BIODIVERSITY ASSESSMENT OF AMPHIBIANS AND REPTILES

FOR THE NEW ALIGNMENT OF THE MATESEVO-ANDRIJEVICA SECTION

SUB-SECTION: TRESNJEVIK TUNNEL – ANDRIJEVICA

October-November 2024

Leading expert:

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I INTRODUCTION

The EBRD Bank has engaged PASECO S.P. Ltd Greece (hereinafter referred to as the "Leading Consultant") to provide consultancy services and implement the project "Montenegro: Construction of the Bar-Boljare Highway – Environmental and Social Assessment" (hereinafter referred to as the "Project"), in accordance with EBRD Performance Requirements. As part of the Project, a biodiversity assessment was conducted in 2019–2021 for the Matesevo-Andrijevica section. Biodiversity assessment for the purposes of the Project covered the following aspects:

- Habitats and flora
- Bats and other mammals
- Ichthyofauna and benthic fauna
- Amphibians and reptiles
- Ornithofauna

Due to recent changes in the preliminary design for an approximately 12 km stretch of the route, from the entrance of the Tresnjevik tunnel to Andrijevica, it became necessary to conduct a complementary biodiversity assessment for this new alignment, Tresnjevik-Andrijevica (hereinafter referred to as the "Sub-Project"). To carry out the Sub-Project, the Leading consultant engaged E3 Consulting Ltd. Montenegro (hereinafter referred to as the "Local consultant") to recruit a local team of biologists and provide key findings. The Sub-Project was conducted by a multidisciplinary team of national experts during October–November 2024, including both fieldwork and reporting in accordance with the methodology provided by the Leading consultant. The Sub-Project covered following biodiversity aspects:

- Flora and Habitats
- Bats
- Mammals
- Ornithofauna
- Icthyiofauna and benthic fauna
- Terrestrial invertebrates
- Aquatic invertebrates
- Amphibians and reptiles

The Sub-Project involved the following tasks:

1. Rapid review of the surveys conducted in the framework of conceptual/preliminary design (for the old alignment) for the Sub-Section (done in 2019-2021). These surveys covered:
   a. Habitats and flora
   b. Bats and other mammals
   c. Ichtyiofauna and bentic fauna
   d. Amphibians and reptiles
   e. Ornithofauna

Local consultant will assess the zones that were researched during the surveys 2019-2021 (e.g. flora and vegetation (habitats) surveys included 500m to the left and right of the planned Project) with the new alignment. The aim is to express the expert opinion on the degree on which the previous surveys cover the new alignment and determine the extent of the new campaign.

2. For the biodiversity features (among (a) to (e) above), for which it is estimated that tne new alignment is not covered by the previous surveys, Local consultant will conduct an additional survey, as follows:
   i. The survey will be conducted until the end of October 2024
   ii. Five on-site days are foreseen
   iii. The survey will follow the same methodology as the 2019-2021 research

3. Drafting of report with the findings. The report will have the main structure as per previous surveys and will be detailed enough to comply with EBRD ESP requirements. The report will include:
   i. Bibliographical data on biodiversity in the zone of the new alignment
   ii. Period of surveys and Methodology used
   iii. Findings of surveys
   iv. Assessment of protection status of habitats/species according to EU legislation, international agreements and national legislation
   v. Significant impact of the highway construction on habitats and species and proposal of relevant mitigation measures
   vi. Maps and photographical documentation

The Sub-Project resulted in the submission of eight separate reports, accompanied by supporting maps and photographic documentation, detailing key biodiversity aspects related to the Sub-Project, with a focus on autumnal research findings.

II RAPID REVIEW OF SURVEYS CONDUCTED 2019-2021

Field surveys of amphibians and reptiles in the impact zone of the old alignment of the Trešnjevik-Andrijevica road section of the Bar-Boljare highway were conducted in summer/early autumn (September 2019) and spring/early summer (May-June 2020).

Surveys along the old alignment from Trešnjevik to Andrijevica took place at five survey points, where five species of amphibians and seven species of reptiles were recorded (Table 1, Figs. 1–3).

Table 1. Surveyed points during the 2019/2020 seasons and recorded species

No.	Location description	Alt	Coordinates	Amphibians recorded	Reptiles recorded
1.	Novovića Stream (Gnjili Stream)	1,000 m	42.745150°, 19.715817°	*S. salamandra* *B. variegata* *B. bufo*	*P. muralis* *N. natrix*
2.	Dubokalj Stream	944 m	42.744833°, 19.737433°	*S. salamandra* *R. graeca*	*L. viridis* *P. muralis* *Z. longissimus* *V. ammodytes*
3.	Kraštica River (Lim ASCI 1st point)	770 m	42.735350°, 19.773917°	*S. salamandra* *R. graeca*	*P. muralis* *N. natrix* *N. tessellata*
4.	Confluence of the Prisojački Stream and Kraštica River in Most Bandovica (Lim ASCI 2nd point)	757 m	42.739901°, 42.739901°	*R. graeca*	*A. fragilis*
5.	Lim River (Lim ASCI 3rd point)	730 m	42.755116°, 19.801226°	*B. variegata* *B. bufo* *P. ridibundus*	*L. viridis* *P. muralis* *N. tessellata*

Note: Records that also correspond to the new alignment are marked in light green.

A comparison of the new and old alignments revealed that the new alignment diverges significantly from the old one in certain sections (where the new alignment's 500 m influence zone extends beyond the influence zone of the previous route, Figs. 1–3).

An examination of the records from previous surveys for the Trešnjevik-Andrijevica section (Ljubisavljević, 2020) showed that records from three survey points—Novovića (Gnjili) Potok Stream, Kraštica River (Lim ASCI 1st point), and Lim River (Lim ASCI 3rd point)—also correspond to the new alignment (Table 1, marked in yellow, Figs. 1–3).

As a result, additional survey points were selected for sections of the new alignment that lack sufficient data on amphibians and reptiles (new points 2 and 4 in Table 3 and Figs. 1–8) or have no data available within the project's impact zone (new points 1, 3, and 5 in Table 3, and Figs. 1–8).

III BIBLIOGRAPHICAL DATA ON BIODIVERSITY IN THE ZONE OF THE NEW ALIGNMENT

Literature records for the zone of the new alignment are quite scarce (AZŽS, 2015; Ljubisavljević et al., 2018). According to the available literature and data presented in the final report for the previous alignment of the highway section from the mountain pass at Trešnjevik to Andrijevica (Ljubisavljević, 2020), several species of amphibians and reptiles are expected to inhabit the zone of the new alignment (Table 2).

