directive of habitat: No specific reference
Palaeraktic reference: No specific reference

The water quality of the irrigation system is heavily influenced by agricultural land. Massive developments of aquatic macrophytes were observed during the summer period, whereas most dominant is *Cladophora glomerata*. Aquatic fauna of the channels is very similar to species of stale water. Most represent resident in the channels is *Mauremys caspica rivulata*, reptile widespread in the south.

Fauna vertebrate animals (for rivers)
Mammals - Typical mammals that inhabit large rivers: South disperses water (*Neomys anomalus*), mink (*Ondatra zibethicus*), the European water type mouse (*Arvicola terrestris*), Southern type mice (*Microtus rossiaemeridionalis*) and marsh coypu (*Myocastor coypus*).

Birds - no characteristic species of birds. Several species can be found during migration and wintering of which are common cormorants (*Phalacrocorax carbo*) and wild duck (*Anas plathyrhynchos*), while small wild duck (*Anas crecca*), wild duck (*Anas acuta*) and small duck (*Anas querquedula*) can occasionally be found during migration. Common kingfisher (*Alcedo atthis*) and water blackbird (*Cinclus cinclus*) are frequent species in winter.

Amphibians - Different kinds and especially their larvae (tadpoles) can be found in rivers. There are frogs (*Rana ridibunda, Rana graeca*), European toads (*Bufo bufo, Bufo viridis* and *Bombina variegata*), smooth newt (*Triturus vulgaris*), southern crested newt (*Triturus karelini*) etc.

Despite the fact that it is a secondary habitats, survival of wetland vegetation (Scirpeto-Phragmitetum) in these areas could be present, having in mind that this type of vegetation through the drying of land for the agricultural production is completely destroyed in certain parts of the Skopje valley.

Figure 14. Bulrush (*Typha latifolia*) and common reed (*Phragmites australis*) led a dominant vegetation along the channel that runs through the site

Bulrush (*Typha latifolia*) and common reed (*Phragmites australis*) are dominant aquatic plants, such as vegetation typical wetland, but at the project site they are included in the channel which passes through the site, represented in Figure 14.

The areas around the airport are present parts of arable fields, which are mainly sown with cereal crops, wheat and barley. In spite of this biotope growing of weed and ruderal flora and vegetation is present.

2.1.4.2 Biotopes at stagnant water

2.1.4.2.1 Stands of common reed (*Phragmites australis*)

Reference form Directive of habitat: No specific reference
Reference Palaeraktic habitat: No specific reference

Belt of common reeds along the irrigation channels do not represent typical biotope of common reeds in most cases (Figure 10 and 14). They develop as typical narrow belts along the slow waters of the canals and some sleeves of the river Vardar. These belts of reeds are usually fragments of Scirpo-Phragmitetum W. Koch 1926 association of wetland plants.

2.1.5 Forest areas and plantation

Plantations of the highway corridor cover small areas. Most of them can be found near existing settlements and along the motor road.

2.1.5.1 Broadleaf plantation

Black locust tree (*Robinia pseudoacacia*), Canadian poplar (*Populus X canadensis*) and high

stemmed *Populus nigra* cultures represent broadleaf plantations along the road corridor. Also can be find small bands of *Ailanthus glandulosa*. However, the latter may be included in ruderal habitats.
Vertebrate animals
Mammals - Fauna in this habitat consists of species typical of forest: wild cat (*Felis sylvestris*), yellow-necked field mouse (*Apodemus flavicolis*), wood mouse (*Apodemus sylvaticus*). However, highly flexible species can also be found in this environment: Red fox, wolf, badger, wild boar etc.

Birds - Only a small number of species of birds live in this habitat, while many others attend from surrounding habitats. Typical bird species are blackcupes (Sylviidae) and tits (Paridae).

Reptiles – Only a limited number of species lived in these habitat, all species found here are from neighboring dwellings.
Amphibians - No characteristic species of amphibians in this habitat type, although some species are more common here than in neighboring habitats (common toad *Bufo bufo*, fiery salamander *Salamandra salamandra*).

