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Green Hydrogen Project Hyrasia One

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1 Methodology

In order to investigate the sensitivity of animals to the presence of wind turbines and transmission lines planned by the Hyrasia One Project and to identify conditions that encourage concentration of birds, a wildlife survey was conducted in 5 Project Areas from 18.10.2023 to 21.10.2024. 86 vantage points (VPs) were set orthogonally to the expected migration corridors in the imaginary lines that cross the entire Project Areas, the area of which amounted to 10,000 km² (see Figure 1 - Figure 6). The VPs were set 4 km apart from each other, to comply with the maximum recommended observation distance of 2 km¹.

Species composition, abundance, behavior, flight direction and height were determined at the VPs and between them. To enable analysis by VP, observations of birds between the VPs were assigned to the VP of destination.

The shape of the Project Areas changed during the year due to changes in the Project layout, but to meet the requirements of the methodology (observations from one point for at least 36 hours during the breeding season and 36 hours outside the breeding season during the year), the position of the VPs was not changed. The exceptions were U1, U2 and U3, which were observed from 18.10.2023 to 28.01.2024 and then abandoned, as the area around them was removed from the Project layout.

Observation along the routes between the VPs was conducted using an internationally and locally recognized methodology ² at a speed of 15-20 km/h by a non-driving ornithologist in both directions: up to 500 m for mammals and birds of prey and up to 200 m for small passerines. Stops were made for counting and species identification. In the warm part of the year when the night temperature was above 5°C, walk-by bat detectors were used to detect bat calls around the night camps, before the dusk made walking unsafe. The walks did not follow a particular pattern but focused on checking the habitats around the camps that could be used by bats hunting or roosting.

Observations were made using BPC 12x50 binoculars. To verify the visual identification of species, photo fixation with full matrix tele lens digital cameras was made.

Table 1 indicates compliance with the in the NatureScot methodology¹ (Section 3.8.6) recommended number of observation hours at each vantage point as "a minimum of 72 hours per VP location divided between seasons (36 hours breeding and 36 hours non-breeding) per year". For observation hours calculation at each VP, the breeding period for all species and all areas was taken as 16.03.-24.06.24. In reality, this period varied from 05.03. to 31.07.24 for the majority of the observed species. Thus, the lack of recommended hours per VP in a particular period is acceptable as long as the total number of observation hours is close to the recommended 72 hours.

¹ Scottish Natural Heritage Recommended bird survey methods to inform impact assessment of onshore wind farms. Version 2, 2017

² Ravkin, Yu. S. (1967): Towards the methodology of bird counting in forest landscapes. Nature of thick-borne encephalitis foci in Altai. Novosibirsk: Nauka. S. 66-75

Table 1: Observation time and number of registered birds at each vantage point. Points where the methodology requirements of 36h in breeding and non-breeding period were fully met are shaded in grey. Points U1-3 were excluded in January 2024

VP	Breeding	Non-breeding	Total time	Birds recorded	VP	Breeding	Non-breeding	Total time	Birds recorded
K01	39:00	36:00	75:00	564	U12	29:55	44:25	74:20	555
K02	39:00	36:01	75:01	401	U13	30:00	41:30	71:30	204
K03	39:00	36:00	75:00	311	U14	30:00	41:30	71:30	230
K04	38:05	35:59	74:04	339	U15	29:50	41:30	71:20	234
K05	39:00	36:01	75:01	291	Z01	39:00	35:06	74:06	465
K06	39:00	36:30	75:30	356	Z02	39:00	36:20	75:20	269
K07	36:00	36:33	72:33	389	Z03	38:00	35:01	73:01	278
K08	39:10	36:16	75:26	282	Z04	39:00	35:03	74:03	226
K09	39:05	36:05	75:10	224	Z05	39:00	35:03	74:03	374
K10	39:00	31:57	70:57	223	Z06	39:00	35:01	74:01	228
K11	39:30	36:04	75:34	190	Z07	37:00	35:00	72:00	253
K12	38:00	36:30	74:30	331	Z08	35:00	34:58	69:58	266
K13	36:15	36:15	72:30	197	Z09	38:20	34:30	72:50	169
B01	32:00	40:02	72:02	363	Z10	38:15	35:27	73:42	260
B02	32:40	39:30	72:10	433	Z11	35:50	35:00	70:50	330
B03	32:40	39:30	72:10	392	M01	34:00	41:30	75:30	438
B04	32:00	40:04	72:04	363	M02	32:50	41:36	74:26	319
B05	33:00	39:00	72:00	378	M03	33:25	43:15	76:40	289
B06	33:00	39:04	72:04	367	M04	32:30	42:32	75:02	301
B07	32:10	39:50	72:00	305	M05	32:00	43:58	75:58	548
B08	32:00	41:00	73:00	275	M06	32:45	45:02	77:47	388
B09	32:20	39:45	72:05	623	M07	32:00	45:00	77:00	376
B10	31:00	41:56	72:56	253	M08	33:00	40:28	73:28	524
B11	33:00	39:01	72:01	289	M09	33:00	41:00	74:00	244
B12	33:05	38:38	71:43	518	M10	32:00	39:58	71:58	420
B13	32:00	40:00	72:00	273	M11	32:00	40:00	72:00	441
B14	33:00	39:00	72:00	218	M12	32:00	40:00	72:00	431
B15	33:00	39:00	72:00	245	M13	32:00	40:25	72:25	497
B16	32:40	39:02	71:42	274	M14	32:50	40:22	73:12	674
B17	33:00	39:05	72:05	581	M15	35:25	36:45	72:10	458
B18	32:30	39:26	71:56	307	M16	34:35	37:25	72:00	398
B19	32:30	39:30	72:00	251	M17	36:00	36:20	72:20	217
U01	0:00	9:00	9:00	26	M18	35:50	36:25	72:15	332
U02	0:00	7:42	7:42	78	M19	36:00	36:52	72:52	289
U03	0:00	7:15	7:15	93	M20	36:00	36:29	72:29	287
U04	33:00	44:44	77:44	377	M21	36:00	37:05	73:05	255
U05	29:50	43:00	72:50	647	M22	36:00	36:20	72:20	295
U06	29:45	43:01	72:46	635	M23	36:00	36:45	72:45	585
U07	30:00	43:00	73:00	764	M24	36:00	36:41	72:41	360
U08	30:00	42:40	72:40	996	M25	35:30	36:20	71:50	384
U09	30:00	42:53	72:53	415	M26	35:30	37:43	73:13	300
U10	29:40	45:06	74:46	581	M27	36:00	38:05	74:05	364
U11	30:15	44:40	74:55	396	M28	33:00	42:00	75:00	288

Legend: Project areas,

- K for Teren oi,
- B for Kanagat,
- U for Rahym,
- Z for Talap and
- M for Enbek.

Bats were surveyed using a hand-held Wildlife Acoustics Eco Meter Touch 2 Pro detector and 5 passive detectors Song Meter Mini Bat. For arrangement of the passive detectors, the South African Guidelines³ were used. Based on Appendix 1 of the Guidance the static surveys should have:

- Even spread of survey points with at least 1 point per 50-100 km² (100 km² constitutes to 6 km maximum coverage radius or 12 km between the observation points),
- Minimum of 75 % coverage of the bat active period (in Mangystau Region from March to October),
- Placement of a low microphone at 7-10 m and a high microphone at 50-80 m at meteorological masts.

The stationary bat detectors are normally mounted on the wind monitoring masts that, according to the European Bank for Reconstruction and Development (EBRD) requirements, are to cover all the area planned for the wind turbines with a maximum 10 km distance from the masts which is equal to 314 km². As no wind measuring masts were available, it was decided to conduct a preliminary assessment with low microphones only to assess potential foraging activities of bats near the ground. During the period from 18.03.24 to 21.10.24, covering the expected bat active period in spring, summer and autumn season, five Wildlife Acoustics Mini Bat detectors mounted on the top of 10 m masts were placed at the vantage points with odd numbers and moved to the next 5 points after 2 weeks. With 8 km distance between the survey points, each point would cover 50.3 km² along the VPs line. Bat experts have analyzed the obtained data in the Kaleidoscope software, the results of which are presented in Table 7.

Bats monitoring was also planned in the walking distance from the night stays in the places where bats activity was possible: along the cliffs, shrub thickets, and inside the structures. The stays location changed over the year of survey as the teams were not to travel in the reduced visibility time and had to set up the camps on the way not later than 30 min before the dusk. At this point, one observer, released from setting up the camp and cooking, surveyed the surrounding area for places of possible bats activity with a torch and a walk-by active bat detector Eco Meter Touch 2 Pro. If no possible bats feeding places were noted, circular walks were conducted for 40-60 minutes and covered at least 0.5 km from the night camp.

The birds and other animals were also recorded while moving in between the vantage points. As their habitat was larger than the distances between the points, their observations were assigned to the point of destination. When weather and time allowed, voluntary habitat surveys were conducted by the zoologists free of food preparation in the area 0.5 to 1 km from the night camp.