Table 2. Species expected to occur in the project impact zone of the new alignment based on literature and previous report (Ljubisavljević, 2020).

Amphibians	Reptiles
Salamandra salamandra	*Lacerta agilis*
Bombina variegata	*Lacerta viridis*
Bufo bufo	*Podarcis muralis*
Pelophylax ridibundus	*Anguis fragilis*
Rana graeca	*Zamenis longissimus*
	Natrix natrix
	Natrix tessellata
	Vipera ammodytes

IV SURVEY PERIOD AND METHODOLOGY

Field surveys for amphibians and reptiles within the impact zone of the new alignment of the highway section from Trešnjevik to Andrijevica were conducted over five days in the latter part of October 2024. Weather conditions were sunny but cool, with a daily temperature range averaging from 9°C to 18°C, calm winds, and no rain. Fresh morning temperatures limited animal activity to midday hours.

Survey points were selected in areas where the new alignment significantly diverges from the previous alignment, particularly where it crosses or is in the zone of influence on sensitive freshwater and riverine wetland habitats, such as streams and rivers, as well as other habitats where amphibians and reptiles were expected to be present. These included natural and semi-natural habitats like road banks, meadows, and forest edges (Table 3, Figs. 1–11).

Table 3. Selected locations for surveys of amphibians and reptiles

Nos. in Figures	Location description	Altitude	Coordinates
1	Trešnjevik	1,115 m	42.747266°, 19.703589°
2.	Dubokalj Stream	944 m	42.742504°, 19.737018°
3.	Kralje (confluence of Mala rijeka Stream and Kraštica River)	820 m	42.733445°, 19.750990°
4.	Most Bandovića (Kraštica River)	750 m	42.740430°, 19.785474°
5.	Lim River	740 m	42.744730°, 19.789621°

Where accessible, a 500-meter-wide belt on both sides of the proposed highway route was surveyed using walked transects. Animals were recorded through visual inspection and netting, following standard methods for assessing amphibian and reptile diversity (e.g., Gent and Gibson, 1998; Hill et al., 2005; Manley et al., 2006). After data collection, captured individuals were promptly released at the capture site, and the coordinates of each record were logged using a mobile device.

The impact assessment for the construction and operational phases of the highway was conducted according to Hardner et al. (2015), as recommended in EBRD PR 6 (2023) for biodiversity conservation and natural resource management (Tables 4 and 5). Priority biodiversity features (PBF) and critical habitat (CH) triggers were determined based on the criteria specified in the same document.

Limitations of field surveys

Mid-autumn is not an optimal time for field surveys of amphibians and reptiles in the mountainous regions of Montenegro. Temperatures are cool, the reproductive period has ended, and these groups of animals are nearing hibernation, which likely contributed to reduced species detection.

Table 4. Definitions of impact consequences based on the IUCN conservation status assessment methodology (Hardner et al., 2015)

Impact Consequence	Description
Minor	There is no net loss in the value of biodiversity, regardless of conservation status
Moderate	Loss in value of species with LC, NT and VU status
Serious	Loss of value of species with EN status, or the value status changes to EN due to the impact of the project
Extreme	Loss in value of species with CR status, or the value status changes to CR due to the impact of the project
Catastrophic	The value status changes to EV due to project impact

Table 5. Risk matrix for assessment of impact on biodiversity. The risk assessment is a function of the consequence of the impact and the probability of its occurrence (Hardner et al., 2015)

Probability	Consequence				
	Minor impact	Moderate impact	Serious impact	Extreme impact	Catastrophic impact
Almost certain (expected to happen according to the project plan)	M	H	C	C	C
Probable (likely to happen according to the project plan)	M	H	H	C	C
Possible (may occur under certain circumstances)	L	M	H	C	C
Unlikely (may occur at some point)	L	L	M	H	C
Rare (only in exceptional cases)	L	L	M	H	H

Note: Risk level: L – low; M - moderate, H - high, C - critical

V KEY RESEARCH FINDINGS

Three **(3)** amphibian species and two **(2)** reptile species were recorded during the autumn field surveys at four survey points within the 500-meter impact zone of the project (Table 6, Figs. 12–16). No species were recorded at the first survey point (Trešnjevik) during this occasion.

All species had previously been confirmed to inhabit the zone of influence of the initially proposed highway alignment during the 2019/2020 season. The recorded species have a broad distribution in Montenegro or predominantly occur in the mountain-valley region. According to both previous and current findings, these species are common within the Project's impact zone. Streams, rivers, their slow-flowing sections, and floodplains within the Project's impact zone serve as corridors and as permanent or breeding habitats for the detected amphibians. With the exception of the Greek stream frog (*Rana graeca*), which rarely occupies man-made or altered habitats, the other detected species sometimes or frequently inhabit areas under anthropogenic influence (Table 7).

Sensitive Areas for Batracho and Herpetofauna

The new alignment passes through the Area of Special Conservation Interest (ASCI) "Lim River." The riparian areas of the Lim River, along with other streams and small rivers within the Project's impact zone, are particularly sensitive to impacts on water quality, caused by pollution, disturbance of riverbeds, sedimentation, and turbidity. To avoid significant damage to the ecological value of these areas and their batracho- and herpetofauna, impacts related to highway construction and operation can be minimized by defining protection and mitigation measures during construction and post-construction phase.

VI ASSESSMENT OF PROTECTION STATUS OF SPECIES

Except for the Greek stream frog (*Rana graeca*), which is an endemic species of the Balkans, all recorded species have wide distributions across Europe or Eurasia. With the exception of the nose-horned viper (*Vipera ammodytes*), all are protected in Montenegro. None of the detected species are listed under Bern Convention Resolution 6. Additionally, except for the Common fire salamander (*Salamandra salamandra*, IUCN: VU), the species are not considered threatened (IUCN: LC, MNE: LC). Detected reptiles and *R. graeca* are listed under Annex IV of the Habitat Directive (Table 8).