2.1.5.2 Clean belts of black locust (*Robinia pseudoacacia*)

Reference from Directive of habitat: No specific reference
Reference Palaeraktic habitat: 83,324 Plantations of black locust

Belts of black locust have a small area. They are very open and have well-developed ground vegetation and it is very similar to that of the surrounding prairies. Many ruderal elements are present in the belt of black locust tree due to their proximity to roads and settlements. Belts of this biotope are similar to that of forests biotope and are rare in the explored corridor, but more common are the black locust tree belts along roads.

Black locust biotope is characterized by the presence of some wild mushrooms that are not common in other biotopes.

The fauna of the black locust tree is not specific and is a mixture of thermophile species that inhabit the neighboring sites.

Distribution: Black locust biotope forests in Macedonia are widespread as a result of fast growing characteristics of the species and also of high resistance to unfavorable environment. Many fields were planted to prevent from aeolian and alluvial erosion.

2.1.5.3 Alleys along the roads (*Ulmus* spp., *Ficus carica, Prunus cerasifera, Robinia pseudoacacia*)

Reference from Directive of habitat: No specific reference
Reference Palaeraktic habitat: 84.1 Alley dwellings

Avenues of trees along the roads cannot create a specific plant community or habitat individually. The importance of this vegetation, as well as avenues of trees at the end of

fields, fields and gardens is great because it can serve as corridors for the spread of many species.

Species of trees and shrubs that makes this biotope are from natural and anthropogenic origin. Some species of trees reminds of the natural vegetation (*Ulmus* spp., *Celtis australis*, *Pyrus amygdalyformis*, *Prunus spinosa*, *Crataegus monogyna*, *Rosa canina*, *Rubus* spp.) while some species were cultivated by humans (*Populus* cv *italica*, *Prunus cerasifera*, *Robinia pseudoacacia*, *Ailanthus altissima*), etc. Plant species are represented by elements from neighboring ruderal or agricultural communities. Avenues of trees are discontinuity distributed in of interest (Figure 13).

Figure 13. Unevenly and sparsely distributed trees along main street M-1

3. VALORIZATION OF THE SPECIES IN THE PROJECT LOCATION

Due to the relatively small area that encompasses the municipality of Ilinden and its setting (especially very small area of 4.4 ha project site), it is not distinguished by particular characteristics of the flora and fauna.

The classes of mammals present are: ordinary rabbit, badger, wolf, fox, common mole, hedgehog, turtle and more.

The classes of birds recorded are: hen hawk, hawk, hoodie, magpies, polish partridge, cuckoo, sparrow, swallow, raven, dove, wild dove, stork and others.

The class of reptiles representing different types lizards, fig, gray viper, European viper, colorful salamander, etc.

Due to specific natural conditions and changes the climate of this region, plant species are present in smaller numbers. Main prevailing community on grass pastures and natural vegetation is very little fragments represented by individual trees and shrubs. The natural

forest vegetation can be found as remnants of former forest and byocenosis, as individual trees of oak, polish elm, wild pear, willow, wild rose and others.

On the location for construction the road intersection, during the project studies activities, as an individual and rarely spread plant species sown on figure 14, were observed following plant varieties: granland tor *Paliurus spina-christy* Mill., black acacia *Robina pseudoacacia*, narrow leafed ash *Fraxinus angustifolia*, tree of haven *Alianthus glandulosa,* black elder *Sambucus nigra* and in the channel dominated bulrush *Typha latifolia* and common reed *Phragmites australis.*

Figure 14. Plant biodiversity of the project location for construction of road intersection

The negative impact on this biodiversity had a human factor. Forests were uncontrolled and mercilessly cut for firewood, and also the development of livestock production contributed to the reduction of the forest fund. Lately it is evident the actions of man in the municipality of Ilinden, especially in the afforestation of bare lands and pastures. Afforestation is mainly occur with cypress, black pine, ash, acacia and others species. Although these species are not appropriate for this area, however, they form a well assembled and quality forest belts with a great protection and ecological significance that will contribute for reducing the negative environmental impacts.