³ McEwan *et al.* South African Best Practice Guidelines for Pre-construction Monitoring of Bats at Wind Energy Facilities. 2020

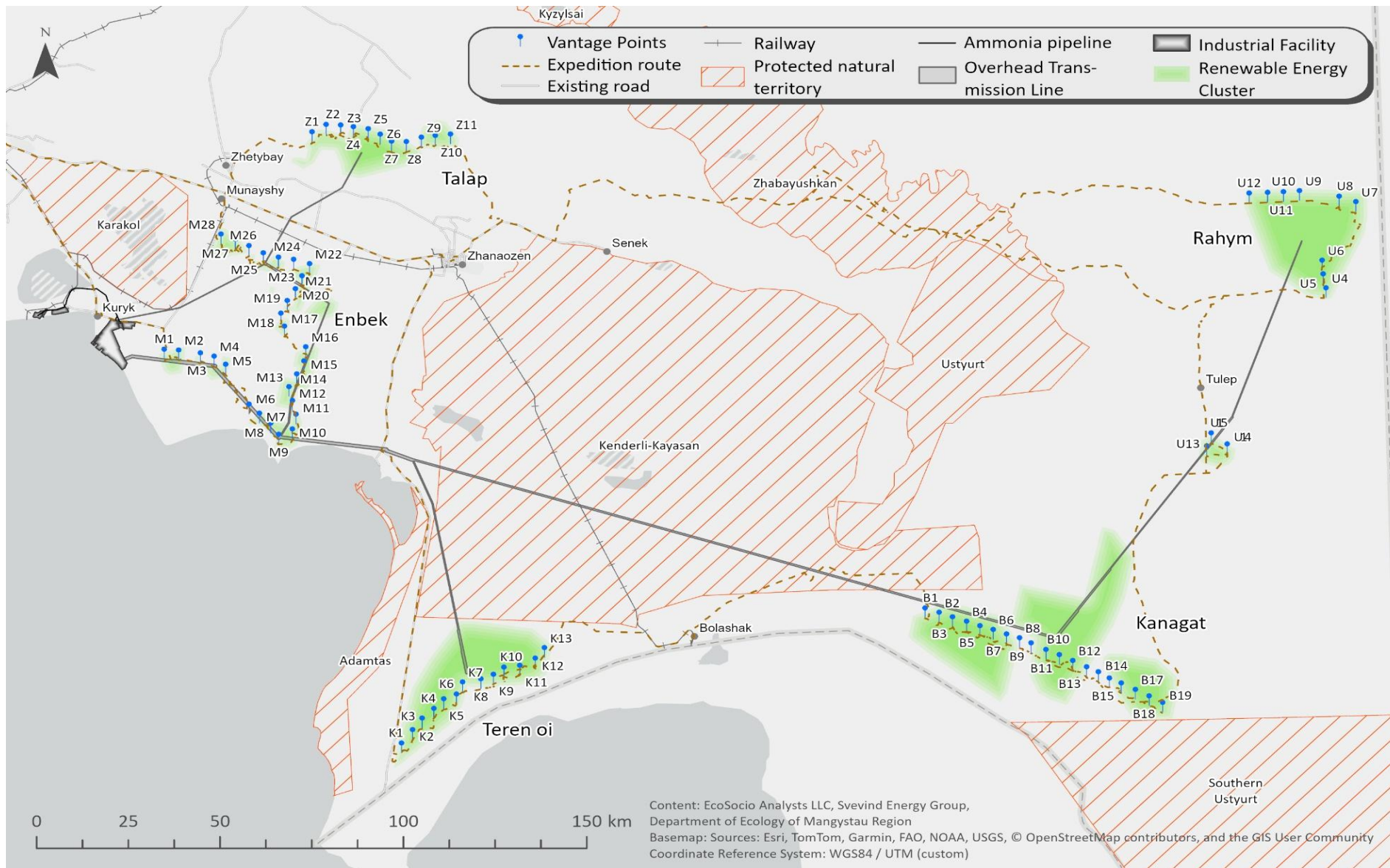


Figure 1: Overview map of the Project Areas, Project components and Vantage Points



Figure 2: Map of the Project Areas, Project components and Vantage Points in Teren oi Project Area

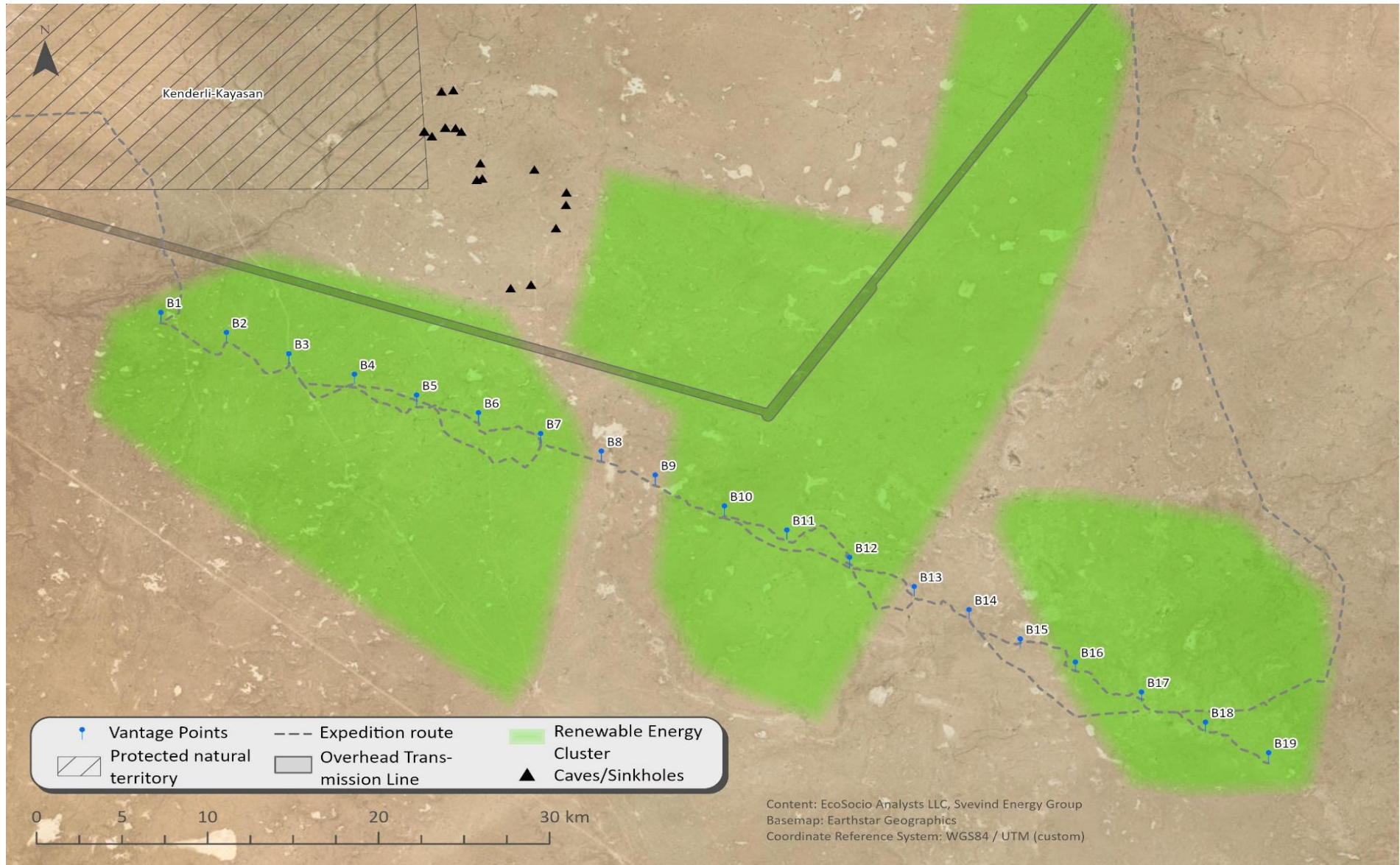


Figure 3: Map of the Project Areas, Project components and Vantage Points in Kanagat Project Area