Table 6. The list of exact locations and number of specimens observed

Group	Species name (latin and english)	Selected location No.	Location name	Number of specimens	Coordinates
Amphibians	*Salamandra salamandra* (Common fire salamander)	3	Kralje (confluence of Mala rijeka Stream and Kraštica River)	1	42.732010°, 19.749309°
Amphibians	*Bufo bufo* (Common toad)	3	Kralje (confluence of Mala rijeka Stream and Kraštica river)	1	42.733897°, 19.752185°
Amphibians	*Rana graeca* (Greek stream frog)	3 4	Kralje (confluence of Mala Rijeka stream and Kraštica river) Most Bandovića (Kraštica River)	1 2	42.730911°, 19.748728° 42.740542°, 19.786019°
Reptiles	*Podarcis muralis* (Common wall lizard)	3 4 4 5 5 5	Kralje (confluence of Mala stream and Kraštica River) Most Bandovića (Kraštica River) Most Bandovića (Kraštica River) Lim River Lim River Lim River	1 2 2 1 2 3	42.733743°, 19.751516° 42.741749°, 19.790716° 42.742080°, 19.792352° 42.744960°, 19.790607° 42.745039°, 19.791137° 42.745057°, 19.791337°
Reptiles	*Vipera ammodytes* (Nose-horned viper)	2	Dubokalj Stream	1	42.743758°, 19.737657°

Table 7. Characteristics of habitats and populations of the recorded species

Species	Distribution in ME	Habitat under the Project impact zone- importance in ME	Abundance/ Commonness in the Project impact zone	Relation to man-made, altered or habitats under anthropogenic impact	Corridors/breeding habitats in the Project impact zone	Activity (depending on altitude)
Salamandra salamandra	Mountain-valley region	No special importance with regard to other ones	Common	sometimes occupies	Corridor and breeding hab.	Apr-Oct
Bufo bufo	Wide	No special importance with regard to other ones	Common	often occupies	Corridor and breeding hab.	March-Nov
Rana graeca	Predominantly in Mountain-valley region	No special importance with regard to other ones	Abundant/ Common	rarely occupies	Corridor and breeding hab.	March-Oct
Podarcis muralis	Wide	No special importance with regard to other ones	Abundant/ Common	very adaptable	One of the many corridors in ME	March-Nov
Vipera ammodytes	Wide	No special importance with regard to other ones	Common	often occupies	One of the many corridors in ME	March-Oct

Table 8. The list of confirmed species with their conservation statuses and levels of threats in Europe

Group	Species name (latin)	Species name (in English)	Endemicity	List of protected species in Montenegro	Red list (IUCN)	Red list (MNE)	EU Habitat directive annex	Bern convention Resolution 6	Bern convention appendix
Amphibians	*Salamandra salamandra*	Common fire salamander	-	+	VU	LC	/	/	III
Amphibians	*Bufo bufo*	Common toad	-	+	LC	LC	/	/	III
Amphibians	*Rana graeca*	Greek stream frog	endemic species of the Balkans	+	LC	LC	IV	/	III
Reptiles	*Podarcis muralis*	Common wall lizard	-	+	LC	LC	IV	/	II
Reptiles	*Vipera ammodytes*	Nose-horned viper	**-**	-	LC	LC	IV	/	II

VIII IMPACTS OF THE HIGHWAY CONSTRUCTION ON HABITATS AND SPECIES AND MITIGATION MEASURES

8.1 Impacts and mitigation measures during construction phase

Habitat Fragmentation, Degradation, and Loss

Excessive vegetation removal for road construction, elimination of natural land characteristics within paved areas and adjacent roadsides, and soil compaction due to machinery operation may fragment, degrade, and destroy habitats. This impact is expected to have *moderate* consequences on detected species, with an almost certain likelihood of occurrence, resulting in high risk prior to mitigation. After implementing appropriate measures, the risk is expected to decrease to moderate and be of short-term duration.

Mitigation Measures:

- Limit the clearing of natural vegetation strictly to the necessary extent.
- Restrict heavy machinery movement to essential areas, using existing clearings to avoid additional habitat fragmentation and degradation. Pay special attention to areas where the new route passes over or near streams and rivers (e.g., Dubokalj and Mala Rijeka streams, Kraštica and Lim rivers, survey points 2-5).
- Preserve topsoil removed during construction and redistribute it over disturbed areas as soon as possible after disturbance to expedite natural re-vegetation. This will minimize erosion and restore lands to a usable condition for amphibians and reptiles.

Changes in Water Conditions

Disposal of removed soil and waste along river and stream banks, direct disposal into aquatic habitats, in-river works, and dust emissions during construction may directly and indirectly impact aquatic/semi-aquatic reptiles (e.g., *Natrix tessellata* and *Natrix natrix*), amphibians, and their aquatic prey. Since much of the new alignment runs close to or crosses streams and rivers, this impact is expected to have a probable likelihood of occurrence, with moderate consequences leading to high risk before implementing mitigation measures. After appropriate mitigation, the risk is expected to be *low and short-term*.

Mitigation Measures:

- Implement and strictly apply pollution prevention measures, such as using silt fences, retaining vegetation cover along river/stream banks, restoring vegetation, minimizing dust emissions by reducing vehicle speed, and watering roads. Prevent disposal of removed soil and construction waste on riverbank slopes. Protect the riverbed and execute activities around watercourses in the shortest possible timeframe.

Habitat Pollution

Emissions of dust, waste, and pollutants from construction vehicles, as well as waste from work camps, may impact both terrestrial and aquatic habitats. Special attention should be paid to aquatic habitats, as much of the new alignment runs close to or crosses streams and rivers. This is expected to be a *moderate* consequence impact with a possible likelihood of occurrence, leading to a moderate risk before mitigation. After mitigation, the impact risk is expected to be *low*.

Mitigation Measures:

- Prevent accidental pollution of aquatic habitats and riparian areas by prohibiting vehicle servicing and refueling near these habitats.

Ban the disposal of waste materials and construction consumables in riparian areas during the construction of crossings, and set chemical and oil storage areas at a safe distance from watercourses. Install drainage systems to divert runoff into drains, soak-aways, and detention basins to avoid contamination of watercourses.

- Minimize dust by reducing vehicle speed and watering roads.
- Locate construction camps away from riparian areas. Dispose of all waste at designated locations and manage it properly.

Direct Mortality

Direct mortality may occur due to collisions with construction vehicles during habitat clearance, deliberate killing by workers (e.g., snakes), or accidental trapping in pits and excavations. It is expected that animals will avoid the project area due to human presence, noise, and vibrations from machinery. This impact is expected to have *moderate* consequences, with a probable likelihood of occurrence, resulting in high risk prior to mitigation. After mitigation, the risk is expected to be *low* and of short-term duration.

Mitigation Measures:

- Restrict heavy machinery and vehicle movement to designated haul routes.
- Impose speed limits on vehicles.
- Begin work after vegetation removal to reduce the likelihood of animal presence. If possible, remove vegetation gradually to encourage animals to relocate naturally.
- Fill in pits and excavations as soon as possible after work is completed. For longer-term pits, equip them with escape ramps or crossing points, and rescue trapped animals with a qualified specialist's assistance. If pits fill with water, they may attract amphibians; a specialist should inspect and relocate any captured animals before filling.