One of the most typical examples of the disruption of nature in the municipality of Ilinden is unregulated logging and deforestation in the past as the fire and the herds to cattle. Some unofficial data, sows that forests was decreased by 4-5 times compared to original condition, so that today there are only 50 ha forest or 0.04% of the total area of the municipality of Ilinden (106,7 km^2). Unfortunately, in the Municipality of Ilinden, despite the general impression of a fully anthropogenic environment, forests are reduced to extremely minor fragments of natural populations of oak, beech and other deciduous species (only about 10 ha), artificially isolated plantations of coniferous forests (mainly black pine and cypress are approximately 40 ha) and completely bare hilly areas (over Ajvatovci, Miladinovci etc.) reduced to grassland pastures with visible erosion covering 50-10 ha area.

Despite of clear need for intensive reforestation of large areas in the Municipality, it is pronounced wrong policy of afforestation with no native (incompatible) types of trees (cypress, black pine, with a planted 20,000 units / 10 ha from 2001-2003, and with 5,000 units / 5 ha in 2004) that completely alter the natural characteristics of the region and irreversibly stopped the revitalization of nature wildlife populations of in the region.

More than two thirds of the territory of municipality Ilinden which is located in the flat part of the Skopje valley, previously was intensively cultivated, but now is divided into numerous parcels of varying sizes, among them rarely including are uncut lowland meadows and water and bog vegetation around irrigation/drainage channels (about 30 ha). The overall picture of this part of the municipality is complete anthropogenic on the previous space, transverse with numerous buildings (airport, highway, railway, main road, industrial and residential buildings) and extremely low representation of natural vegetation which is often reduced to isolated individual trees or very small forest populations.

Possible natural centers of biodiversity in the municipality of Ilinden are imposes numerous channels filled with water (such canal a pass through the project location) and their surroundings. However, due to extremely poor condition of canals and poor water quality, flora and fauna is reduced to a few most resistant species. In the water dominated the water macrotrophic and long strings of green and blue-green algae (as a indicators of high eutrophic) and channels are overgrown with common reeds and visible surface growth of blue-green algae and Canadian water plague. In such a case cannot speak of any natural wealth of species. With their cleaning, they would have advocated bio corridors in the anthropogenic environment and the right place for establishment of the natural populations of living organisms.

According to experts elaborate for Protection of Natural Heritage developed by the Spatial Plan of the Republic Macedonia in the Municipality of Ilinden has no recorded natural heritage near at the space where the road intersection construction for connecting the airport with main road M-1 is placed. There is no registered endemic species, natural rarity, endangered or protected species.

3.1 Measures to mitigate the environmental impact

Although a location possesses a low degree of biodiversity however should be still taken as follows:

- Increased frequency of road vehicles can cause a negative impact on amphibians (amphibians);
- There is a possibility of disturbing the flora and fauna during construction (eg. reptiles that will transcend the constructed path, can easily become victims of road traffic);
- The new route may become an obstacle for some small species of fauna present, ie it disrupts their area of distribution.

Most of the measures to mitigate the environmental impact related to the possible impacts, as defined in this study and also in the basic design project study. These measures are

relate to the proper design of access roads in accordance with local conditions. During the construction of road intersection all necessary measures will be fully complied to protect the environment. Construction debris and excess material that is not used in the construction should be transported and disposed of in a particular location / landfill designated by the investor.

In order to avoid pollution of the environment, the following measures should be applied:

- Construction debris should be regularly and promptly transported to the site and to postpone the planned landfills for construction debris.
- Refueling or servicing of vehicles and construction machinery should be made only on the impermeable base;
- To plan special measures to avoid leaks and leaks;
- Washing of vehicles and equipment on site should be limited;
- Appropriate management of chemicals and other liquid and solid hazardous materials (includes: management and storage);
- Wastewater from the residence facilities for workers should get busy and properly treated and not discharged into the channel location;
- Solid waste should be collected and disposed of proper landfill designated by the investor.