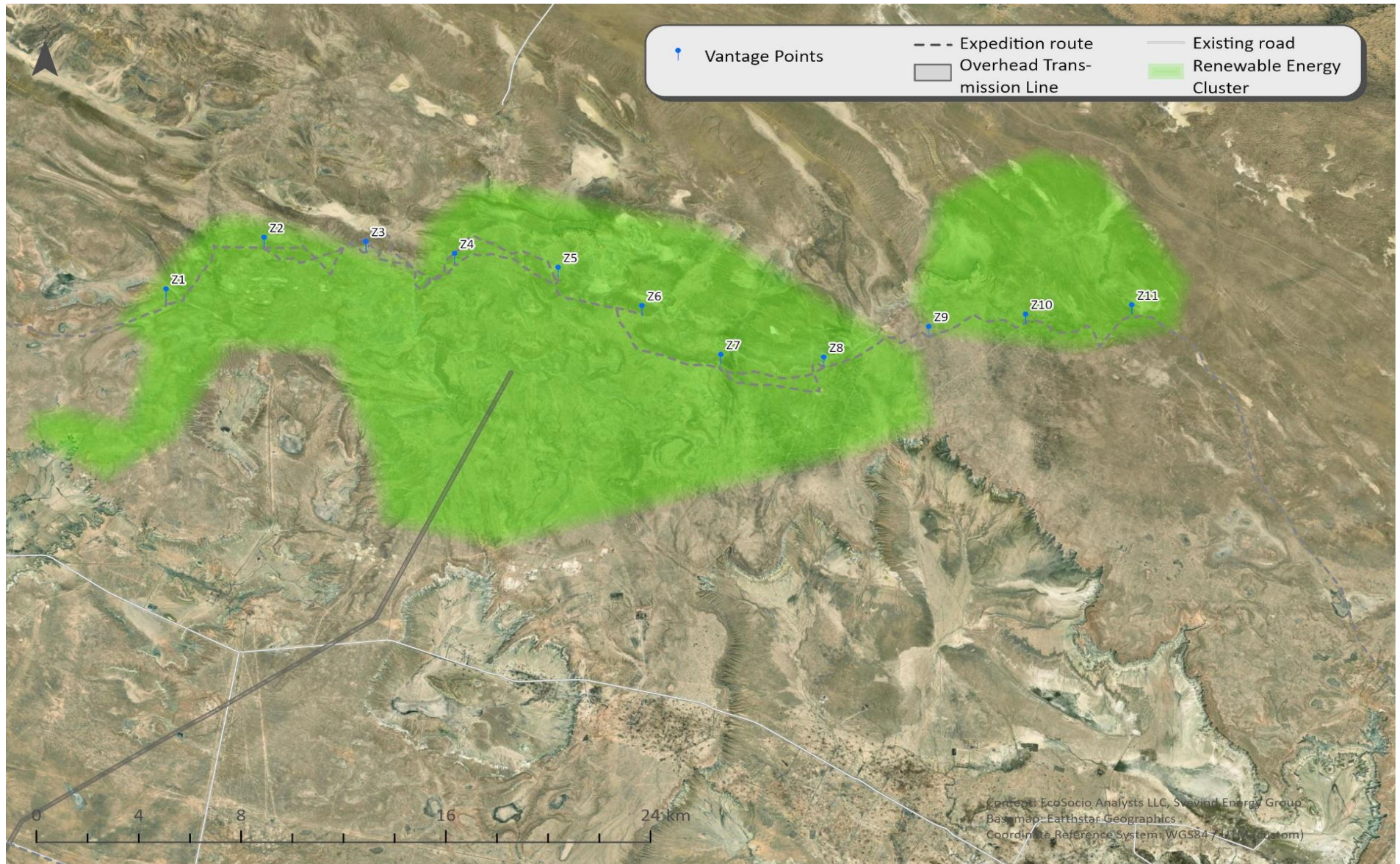


Figure 4: Map of the Project Areas, Project components and Vantage Points in Talap Project Area

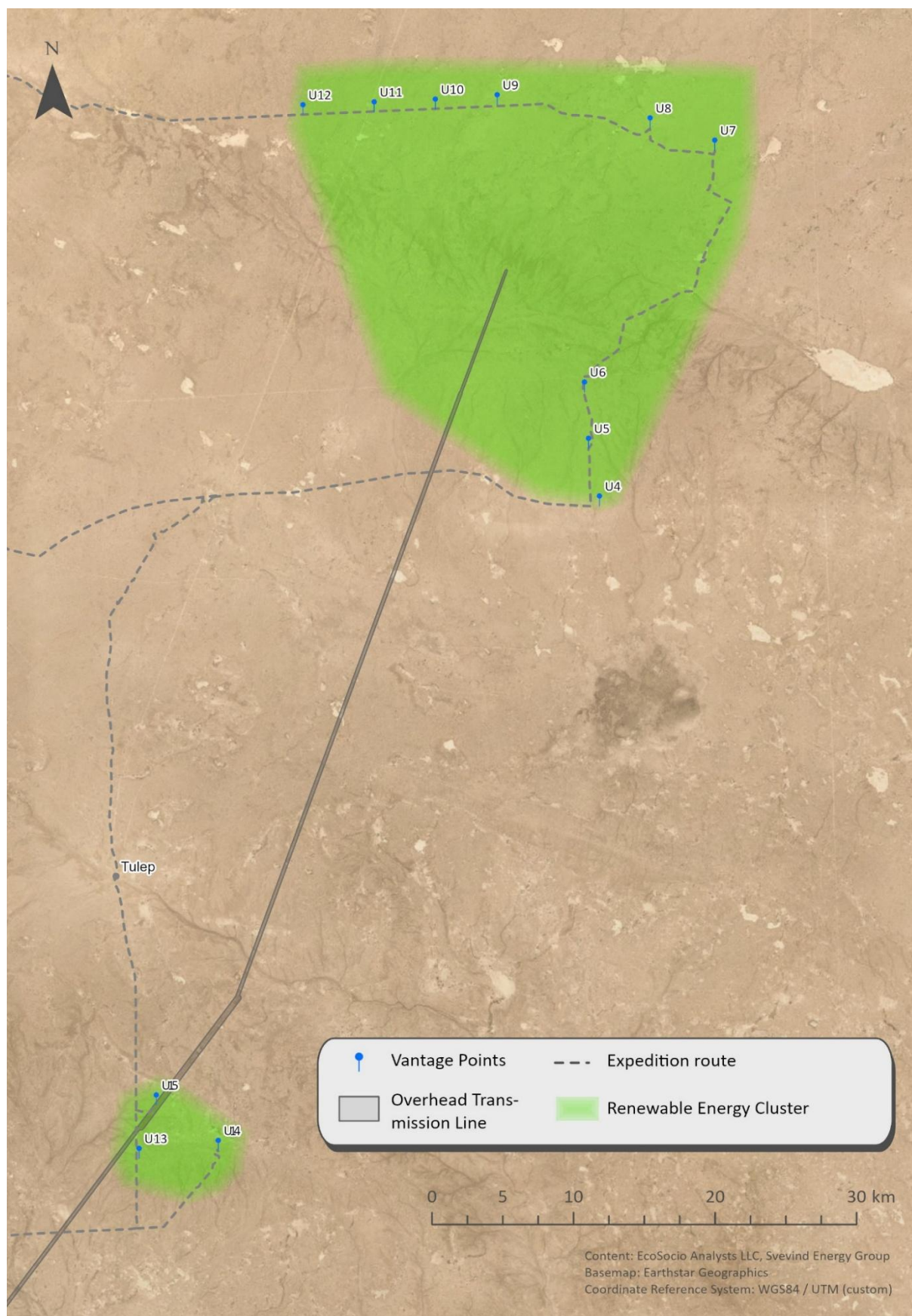


Figure 5: Map of the Project Areas, Project components and Vantage Points in Rahym Project Area