- Inform workers that intentional killing of animals is prohibited.
- Provide health and safety guidelines regarding venomous snakes (*V. ammodytes*) detected within the project area.
- If animals are found near or within ground holes during work (e.g., snake hibernacula), stop work and consult a specialist to ensure animals are unharmed.

Visual, Noise, and Vibration Disturbance

Construction work and machinery movement may disturb and displace individuals due to noise, vibration, and visual disturbances. The impact is expected to have moderate consequences, with an almost certain likelihood of occurrence, leading to high risk before mitigation. After mitigation, the risk is expected to be moderate to low and of short-term duration.

Mitigation Measures:

- Reduce noise and vibration impacts by scheduling intensive construction activities, if possible, outside the winter hibernation and spring breeding periods.
- Direct construction and camp lighting downward to avoid illuminating nearby habitats and disturbing animals. Keep aquatic habitats shaded, if possible.
- Minimize noise during construction by maintaining vehicles according to the manufacturer's specifications, using enclosures for noisy equipment, and reducing the height from which materials are dropped during loading or unloading.

8.2 Impacts and mitigation measures during operational phase

Habitat Degradation and Fragmentation

The construction of the Trešnjevik tunnel, along with multiple bridges and crossings, will reduce the overall width of the area affected by permanent habitat loss and fragmentation of movement corridors. Furthermore, many detected terrestrial species are known to occupy man-made or anthropogenically impacted habitats (Table 7). Autumn field surveys in the zone of the new alignment have not identified any specific locations where animal passages would be necessary.

This impact is expected to have moderate consequences, with a possible likelihood of occurrence at some open-ground road sections for certain terrestrial species, resulting in a moderate risk before mitigation. The post-mitigation significance of risks related to habitat degradation and fragmentation is expected to be low.

Mitigation Measures:

- Monitor the frequency of road kills one year after project completion and, if necessary, implement additional mitigation measures.
- Preserve roadside vegetation to maintain habitat connectivity and reduce fragmentation.

Habitat Pollution

Operational roads will generate pollution from runoff and accidental spillage of chemicals such as gasoline, oil, and various toxic compounds, which may affect habitats similarly to construction-related pollution.

This impact is expected to have moderate consequences for detected species, with a possible likelihood of occurrence, resulting in a moderate risk before mitigation. The post-mitigation significance of this risk is expected to be low.

Mitigation Measures

- Prohibit the direct discharge of untreated runoff into watercourses. Install drainage systems that divert runoff into drains, soakaways, and detention basins to prevent contamination of watercourses. Detention basins and drainage systems should be fenced or grated to prevent animals from being trapped.
- Regularly inspect and maintain drainage structures to ensure their permeability.
- Implement roadside waste collection and regular road clean-up to reduce contamination risks.

Direct Mortality

Direct mortality may occur due to collisions between amphibians and reptiles and vehicles when they cross the road for habitat, food, reproduction, or thermoregulation. The construction of the Trešnjevik tunnel, along with several bridges and crossings, will reduce the impact on animal corridors. However, autumn 2024 field surveys within the new alignment zone have not identified specific locations requiring animal passages.

This impact is expected to have moderate consequences, with a possible likelihood of occurrence at some open-ground road sections for certain terrestrial species, leading to a moderate risk before mitigation. With appropriate mitigation, the risk is expected to be low.

Mitigation Measures

- If sections of the route require fencing for safety (e.g., to prevent landslides or large animal mortality), ensure that the fence is gap-free and permanent. The fence should have small mesh holes or additional materials such as hardware cloth at the base to prevent reptiles from passing through and reduce the risk of small snakes getting stuck.

An overhang lip should extend away from the road to deter climbing, and the fence should be secured with posts at regular intervals to prevent collapse. Fencing should direct animals towards safe crossing points, such as above tunnels or under bridges.

- Monitor roadkill frequency one year after project completion, and if necessary, implement additional mitigation measures.

Noise, Light, and Vibration Disturbance

Most species detected during field surveys were found close to the main Mateševo-Andrijevica road or local roads and are likely already habituated to noise. They may also acclimate to the noise and vibration associated with highway traffic over time. However, artificial lighting on the road attracts insects, which could increase collision risks for their predators, including nocturnal amphibians (e.g., toads). Additionally, artificial lighting may disrupt foraging and reproductive behavior.

This impact is expected to have moderate consequences for detected species, with a possible likelihood of occurrence, leading to a moderate risk before mitigation. The post-mitigation significance of this risk is expected to be low.

Mitigation Measures

- Avoid installing lighting near sensitive areas for amphibians and reptiles unless required for human or road safety. Where lighting is necessary adjacent to these sites, use designs or shades to direct light downward and away from natural areas.

Critical Habitat (CH) / Priority Biodiversity Features (PBF) Triggers

According to the criteria provided in EBRD PR 6 (2023), four species detected during the autumn 2024 field surveys are considered triggers for Critical Habitat (CH) and/or Priority Biodiversity Features (PBF). These species include:

- *Rana graeca*, *Podarcis muralis*, and *Vipera ammodytes* as CH triggers (HD IV).
- *Salamandra salamandra* as a PBF trigger (IUCN: VU).
- *Rana graeca*, an endemic species of the Balkans, also as a PBF trigger (Table 9).

Table 9. Impacts and mitigation measures for PBF and CH trigger species, with comments on their conservation statuses

Latin name	PBF/CH	Impacts		Mitigation measures	Comment
		Construction phase	Operation phase		
Salamandra salamandra	PBF	All outlined above	All outlined above	General measures outlined above should be strictly followed	Based on field data for the new and old alignment, *S. salamandra* suitable reproductive habitats (many streams and brooks) as s well as terrestrial habitats in deciduous woods are widely present within the project's impact zone. The anticipated loss of terrestrial habitat within the project footprint is not expected to significantly impact the species' long-term survival or its conservation status. However all mitigation measures should be implemented.
Rana graeca	PBF/CH	Changes in water conditions and pollution	Habitat pollution; Noise, light and vibration disturbance	General measures outlined above for both phases should be strictly followed especially pollution prevention and limitation of machinery to the Project RoW at points close to watercourses during construction phase	Based on field data for the new and old alignment, *R. graeca* is more widely present in streams and rivers within the project's impact zone. This area does not support a globally significant percentage of the population. Habitat loss for this species is not expected if the mitigation measures listed above are implemented.
Podarcis muralis	CH	Habitat fragmentation, degradation pollution and loss; direct mortality; Visual and vibration disturbance	Habitat fragmentation, degradation and pollution; direct mortality	General measures outlined above for both phases	Based on field data for the new and old alignment it is abundant species and has widely represented habitats in the project's impact zone. The species is highly adaptable to anthropogenically altered habitats, and the project is not expected to impact the species' long-term survival or conservation status.
Vipera ammodytes	CH	Habitat fragmentation, degradation pollution and loss; direct mortality; Visual and vibration disturbance	Habitat fragmentation, degradation and pollution; direct mortality;	General measures outlined above for both phases	Based on field data for the new and old alignment it is expected to be common species in the project's impact zone. The species is often find in habitats under anthropogenic influence , and the project is not expected to impact the species' long-term survival or conservation status. However, the mitigation measures outlined above must be implemented.