Proposed measures to mitigate the environment impact include the following:

- Use appropriate methods of construction and careful planning of construction works to minimize the impact on habitats, flora and fauna;
- Design of natural crossings (eg. temporary channel, Figure 10);
- Careful planning of construction activities on the road node;
- Identify and careful choice of location for construction material storage / disposal of construction waste;
- Clearing the site upon completion of construction activities;
- After building rehabilitation activities should be perform on the location by planting grass, trees and ornamental species or other appropriate measures should be taken.

4. CONCLUSIONS AND RECOMMENDATIONS

According to all the above stated in the study, according to studies made of the current state of the environment, and the proposed solution to build the road intersection for connecting the airport "Alexander the Great" to main road M-1, there are no risks or obstacles for endangering environment in the project locations. It is recognized the emergence of any possible negative impacts of the project and proposed measures for mitigation will be included in the implementation of the Basic project, in order to protect, reduce and mitigate the negative impact on the environment and human health. Implementation and monitoring of the project are in accordance with the legislation of the Republic of Macedonia to protect the environment.

At the project locations there is no recorded natural heritage, or not recorded endemic species, natural rarity, endangered and protected species.

It can be concluded that construction of the road intersection to connect the airport "Alexander the Great" to main road M-1 will not cause negative impact on the environment.

All planned activities listed in the basic design project for the realization of the road intersection to connect the airport "Alexander the Great" to main road M-1 can be realized.

A N N E X I

ИЗВЕШТАЈ ОД ТЕСТИРАЊЕ

	Резултат	MaxDK
ПРЕГЛЕД НА ПОВРШИНСКИ ВОДИ (МИКРОБИОЛ.)		
Микробиолошка анализа		
Најверојатен бр.колиформни бакт.во 1/ (br.bakt./l)	30.000	200000.000
Колиформни бакт.од фекално потекло 1/ (br.bakt./l)	20.000	100000.000
Вк.бр.на аеробни мезофилни бакт.во 1/ (br.bakt./l)	30.000	200000.000
Стрептококи од фекално потекло во 1/l (br.bakt./l)	30.000	100000.000

Според испитуваните параметри, примерокот ОДГОВАРА НА:
Уредба за класификација на водите и Уредба за категоризација на водотеците,езерата,акумулациите и подземните води Сл.весник на СРМ бр.9/1984 и Сл.весник на РМ бр.18/1999год.

Служба по микробиологија

Прин.Д-р.Сашка Ловески
Спец. микробиолог

ПРЕГЛЕД НА ПОВРШИНСКИ ВОДИ(ФИЗИЧКО-ХЕМ.)			
Физички показатели			
Матност	(mg/l силик.зем.)		0.800
Физичко-хемиски показатели			
pH			6.780
Потрошувачка на KMnO4		(mg/l)	6.800
Електролитска спроводливост при 293.	(microScm -1)		237.000
Хемиски показатели			
Амонијак како азот		(mg/l)	н.д.
Нитрити како азот		(mg/l)	н.д.
Нитрати како азот		(mg/l)	3.700
Хлориди		(mg/l)	25.000
Железо		(mg/l)	н.д.
Манган		(mg/l)	н.д.
Флуориди		(mg/l)	0.100
Хром вестеалентен		(mg/l)	н.д.

Според испитуваните параметри, примерокот ОДГОВАРА НА:
Уредба за класификација на водите и Уредба за категоризација на водотеците,езерата,акумулациите и подземните води Сл.весник на СРМ бр.9/1984 и Сл.весник на РМ бр.18/1999год.