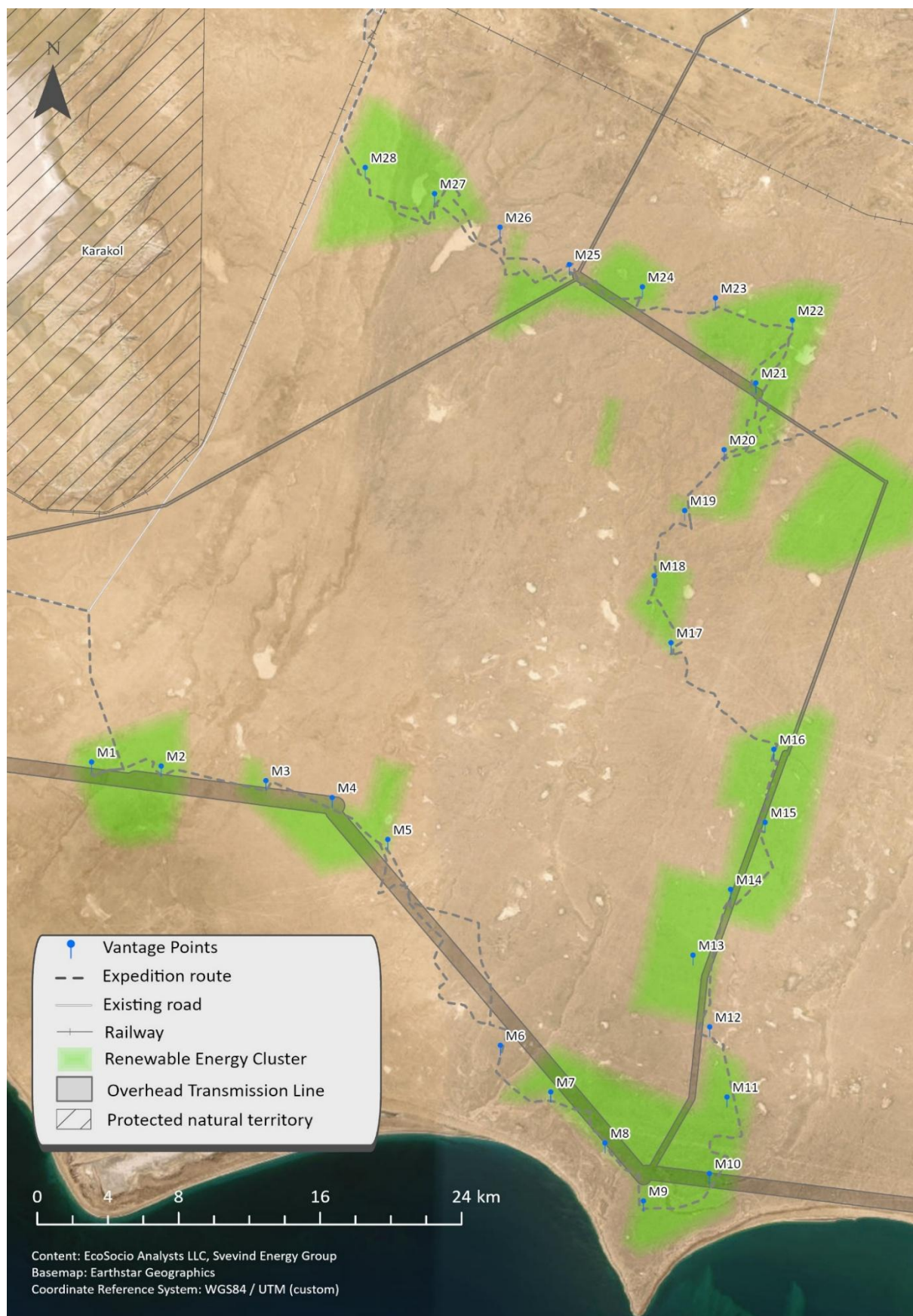


Figure 6: Map of the Project Areas, Project components and Vantage Points in Enbek Project Area

2 Literature Review

2.1 Birds

The shallow and silty seashore in the Project Area attracts a large number of birds, especially during seasonal migrations. GPS trackers set on 9 Eastern Imperial Eagles showed that the migrations during 2017-2018 were in a broad front along the coast. Literature also shows that one of the main migration routes from Western Siberia to Central Asia, Iran, and the Arabian Peninsula passes through this area (Figure 7 and Figure 8). This is also confirmed by the rings return data and aerial visual monitoring of the Seal Island birds⁴, which showed that during spring migration 158 600 birds of 30 species congregate along the eastern shore of the Caspian Sea. Among them are the specially protected Pink and Dalmatian pelicans, Black-headed Puffin, Flamingo and White-tailed Eagle. Autumn surveys⁴ showed that an average of 262 000 birds congregate on the eastern coast, reaching 420 000 birds in October.



Figure 7: Nine migration routes of Eastern Imperial Eagles in 2017-2018⁵

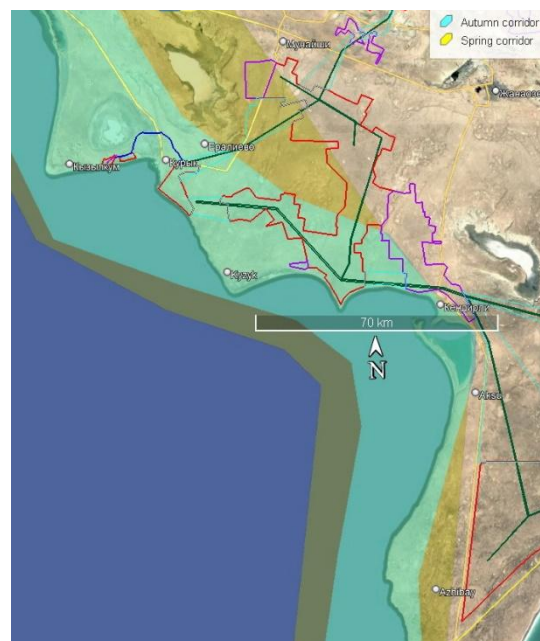


Figure 8: Main birds migratory routes with landing based on the rings return of Seal Island birds. Legend: yellow-spring and blue- autumn⁶

Table 5 summarizes species that may occur in the area with the exception of passerines that are not expected to be at risk of collision with the turbine blades due to their flight being mainly below the blade rotation area (assumed to be from 15 to 280 m high). The waterfowl, prey and scavenging birds are at greater risk of collision. These are Anseriformes, Phoenicopteriformes, Otidiformes, Pteroclitiformes, Suliformes, Pelicaniformes, Accipitriformes and Falconiformes as shown in Table 5. The list includes 189 species, 42 of which are listed in the IUCN Red List or the Kazakhstan Red Book. The largest order in the table (56 species) is shore birds (Charadriiformes) with the duck like birds following them (Anseriformes,

⁴ Kovshar V.A., Karpov F.F. Aerovisual monitoring of bird population of seal islands (Northeast Caspian). Terrestrial vertebrates of arid and subarid ecosystems of the Aral-Caspian region. Proceedings of the III International Conference in Memory of Zarusny N.A. Orenburg 2023 P87-93

⁵ www.korepov1986.livejournal.com/19036.html)

⁶ Gavrilov A.E. Unpublished)

30 species). These are confined to the seashore, but some eagles (Accipitriformes, 26 species) and falcons (8 species) may occupy the desert area. Six out of 11 red listed eagles are in the endangered, vulnerable or near threatened group. Seven species of owls (Strigiformes) can also occur in the desert area but none of them are critically endangered.

Thus, the available data on birds from the literature places the main constraint on the nearshore parts of Enbek and Teren oi areas and on positioning the turbine rows in the west-east orientation. No constraints are identified in relation to the terrestrial animals and the other Project Areas as far as the planned sub-meridian (north-south) orientation of the turbine rows is maintained.

Table 2: Birds species that may occur in the area with the exception of passerines. The Kazakhstan Red Book species are shown in **red** and prey birds in **bold**.

Key to the orders:

Cor	Coraciiformes	Pel	Pelecaniformes	Col	Columbiformes	Pas	Passeriformes
Pho	Phoenicopteriformes	Cuc	Cuculiformes	Cap	Caprimulgiformes	Buc	Bucerotiformes
Str	Strigiformes	Cor	Coraciiformes	Pic	Piciformes	Fal	Falconiformes
Cic	Ciconiiformes	Sul	Suliformes	Apo	Apodiformes		

Key to families:

Pho	Phoenicopteridae	Bur	Burhinidae	Cic	Ciconiidae	Gla	Glareolidae	Ste	Stercorariidae
Rec	Recurvirostridae	Alc	Alcedinidae	Cuc	Cuculidae	Cap	Caprimulgidae	Apo	Apodidae
Pha	Phalacrocoracidae	Gav	Gaviidae	Pel	Pelecanidae	Thr	Threskiornithida	Pic	Picidae
Hae	Haematopodidae	Pan	Pandionidae	Upu	Upupidae	Mer	Meropidae	Cor	Coraciidae

Project area presence types: M-Migrating; W-Wintering; B-Breeding; R-Resident; V-Visit; S-Single visits; ND-no data

Protection status: International Union for Conservation of Nature (IUCN) status (www.iucnredlist.org, Version 2025-1): CR - critically endangered; EN - endangered; VU - vulnerable; NT - near threatened; LC - least concern. Kazakhstan Red Book categories (fourth edition, www.redbook.kz): I - disappeared (not recorded for the last 50 years) and under the threat of disappearance; II - catastrophically rapidly depleting population that may lead to disappearance; III - rare small or spatially localized populations vulnerable to changes in their habitats; IV - concern over quantity and population condition but data missing to assign the other category; V - previously endangered fully recovered population that requires monitoring and is exempt from commercial hunting.

Order	Family	Russian name	English Name	Scientific name	Presence Type	Protection status
Galliformes	Phasianidae	Кеклик	Chukar Partridge	<i>Alectoris chukar</i>	R	
		Пустынная куропатка	See-see Partridge	<i>Ammoperdix griseogularis</i>	R	
		Серая куропатка	Grey Partridge	<i>Perdix perdix</i>	R	
		Перепел	Common Quail	<i>Coturnix coturnix</i>	M	
Anseriformes	Anatidae	Лебедь-шипун	Mute Swan	<i>Cygnus olor</i>	M, W	
		Лебедь-кликун	Whooper Swan	<i>Cygnus cygnus</i>	M, W	LC / II
		Малый лебедь	Bewick's Swan	<i>Cygnus bewickii</i>	M	VU / V
		Серый гусь	Greylag Goose	<i>Anser anser</i>	M	
		Белолобый гусь	Greater White-fronted Goose	<i>Anser albifrons</i>	M	
		Пискулька	Lesser White-fronted Goose	<i>Anser erythropus</i>	M	VU
		Гуменник	Bean Goose	<i>Anser fabalis</i>	M	
		Краснозобая казарка	Red-breasted Goose	<i>Branta ruficollis</i>	M	VU / II
		Огарь	Ruddy Shelduck	<i>Tadorna ferruginea</i>	B	
		Пеганка	Common Shelduck	<i>Tadorna tadorna</i>	B	
		Свиязь	Eurasian Wigeon	<i>Anas penelope</i>	M	
		Серая утка	Gadwall	<i>Anas strepera</i>	M	
		Чирок-свиистунок	Common Teal / Eurasian Teal	<i>Anas crecca</i>	M	
		Кряква	Mallard	<i>Anas platyrhynchos</i>	B, W	
		Шилохвость	Northern Pintail	<i>Anas acuta</i>	W	
		Чирок-трескунок	Garganey	<i>Anas querquedula</i>	M	
		Широконоска	Northern Shoveler	<i>Anas clypeata</i>	W, M	
		Красноносый нырок	Red-crested Pochard	<i>Netta rufina</i>	W, B, M	
		Красноголовый нырок	Common Pochard	<i>Aythya ferina</i>	W, M	