IX MAPS AND PHOTOGRAPHICAL DOCUMENTATION

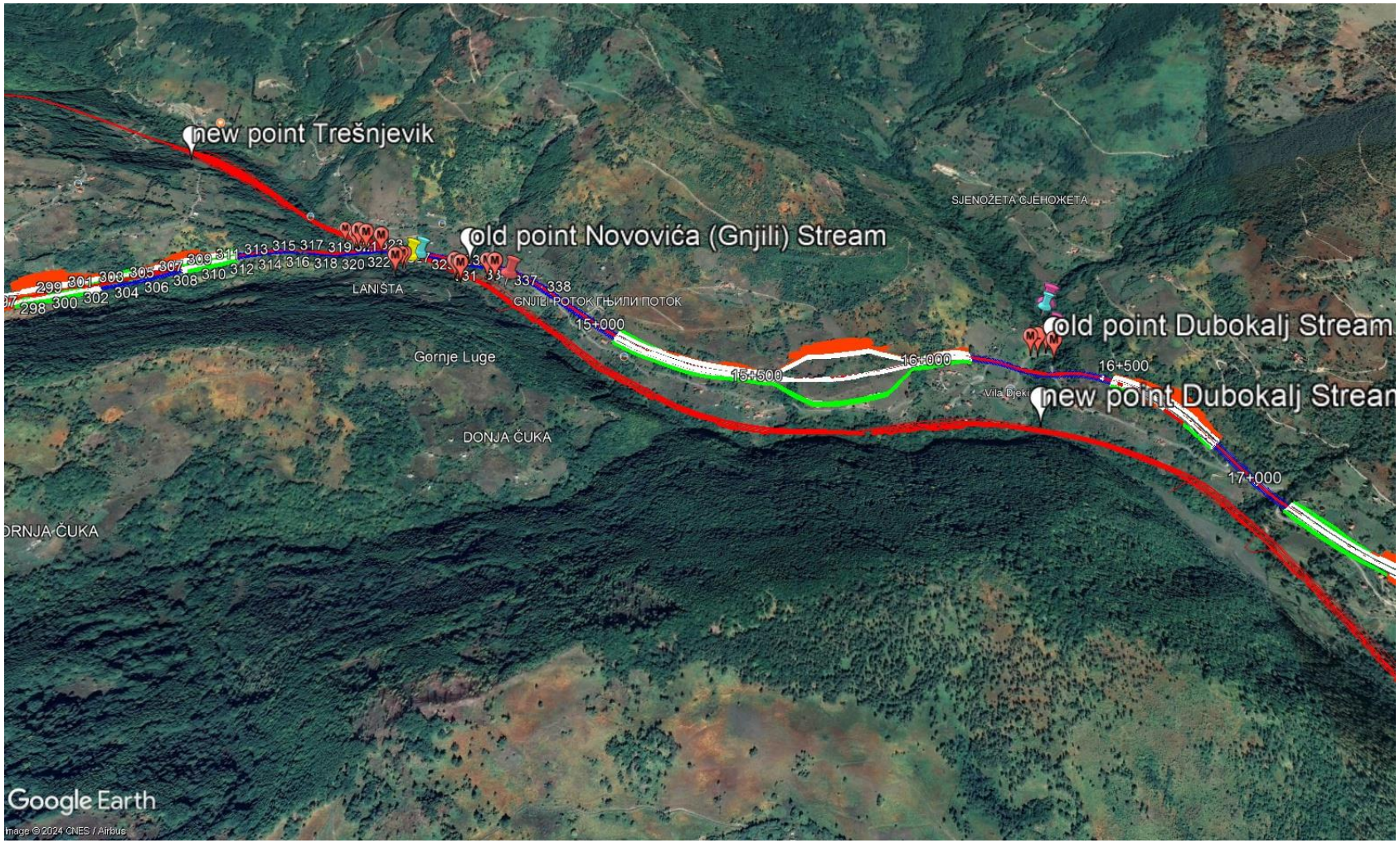

Figure 1. Comparison of the new (red) and old alignments, showing the locations of old and new survey points and records of amphibians and reptiles collected in 2019/2020. Species detected at specific survey points are listed in Table 1.