Снежана [illegible]
Дипл.[illegible] техничар

СТРУЧНО МИСЛЕЊЕ:
Врз основа на лабораториските наоди согласно Уредбата за класификација на водите, анализираниот примерок на вода според микробиолошките показатели одговара на I класа, а според физичко-хемиските показатели одговара на I класа. Во природна состојба може да се употребува за наводнување.

Раководител на одд. за хиги

Д-р Нај[illegible]
Спец. [illegible]

НАПОМЕНА: Резултатот и стручното мислење се однесуваат само на испитаниот примерок.

Figure 1. Report from the water analysis of health security of surface water

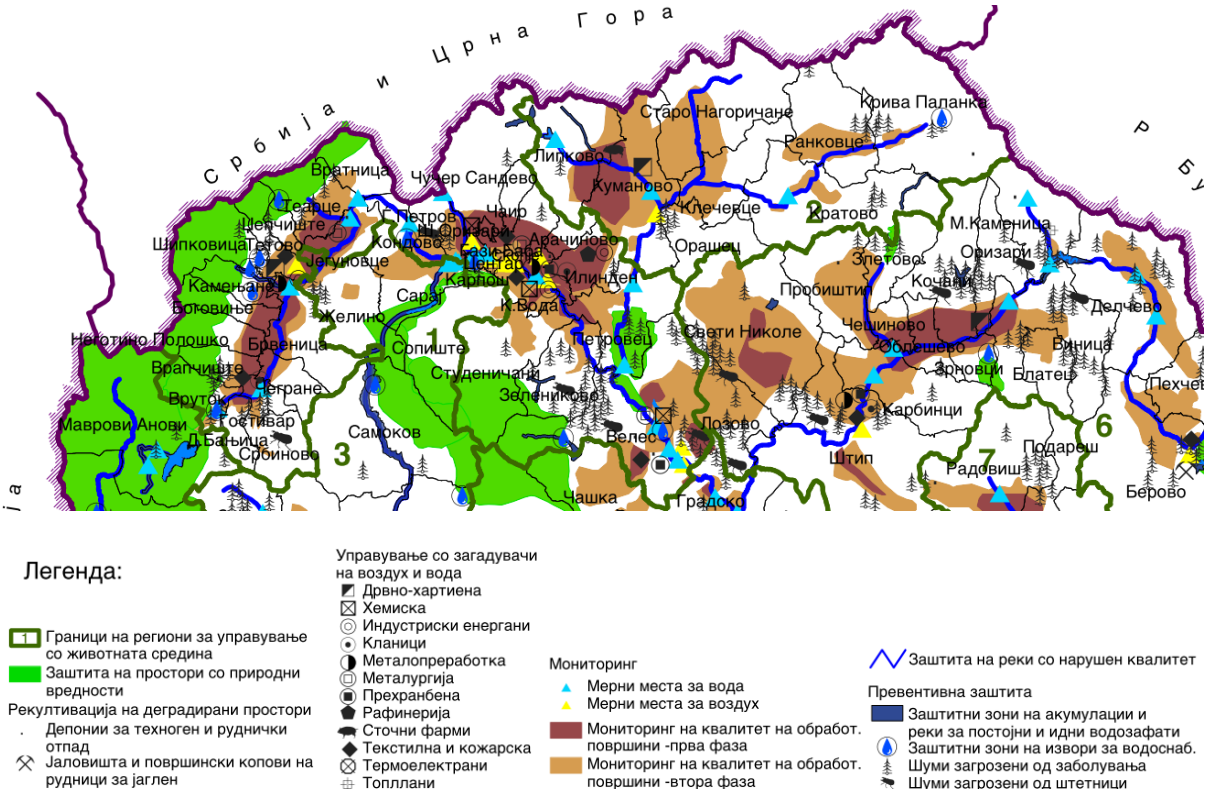


Figure 3. Excerpt from the Spatial Plan of Republic of Macedonia, the draft Plan 2002-2020, Environmental Protection, Ministry of Environment and Physical Planning and Public Enterprise for Spatial and urban development plans, catalog 2002

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