Order	Family	Russian name	English Name	Scientific name	Presence Type	Protection status
		Белоглазый нырок	Ferruginous Duck	<i>Aythya nyroca</i>	M	NT
		Хохлатая чернеть	Tufted Duck	<i>Aythya fuligula</i>	W, M	
		Морская чернеть	Greater Scaup	<i>Aythya marila</i>	W, M	
		Синьга	Common Scoter	<i>Melanitta nigra</i>	ND	
		Турпан	Velvet Scoter	<i>Melanitta fusca</i>	M	EN / III
		Морянка	Long-tailed Duck / Oldsquaw	<i>Clangula hyemalis</i>	W, M	
		Гоголь	Common Goldeneye	<i>Bucephala clangula</i>	W, M	
		Луток	Smew	<i>Mergellus albellus</i>	W	
		Длинноносый крохаль	Red-breasted Merganser	<i>Mergus serrator</i>	W, M	
		Большой крохаль	Goosander	<i>Mergus merganser</i>	W	
		Савка	White-headed Duck	<i>Oxyura leucocephala</i>	ND	EN / I
Pho	Pho	Розовый фламинго	Greater Flamingo	<i>Phoenicopterus roseus</i>	B, M	LC / II
Podicipediformes	Podicipedidae	Малая поганка	Little Grebe	<i>Tachybaptus ruficollis</i>	W, M	
		Серощёкая поганка	Red-necked Grebe	<i>Podiceps grisegena</i>	W, M	
		Чомга	Great Crested Grebe	<i>Podiceps cristatus</i>	W, M	LC
		Красношейная поганка	Horned Grebe	<i>Podiceps auritus</i>	M	
		Черношейная поганка	Black-necked Grebe	<i>Podiceps nigricollis</i>	W, M	
Gruiformes	Rallidae	Водяной пастушок	European Water Rail	<i>Rallus aquaticus</i>	W, M, B?	
		Коростель	Corncrake / Corn Crake	<i>Crex crex</i>	ND	
		Погоныш	Common Crake	<i>Porzana porzana</i>	M	
		Малый погоныш	Little Crake	<i>Zapornia parva</i>	V	
		Погоныш-крошка	Baillon's Crake	<i>Zapornia pusilla</i>	V	
		Султанка	Grey-headed Swamphen	<i>Porphyrio porphyrio</i>	W	LC / II
		Камышница	Common Moorhen / Common Gallinule	<i>Gallinula chloropus</i>	B	
		Лысуха	Common Coot / Eurasian Coot	<i>Fulica atra</i>	B	
		Серый журавль	Common Crane	<i>Grus grus</i>	M	LC / III
		Красавка	Demoiselle Crane	<i>Anthropoides virgo</i>	M	LC / V
Charadriiformes	Bur	Авдотка	Eurasian Stone-curlew	<i>Burhinus oedichenus</i>	ND	
	Нае	Кулик-сорока	Eurasian Oystercatcher	<i>Haematopus ostralegus</i>	B, M	
	Rec	Шилоклювка	Pied Avocet	<i>Recurvirostra avosetta</i>	B	
		Ходулочник	Black-winged Stilt	<i>Himantopus himantopus</i>	B	
	Charadriidae	Тулес	Grey Plover	<i>Pluvialis squatarola</i>	M	
		Золотистая ржанка	Eurasian Golden Plover	<i>Pluvialis apricaria</i>	M	
		Галстучник	Common Ringed Plover	<i>Charadrius hiaticula</i>	M	
		Малый зуёк	Little Ringed Plover	<i>Charadrius dubius</i>	B	
		Морской зуёк	Kentish Plover	<i>Charadrius alexandrinus</i>	B	
		Каспийский зуёк	Caspian Plover	<i>Charadrius asiaticus</i>	B	
		Хрустан	Eurasian Dotterel	<i>Eudromias morinellus</i>	M	
		Чибис	Northern Lapwing	<i>Vanellus vanellus</i>	M	
		Белохвостая пигалица	White-tailed Lapwing	<i>Vanellus leucurus</i>	ND	
		Кречётка	Sociable Lapwing	<i>Vanellus gregarius</i>	B	CR
	Scolopacidae	Средний кроншнеп	Whimbrel	<i>Numenius phaeopus</i>	M	
		Большой кроншнеп	Eurasian Curlew	<i>Numenius arquata</i>	M	
		Большой веретенник	Black-tailed Godwit	<i>Limosa limosa</i>	M, W	
		Малый веретенник	Bar-tailed Godwit	<i>Limosa lapponica</i>	M	
		Камнешарка	Ruddy Turnstone	<i>Arenaria interpres</i>	M	
		Кулик-воробей	Little Stint	<i>Calidris minuta</i>	M	
		Белохвостый песочник	Temminck's Stint	<i>Calidris temminckii</i>	M	
		Песчанка	Sanderling	<i>Calidris alba</i>	W, M	
		Краснозобик	Curlew Sandpiper	<i>Calidris ferruginea</i>	M	
		Чернозобик	Dunlin	<i>Calidris alpina</i>	M	

Order	Family	Russian name	English Name	Scientific name	Presence Type	Protection status
		Турухтан	Ruff (male), Reeve (female)	<i>Philomachus pugnax</i>	M	
		Грязовик	Broad-billed Sandpiper	<i>Limicola falcinellus</i>	M	
		Вальдшнеп	Eurasian Woodcock	<i>Scolopax rusticola</i>	W, M	
		Бекас	Common Snipe	<i>Gallinago gallinago</i>	M	
		Гаршнеп	Jack Snipe	<i>Limnocyrtus minimus</i>	ND	
		Круглоносый плавунчик	Red-Necked Phalarope	<i>Phalaropus lobatus</i>	M	
		Мородунка	Terek Sandpiper	<i>Xenus cinereus</i>	M, W	
		Перевозчик	Common Sandpiper	<i>Actitis hypoleucos</i>	M	
		Черныш	Green Sandpiper	<i>Tringa ochropus</i>	W,S,M	
		Фифи	Wood Sandpiper	<i>Tringa glareola</i>	W, M	
		Щёголь	Spotted Redshank	<i>Tringa erythropus</i>	M	
		Травник	Common Redshank	<i>Tringa totanus</i>	B, M	
		Поручейник	Marsh Sandpiper	<i>Tringa stagnatilis</i>	M	
		Большой улит	Common Greenshank	<i>Tringa nebularia</i>	W, M	
		Степная тиркушка	Black-winged Pratincole	<i>Glareola nordmanni</i>	M	
	Laridae	Сизая чайка	Common Gull	<i>Larus canus</i>	W, M?	
		Клуша	Lesser Black-backed Gull	<i>Larus fuscus</i>	M	
		Хохотунья	Caspian Gull	<i>Larus cachinnans</i>	B, W	
		Черноголовый хохотун	Great Black-headed Gull	<i>Larus ichthyaetus</i>	B	LC / II
		Озёрная чайка	Common Black-headed Gull	<i>Larus ridibundus</i>	B, W	
		Морской голубок	Slender-billed Gull	<i>Larus genei</i>	M	
		Малая чайка	Little Gull	<i>Hydrocoloeus minutus</i>	W, M	
		Моевка	Black-legged Kittiwake	<i>Rissa tridactyla</i>	M?	
		Чайконосная крачка	Gull-billed Tern	<i>Gelochelidon nilotica</i>	B, M	
		Чеграва	Caspian Tern	<i>Hydroprogne caspia</i>	B, M	
		Пестроносая крачка	Sandwich Tern	<i>Thalasseus sandwicensis</i>	B	
		Речная крачка	Common Tern	<i>Sterna hirundo</i>	B	
		Малая крачка	Little Tern	<i>Sternula albifrons</i>	B	
		Белощёкая крачка	Whiskered Tern	<i>Chlidonias hybrida</i>	M	
		Белокрылая крачка	White-winged Tern	<i>Chlidonias leucopterus</i>	M	
		Чёрная крачка	Black Tern	<i>Chlidonias niger</i>	M	
		Короткохвостый поморник	Parasitic Jaeger	<i>Stercorarius parasiticus</i>	B	
Otidiformes	Otididae	Стрепет	Little Bustard	<i>Tetrax tetrax</i>	M	NT / II
		Дрофа	Great Bustard	<i>Otis tarda</i>	M	VU / I
		Джек	Houbara Bustard	<i>Chlamydotis macqueenii</i>	B	VU / II
Cuc	Cuc	Кукушка	Eurasian Cuckoo	<i>Cuculus canorus</i>	M	
Columbiformes	Columbidae	Сизый голубь	Rock Dove	<i>Columba livia</i>	B	
		Клентух	Stock Dove	<i>Columba oenas</i>	W, M	
		Вяхирь	Common Wood-pigeon	<i>Columba palumbus</i>	W, M	
		Горлица	European Turtle-dove	<i>Streptopelia turtur</i>	B	
		Большая горлица	Eastern Turtle-dove	<i>Streptopelia orientalis</i>	M	
		Кольчатая горлица	Eurasian Collared-dove	<i>Streptopelia decaocto</i>	ND	
		Малая горлица	Little Brown Dove	<i>Spilopelia senegalensis</i>	ND	
Pterocliiformes	Pteroclididae	Саджа	Pallas's Sandgrouse	<i>Syrrhaptes paradoxus</i>	B, M	LC / IV
		Чернобрюхий рябок	Black-bellied Sandgrouse	<i>Pterocles orientalis</i>	B, W	LC / III
		Белобрюхий рябок	Pin-tailed Sandgrouse	<i>Pterocles alchata</i>	ND	LC / III
Cap	Cap	Козодой	European Nightjar	<i>Caprimulgus europaeus</i>	B	
Apo	Apo	Белобрюхий стриж	Alpine Swift	<i>Apus melba</i>	B?	
		Чёрный стриж	Common Swift	<i>Apus apus</i>	B	