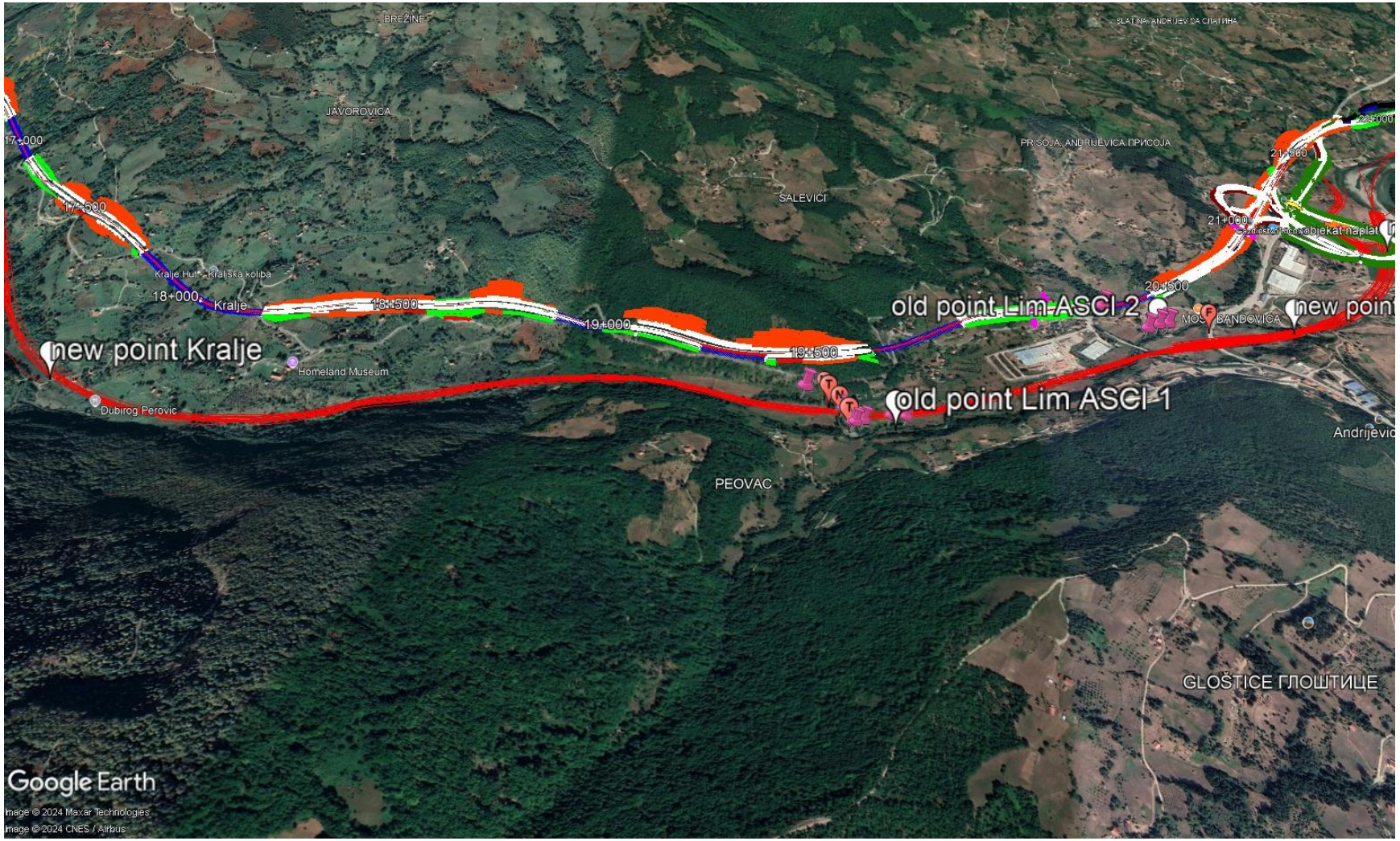

Figure 2. Comparison of the new (red) and old alignments, showing the locations of old and new survey points and records of amphibians and reptiles collected in 2019/2020. Species detected at specific survey points are listed in Table 1.

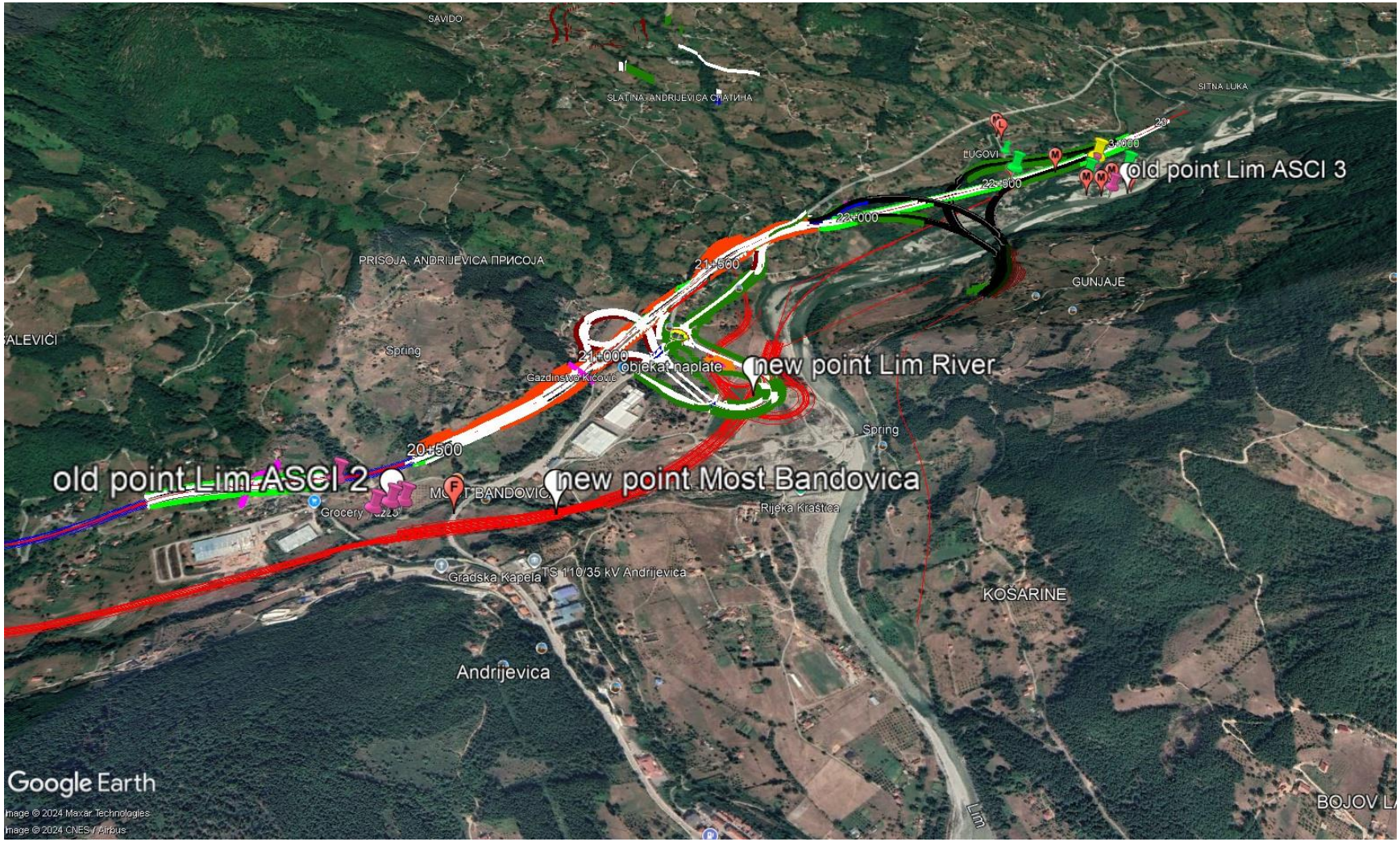

Figure 3. Comparison of the new (in red) and old alignments, showing the locations of old and new survey points and records of amphibians and reptiles collected in 2019/2020. Species detected at specific survey points are listed in Table 1.

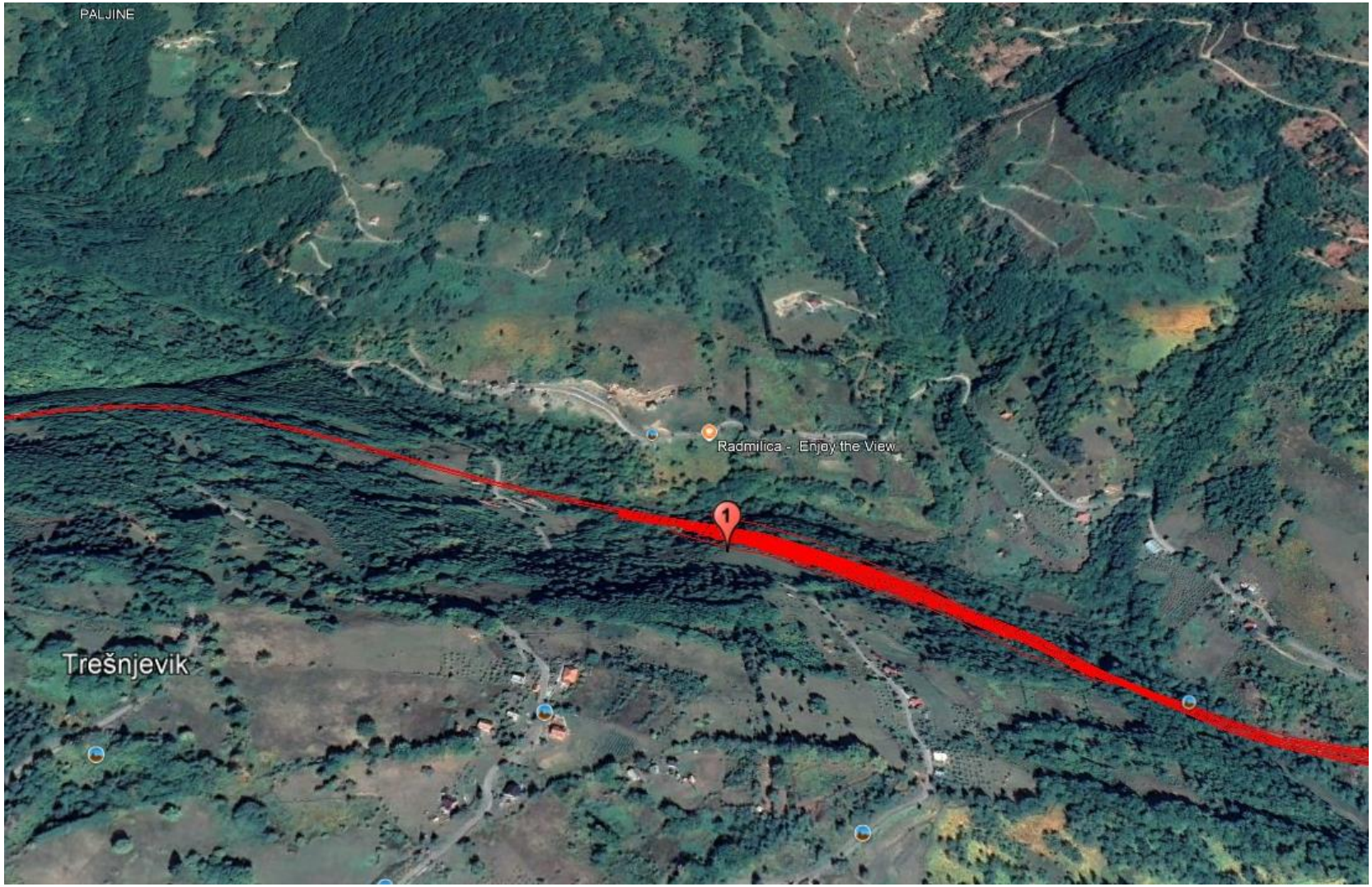

Figure 4. Position of the first surveyed site (1) Trešnjevik

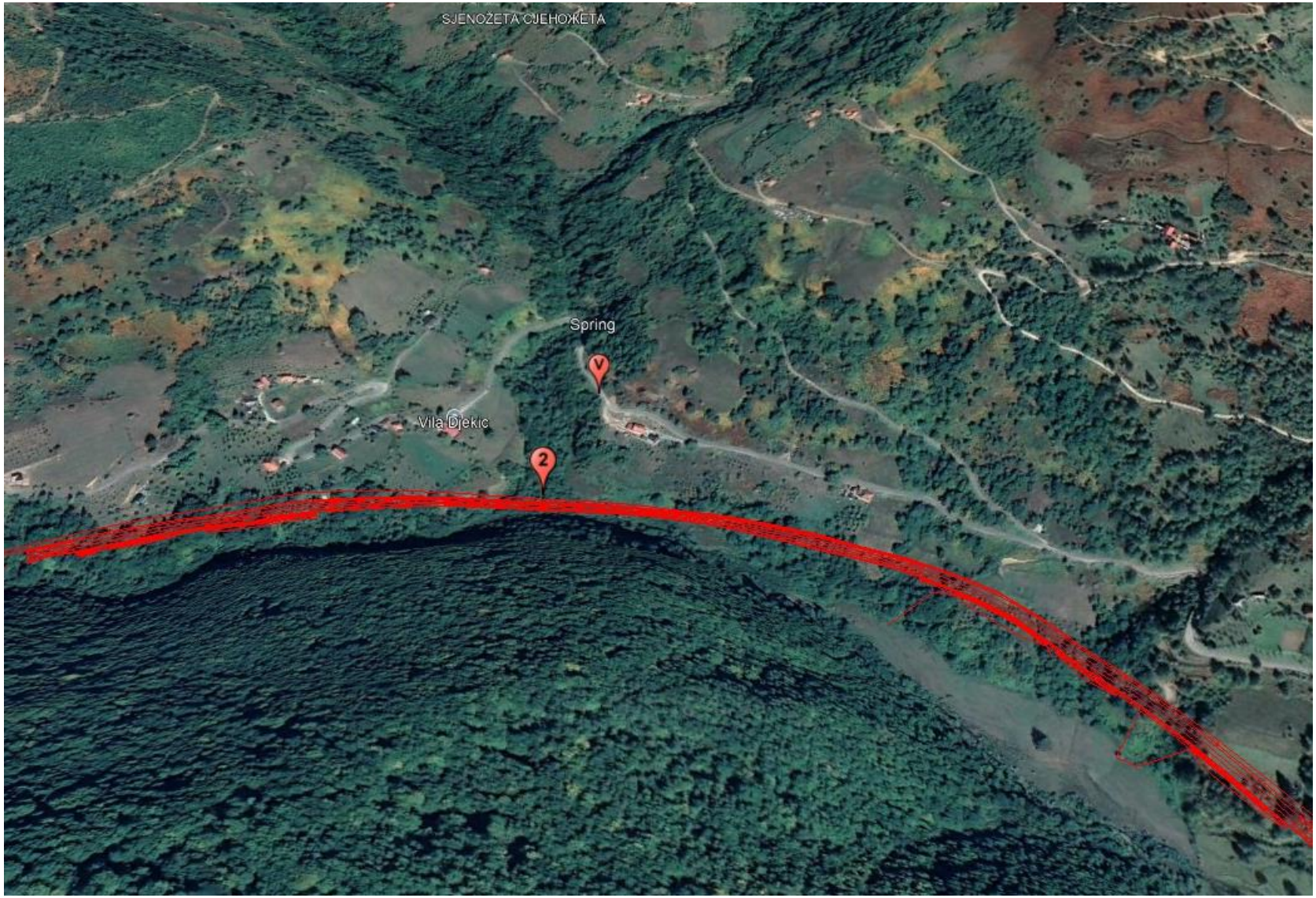

Figure 5. Mapped locations of species recorded at the second surveyed site (2) Dubokalj Stream: (V) *V. ammodytes*

Figure 6. Mapped locations of species recorded at the third surveyed site (3) Kralje: (G) *R. graeca,* (S) *S. salamandra,* (M) *P. muralis*, (B) *B. bufo*.

Figure 7. Mapped locations of species recorded at the fourth surveyed site (4) Most Bandovića: (G) *R. graeca,* (M) *P. muralis*

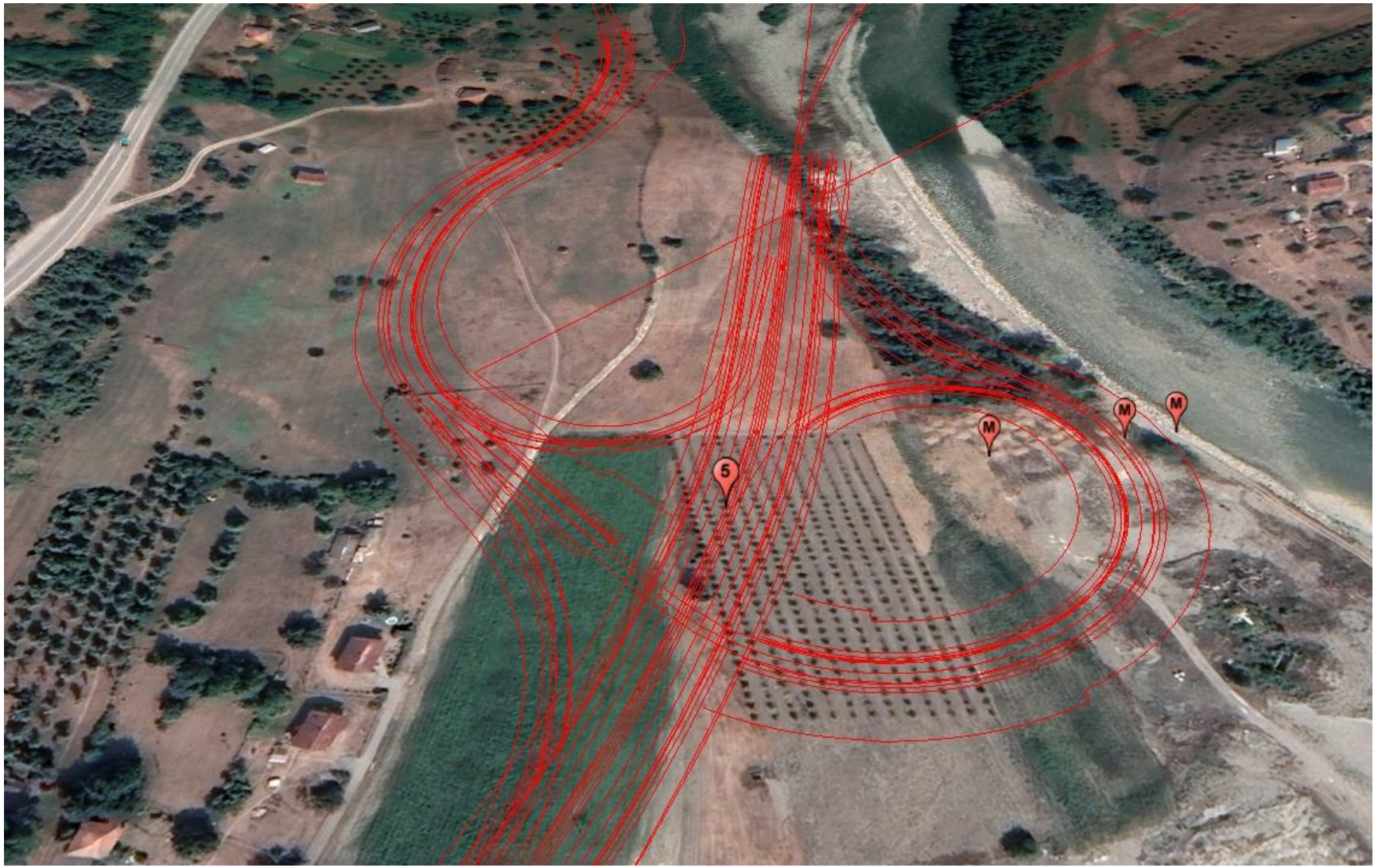

Figure 8. Mapped locations of species recorded at the fifth surveyed site (5) Lim River: (M) *P. muralis*

Figure 9. Selected locations 1 and 2 for field surveys of amphibians and reptiles: Trešnjevik (left) and Dubokalj Stream (right)

Figure 10. Selected locations 3 and 4 for field surveys of amphibians and reptiles: Kralje (left) and Most Bandovića (right)

Figure 11. Selected location 5 for field surveys of amphibians and reptiles: bank of the Lim River.

Figure 12. A road-killed specimen of the Common fire salamander *Salamandra salamandra* (left) and nearby habitat at locality 3 – Kralje in the Project impact zone (right).

Figure 13. A road-killed specimen of the Common toad *Bufo bufo* (left) and nearby terrestrial habitat at locality 3 -Kralje in the Project impact zone (right).

Figure 14. A juvenile specimen of the Greek stream frog *Rana graeca* (left) and its habitat at locality 4 – Most Bandovića in the Project impact zone (right).

Figure 15. A specimen of the Common wall lizard *Podarcis muralis* (left) and its habitat at locality 5 – Lim River in the Project impact zone (right)

Figure 16. A specimen of the Nose-horned viper *Vipera ammodytes* (left) and nearby habitat at locality 2 – Dubokalj Stream in the Project impact zone (right).

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