Order	Family	Russian name	English Name	Scientific name	Presence Type	Protection status
Gaviiformes	Gav	Краснозобая гагара	Red Throated Loon	<i>Gavia stellata</i>	ND	
		Чернозобая гагара	Black-throated Diver	<i>Gavia arctica</i>	M	
	Pha	Малый баклан	Pygmy Cormorant	<i>Microcarbo pygmaeus</i>	M	
		Большой баклан	Great Cormorant	<i>Phalacrocorax carbo</i>	B, W, M	
Pelecaniformes	Pel	Розовый пеликан	White Pelican	<i>Pelecanus onocrotalus</i>	M	LC / I
		Кудрявый пеликан	Dalmatian Pelican	<i>Pelecanus crispus</i>	M	NT / II
	Ardeidae	Большая выпь	Eurasian Bittern	<i>Botaurus stellaris</i>	M	
		Волчок	Little Bittern	<i>Ixobrychus minutus</i>	M	
		Кваква	Black-crowned Night Heron	<i>Nycticorax nycticorax</i>	M	
		Жёлтая цапля	Squacco Heron	<i>Ardeola ralloides</i>	ND	II
		Египетская цапля	Cattle Egret	<i>Bubulcus ibis</i>	ND	
		Малая белая цапля	Little Egret	<i>Egretta garzetta</i>	M	LC / III
		Большая белая цапля	Great Egret	<i>Casmerodius albus</i>	M	
		Серая цапля	Grey Heron	<i>Ardea cinerea</i>	W, M	
		Рыжая цапля	Purple Heron	<i>Ardea purpurea</i>	M	
	Thr	Каравайка	Glossy Ibis	<i>Plegadis falcinellus</i>	M	LC / II
		Колпица	Eurasian Spoonbill	<i>Platalea leucorodia</i>	M	LC / II
Cic	Cic	Белый аист	White Stork	<i>Ciconia ciconia</i>	S	LC / I
Accipitriformes	Pan	Скопа	Osprey	<i>Pandion haliaetus</i>	M	LC / I
	Accipitridae	Осоед	European Honey-buzzard	<i>Pernis apivorus</i>	M	
		Бородач	Bearded Vulture	<i>Gypaetus barbatus</i>	V	NT/ III
		Стервятник	Egyptian Vulture	<i>Neophron percnopterus</i>	B	EN / III
		Белоголовый сип	Gyps fulvus	<i>Gyps fulvus</i>	?	LC
		Чёрный гриф	Monk Vulture	<i>Aegypius monachus</i>	M	NT
		Змееяд	Short-toed eagle	<i>Circaetus gallicus</i>	M	LC / II
		Болотный лунь	Western Marsh Harrier	<i>Circus aeruginosus</i>	M	
		Полевой лунь	Northern Harrier	<i>Circus cyaneus</i>	M, W	
		Степной лунь	Pallid Harrier	<i>Circus macrourus</i>	M, W	
		Луговой лунь	Montagu's Harrier	<i>Circus pygargus</i>	M	
		Тетеревятник	Northern Goshawk	<i>Accipiter gentilis</i>	W, M	
		Тювик	Shikra	<i>Accipiter brevipes</i>	M	
		Европейский тювик	Levant Sparrowhawk	<i>Accipiter brevipes</i>	M	
		Перепелятник	Eurasian Sparrowhawk	<i>Accipiter nisus</i>	W, M	
		Орёл-карлик	Booted Eagle	<i>Hieraetus pennatus</i>	M	LC / III
		Большой подорлик	Greater Spotted Eagle	<i>Aquila clanga</i>	M	
		Степной орёл	Steppe Eagle	<i>Aquila nipalensis [rapax]</i>	M	EN / V
		Орёл-могильник	Eastern Imperial Eagle	<i>Aquila heliaca</i>	B, W, M	VU / III
		Беркут	Golden Eagle	<i>Aquila chrysaetos</i>	R	LC / III
		Орлан-долгохвост	Pallas's Fish-eagle	<i>Haliaeetus leucoryphus</i>	?	EN / I
		Орлан-белохвост	White-tailed Eagle	<i>Haliaeetus albicilla</i>	W	LC / II
		Чёрный коршун	Black Kite	<i>Milvus migrans</i>	M	
		Канюк	Common Buzzard	<i>Buteo buteo</i>	ND	
		Курганник	Long-legged Buzzard	<i>Buteo rufinus</i>	B	
		Зимняк	Rough-legged Buzzard	<i>Buteo lagopus</i>	W	
Strigiformes	Strigidae	Ястребиная сова	Northern Hawk Owl	<i>Surnia ulula</i>	?	
		Домовый сыч	Little Owl / Little Owlet	<i>Athene noctua</i>	R	
		Сплюшка	Eurasian Scops Owl	<i>Otus scops</i>	B, M	
		Ушастая сова	Asio otus	<i>Asio otus</i>	W, M	
		Болотная сова	Short-eared Owl	<i>Asio flammeus</i>	M	
		Белая сова	Snowy Owl	<i>Nyctea scandiaca</i>	W	
		Филин	Eurasian Eagle-owl	<i>Bubo bubo</i>	R	LC / II
Buc	Upu	Удод	Common Hoopoe	<i>Upupa epops</i>	B	

Order	Family	Russian name	English Name	Scientific name	Presence Type	Protection status
Coraciiformes	Mer	Зелёная щурка	Blue-cheeked Bee-eater	<i>Merops persicus [superciliosus]</i>	B	
		Золотистая щурка	European Bee-eater	<i>Merops apiaster</i>	B	
	Cor	Сизоворонка	European Roller	<i>Coracias garrulus</i>	M	
	Alc	Зимородок	Common Kingfisher	<i>Alcedo atthis</i>	M	
Pic	Pic	Вертишейка	Eurasian Wryneck	<i>Jynx torquilla</i>	M	
		Большой пёстрый дятел	Great Spotted Woodpecker	<i>Dendrocopos major</i>	ND	
Falconiformes	Falconidae	Степная пустельга	Lesser Kestrel	<i>Falco naumanni</i>	M	
		Пустельга	Common Kestrel	<i>Falco tinnunculus</i>	B	
		Кобчик	Red-footed Falcon	<i>Falco vespertinus</i>	ND	
		Дербник	Merlin	<i>Falco columbarius</i>	ND	
		Чеглок	Eurasian Hobby	<i>Falco subbuteo</i>	ND	
		Балобан	Saker Falcon	<i>Falco cherrug</i>	B, M	EN / I
		Сапсан	Peregrine Falcon	<i>Falco peregrinus</i>	ND	LC / I
		Шахин	Barbary Falcon	<i>Falco pelegrinoides</i>	ND	I

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2.2 Bats

No information was available on bats which may roost in the limestone cavities and caves like those identified near the Kanagat Project Area (Figure 3). Bats are highly mobile animals. Considering that the region is not well studied and far from urban areas, occurrence of bats in places where they have not been recorded before is possible due to habitat expansion or migratory movements. Thus, below, species of bats that may occur in the Project Areas are listed with their Red Book and IUCN protection categories.

Table 3: *Bats that may occur in the Project Areas including their Red Book Animal Status Categories from <https://redbook.kz> (fourth edition; I - endangered or possibly already extinct; II - catastrophically declining; III - rare, occurring in small numbers; IV - undetermined (insufficiently studied); V - restored, in need of constant monitoring) and IUCN protection categories from www.iucnredlist.org (Version 2025-1; CR – critically endangered; EN – endangered; VU – vulnerable; NT – near threatened; LC – least concern). Species that are protected in Kazakhstan are highlighted **red**.*

Common name	Latin name	Protection Status	Presence character
Whiskered bat	<i>Myotis mystacinus</i>	LC	In Mangystau region this bat is found everywhere, but it is most abundant in Ustyurt Plateau ⁷ .
Lesser mouse-eared bat	<i>Myotis blythi</i>	LC	Poorly studied species. Single appearance mainly in lowland landscape with rugged relief ⁸ .
Grey long-eared bat	<i>Plecotus austriacus</i>	NT	Widespread in arid regions, found in Ustyurt Plateau but its main habitats are mountains and pied-mountainous terrain ⁹ .
Common noctule	<i>Nyctalus noctula</i>	LC	Occurs in Mangyshlak Peninsula during migration ⁹ .
Greater noctule bat	<i>Nyctalus lasiopterus</i>	VU	One bat found on saxaul shrub in Uzbek part of the Ustyurt Plateau during migration 14.09.1966 ⁹ .
Common pipistrelle	<i>Pipistrellus pipistrellus</i>	LC	Lives in structures or ruins. Was found near Ustyurt Plateau cliff in September 1944 ⁹ .
Savi's pipistrelle	<i>Pipistrellus savii</i>	LC	Low numbers live in the North Ustyurt Plateau Cliffs ⁹ .
Serotine bat	<i>Eptesicus serotinus</i>	LC	Widely distributed in Mangystau region structures and ruins ⁹ .
Botta's serotine	<i>Eptesicus bottae</i>	LC	Common in the deserts and sand massifs – barchans of Mangystau region. On the Ustyurt Plateau, it is met in the wetter and wind protected cliffs foundations ⁹ .
Parti-coloured bat	<i>Vespertilio murinus</i>	LC	
Desert long-eared bat	<i>Otonycteris hemprichi</i>	III/LC	Was found only in the west cliff of the Ustyurt Plateau of the Ustyurt State Nature Reserve at the bine water well Kugusem 47 km west of Rahym Project Area ¹⁰ .
Greater horseshoe bat	<i>Rhinolophus ferrumequinum</i>	LC	Was noted in 1883 in the west cliffs of the Ustyurt Plateau 50 km west of Rahym Project Area ⁸ .

⁷ Moscow State University Zoological Museum Collection

⁸ Karelin G.S. Natural works of the North-Eastern shores of the Caspian Sea. Notes of the Imperial Russian Geographical Society, St. Petersburg, Printing house of the Imperial Academy of Sciences Imperial Academy of Sciences. 1883

⁹ Mangystau Region wildlife and its monitoring. Zoology Institute works, Vol. 51, Almaty, 2009 pp. 10-11

¹⁰ Shaymardanov R.T. White-bellied shrew (*Otonycteris hemprichi*) and Asian broad-eared shrew (*Barbastella leucomelas*)

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2.3 Mammals (Excluding Bats)

About 70 species of mammals have been recorded in the region ⁹. These include: 28 species of rodents, 16 carnivores, 5 insectivores, 5 ungulates and 2 rabbits. Almost all of them are likely to be present in the Project areas (Table 4). The ecology of the protected species is described in the next section.

Table 4: Mammals that may occur in the Project Areas including their Red Book Animal Status Categories from <https://redbook.kz> (fourth edition; I - endangered or possibly already extinct; II - catastrophically declining; III - rare, occurring in small numbers; IV - undetermined (insufficiently studied); V - restored, in need of constant monitoring) and IUCN protection categories from www.iucnredlist.org (Version 2025-1; CR – critically endangered; EN – endangered; VU – vulnerable; NT – near threatened; LC – least concern). Species that are protected in Kazakhstan are highlighted **red**

Common name	Latin Name	Protection status
Etruscan shrew	<i>Suncus etruscus</i>	III/LC
Yellow ground squirrel	<i>Spermophilus fulvus</i>	LC
Little ground squirrel	<i>S. pygmaeus</i>	LC
Great jerboa	<i>Allactaga major</i>	LC
Severtzov's jerboa	<i>Allactaga severtzovi</i>	LC
Mongolian five-toed jerboa	<i>Allactaga sibirica</i>	LC
Small five-toed jerboa	<i>Allactaga elater</i>	LC
Dwarf fat-tailed jerboa	<i>Pygeretmus pumilio</i>	LC
Lesser fat-tailed gopher	<i>P. platyurus</i>	LC
Jerboa	<i>Dipodidae</i>	NA
Eversmann's hamster	<i>Allocricetulus eversmanni</i>	LC
Common vole	<i>Microtus arvalis</i>	LC
Northern mole vole	<i>Ellobius talpinus</i>	LC
House mouse	<i>Mus musculus</i>	LC
Brown rat	<i>Rattus norvegicus</i>	LC
Short-tailed bandicoot rat	<i>Nesokia indica</i>	LC
Sunda porcupine	<i>Hystrix javanica</i>	LC
Cheetah	<i>Acinonyx jubatus</i>	I/VU
Honey badger	<i>Mellivora capensis</i>	I/LC
Caracal	<i>Lynx caracal</i>	I/LC
Marbled polecat	<i>Vormela peregusna</i>	III/VU
Sand cat	<i>Felis margarita</i>	III/LC
Pallas's cat	<i>Otocolobus manul</i>	III/LC
Steppe polecat	<i>Mustela eversmanni</i>	LC
Desert weasel	<i>Mustela e. heptneri</i>	LC
European badger	<i>Meles meles</i>	LC
Wolf	<i>Canis lupus</i>	LC
Golden jackal	<i>Canis aureus</i>	LC
Red fox	<i>Vulpes vulpes</i>	LC
Corsac	<i>Vulpes corsac</i>	LC
Afro-Asiatic wildcat	<i>Felis lybica</i>	LC
Hemiechinus	<i>Hemiechinus</i>	NA
Brandt's hedgehog	<i>Paraechinus hypomelas</i>	LC
Lesser white-toothed shrew	<i>Crocidura suaveolens</i>	LC
Piebald shrew	<i>Diplomesodon pulchellum</i>	LC
Saiga antelope	<i>Saiga tatarica</i>	NT
Goitered gazelle	<i>Gazella subgutturosa</i>	III/VU
Wild boar	<i>Sus scrofa</i>	LC
Urial	<i>Ovis vignei arkal</i>	III/VU
Desert hare	<i>Lepus tibetanus</i>	LC
European hare	<i>Lepus europaeus</i>	LC

2.4 Mammals listed in the Red Book or by IUCN

- **Etruscan shrew** (*Suncus etruscus* III LC). A rare, completely unstudied species; the peripheral part of its range is located in Kazakhstan. The smallest representative among mammals known on the globe. A nominal subspecies, *S. e. etruscus* Savi, inhabits Kazakhstan. The Etruscan shrew is distributed in Southern Europe, Arabia, Transcaucasia, Iran, Central Asia, India, Sri Lanka, Taiwan, the Malay Archipelago, the Philippines, Eastern and Southern Africa. In Kazakhstan it is known from the remains found in the remains of birds of prey from two places: the northern Chink of Ustyurt and the northern shore of the Aral Sea. It is confined to the foothills and lower belts of mountain ranges. Inhabits riparian thickets along the banks of lakes and rivers, occurs in areas of cultural landscape (gardens, vegetable gardens, along the roadsides of fields). Like other shrews, it is poorly adapted to burrowing, and in nature, in all probability, the animals make their nests in various natural shelters, crevices, and uninhabited burrows of others. It prefers to settle in damp places.
- **Cheetah** (*Acinonyx jubatus* I VU). Over the last 30-35 years, there is no reliable information on sightings of the Cheetah in this area. Probably, this red-listed species has already disappeared in Kazakhstan.
- **Honey badger** (*Mellivora capensis* I LC). Rare species. Occurs sporadically in a limited area. The only representative of the genus in the world fauna. In Kazakhstan - northern part of its area. Southern part of Mangystau oblast, where it occurs in Southern and South-Western Ustyurt and in Karynzhyrk depression. In South Ustyurt - deeply cut gorges of the Southern Chink, joints of kyr plains with chinks and ravines. In Southwestern Ustyurt - hilly plain, abundant with numerous karst formations - sinkholes, hollows, caves, with a great variety of vegetation complexes with obligatory participation of Haloxylon. In the Karynzhyrk depression there are flat areas bordering the Kenderli sor and Kayasanirek escarpments, crossed by long gully beds, overgrown with Xylosalsola, Caragana, Atraphaxis, Haloxylon.
- **Caracal** (*Felis caracal* I LC). Very rare in Kazakhstan. It was found on the Buzachi and Mangyshlak peninsulas, as well as near the Northern, Western and Southern cliffs of the Ustyurt Plateau¹¹. At least 20 caracals were known to have been hunted and additional 15 caracals were encountered in Mangystau region from 1951 to 1994¹².
- **Marbled polecat** (*Vormela peregusna* III VU). A rare animal with a rapidly decreasing range. It is widespread throughout Ustyurt and flat Mangyshlak, but very rare. It lives next to the large colonies of Great Gerbils (*Rhombomys opimus*) and less frequently in gophers' burrows, on which it mainly hunts. This animal is rarely found in fixed, slightly bumpy sands overgrown with saxaul, teresken, caragana, alternating with solonchak.
- **Sand cat** (*Felis margarita* III LC). Inhabitant of hilly and ridgy, fixed sands of different types. In Mangystau region it inhabits sands of Mangyshlak peninsula and separate sand massifs in Ustyurt.
- **Pallas's cat** (*Otocolobus manul* III LC). Rare species throughout the whole area. Apparently, this cat lives in small numbers on the chinks of Ustyurt and in the mountains of Mangyshlak in deserted low mountains with rocky outcrops and bushes in valleys and chinks. The area of wind turbine installation is not adjacent to their potential habitat.

¹¹ Sludsky A.A. Pallas' Manul // Mammals of Kazakhstan. Alma-Ata: Nauka, Vol. 3, part 2, 1982, (b), 208 – 217 pp.

¹² Bekenov A.B., Plakhov K.N. Numbers and distribution of gazelle and Ustyurt mouflon in the Mangyshlak region // 2nd country conference On the problem of Cadastre and accounting of fauna. Speech extract. Ufa, 1989, part 2, 140 – 141pp.

- **Saiga antelope** (*Saiga tatarica* **NT**). Not protected in Kazakhstan (population accounts for 90 % of the global Saiga population). The rest inhabits Russia and Mongolia. The numbers vary greatly from year to year. The main threats are diseases and thick snow and hard ice that blocks access to grass. In 2015, aero census by the Association for Conservation of Biodiversity in Kazakhstan (ACBK) registered 295 400 adults with 242 500 of them in Bekpakdala population. In May 2015, a viral infection reduced the populations to 108 300 adults with only 51 700 remaining in Bekpakdala population. According to spring 2023 aero census by ACBK, the adult population was 1 915 000 and by April 2024 reached its historic maximum of 2 833 600. In 2023, Saiga was added to the list of species, whose population growth require control to prevent damage to crops.
- **Goitered gazelle** (*Gazella subgutturosa* **III VU**). At present, the total number of gazelles on the territory of Mangystau region is estimated at 1800-2000 heads, i.e. at the level of 2002. As a rare species, it is included in the Red Book of Kazakhstan.
- **Urrial** (*Ovis vignei arkal* **III VU**). *Ovis vignei arkal* is a mountain animal. In conditions of Ustyurt they are typical inhabitants of chinks. They also live in the mountains and drainless depressions of Mangyshlak, the slopes of which resemble the chinks of Ustyurt.

2.5 Reptiles and Amphibians

Among the reptile species inhabiting the territory of the Mangystau region, only the Blotched Snake (*Elaphe sauromates*, LC) is included in the Red Book of the Republic of Kazakhstan (Shaimardanov and Lobachev, 2010). The Russian Tortoise (*Testudo horsfieldii*, VU) is a common, widespread and in some places quite numerous species in the territory of Mangystau. Nevertheless, it has the status of a Vulnerable according to the criteria of the Red List of IUCN.

No amphibians have been mentioned in the literature or encountered during the annual monitoring on the Project Areas. Only once European Green Toad (*Bufo viridis*) was heard singing on Enbek Project Area on 05.05.2024.

3 Results

3.1 Birds

Field data on the bird species observations at each of the VPs can be found in a separate Excel file, due to the big volume of data contained in it, and for facilitating data analysis. A summary of the results is given in Table 5.

During observation at 86 VPs and 418 km of routes, 30 769 birds of 107 species from 19 orders were recorded (Table 5). Of these, more than a quarter were residents (7 854), another half nested in Project Areas (15 662), and less than 10 % had nests in neighboring areas (2 871). Surprisingly, only 12 % of observed species migrated through the area (4 361).

3.1.1 The Project Areas Birds Sensitivity to Human Impact (based on Larks, Protected and Prey Birds)

To compare sensitivity of the Project Areas to human impact, skylarks density and diversity were used as this family was present at all the VPs throughout the year. The literature suggests that they are sensitive to environmental and climatic changes¹³. Additionally, prey birds such as eagles, hawks, and vultures, are at risk of colliding with turbine blades. These birds often fly at altitudes where turbine blades rotate, and they may be focused on hunting or scanning the ground, making them less aware of obstacles in their flight path. Furthermore, due to their limited numbers, protected species are also sensitive to human impacts, since a low number of fatalities can lead to serious implications for their populations.

In Rahym, the territory with the observed least human impact, the skylarks density was the highest among the areas. On the other hand, their density and diversity in Enbek and Talap were clearly affected by human activities that also change their habitats. The summary below, organized by the Project Areas, illustrates this observation.

Enbek: 10 702 birds of 17 orders and 89 species were recorded at 28 VPs and on 153 km of the routes between them. As the widths of observation corridors are 1 km for prey birds and 0.4 km for passerines (see methodology), the area surveyed along the routes was 153 km² for birds of prey and 61.2 km² for small passerines. The Passerines were most abundant (8 945) with skylarks as a background species (8 566). The density of skylarks was 140 birds/km². The following protected and prey birds were observed on this area: 6 Greater Flamingos (Category II according to Kazakhstan Red Book), 207 Demoiselle Cranes (V), 1 Little Bustard (II), 52 Macqueen's Bustards (II), 731 Black-bellied Sandgrouses (III), 94 Pallas's Sandgrouses (IV), 2 White-tailed Sea-Eagles (I), 5 Pallid Harriers, 2 Harriers, 7 Hen Harriers, 5 Montagu's Harriers, 7 Long-legged Buzzards, 9 Merlins, 2 Lesser Kestrels and 38 Common Kestrels.

¹³ Davidenko O.N. Ecological characteristic of the skylarks habitats in the desert steppes. PhD Thesis. Saratov, 2006

Talap: 3 118 birds of 9 orders and 49 species were recorded at 11 VPs and on 47 km of the routes between them. The area surveyed along the routes was 47 km² for birds of prey and 18.8 km² for small passerines. The Passerines were most abundant (2 520), with skylarks as a background species (2 294). The density of skylarks was 122 birds per km². The following protected and prey birds were observed on this area: 67 Pallas's Sandgrouses (IV), 381 Black-bellied Sandgrouses (III), 1 Hen Harrier, 4 Black Kites, 3 Long-legged Buzzards, 2 Saker Falcons (I), 1 Pallid Harrier, 1 Steppe Eagle (V) nest, 5 Golden Eagles (III), 2 Lesser Kestrels, 23 Eurasian Kestrels, 2 Short-eared Owls and 3 Little Owls.

Teren oi: 4 111 birds of 13 orders and 77 species were recorded at 13 VPs and 67 km of the route. The area surveyed along the routes was 67 km² for birds of prey and 26.8 km² for small passerines. The Passerines were most abundant (3 754) with skylarks as a background species (3 496). The density of skylarks was 130.4 birds per km². The density of hawks, falcons and owls (119 birds) was 0.9 birds per km², but more than half of them were Common Kestrels (63), which can be considered a background species (species that appear everywhere). Three noted hawk species are listed in the Red Book of the Republic of Kazakhstan: the Eastern Imperial Eagle (5 birds), Golden Eagle (2 birds) and White-tailed Sea Eagle (1 bird).

Kanagat: 6 023 birds of 13 orders and 88 species were recorded at 19 VPs and 80 km of the routes between the VPs. The area surveyed along the routes was 80 km² for birds of prey and 32 km² for small passerines. The Passerines were most abundant (5 399) with skylarks as a background species (4 851). The density of skylarks was 151.6 birds per km². 133 birds of hawks and owls were recorded, totaling 0.8 birds per km². Seventy-three McQueen's Bustards (Category II according to Kazakhstan Red Book) were observed throughout the year in Kanagat and between Kanagat and Teren oi area. A congregation of 187 Pallas's Sandgrouses (IV) were met here in December. The Black-Bellied Sandgrouse (III) was met on 2 occasions in December and April. Both birds are residents in the area. Five species of prey birds listed in the Red Book of Kazakhstan were recorded here: Steppe Eagle (14 birds); White-tailed Sea Eagle (6 birds); Saker Falcon (2 birds); Golden Eagle (15 birds) and Eastern Imperial Eagle (15 birds). The internationally protected Pallid Harrier (NT according to IUCN Red List) was met on 8 occasions (16 birds).

Rahym: 6 130 birds of 13 orders and 61 species were recorded at 12 VPs and 71 km of the routes between the VPs. The area surveyed along routes for birds of prey was 71 km² and 28.4 km² for small passerines. The Passerines were most abundant (4 907), with skylarks as a background species (4 750). The density of skylarks was 167.2 birds per km². Eighty-four hawks, falcons and owls were recorded, totaling 0.6 birds per km². Thirty-one birds were hawks listed in the Red Book of the Republic of Kazakhstan. These belonged to following species: Steppe eagle (10), Eastern Imperial Eagle (8), Short-toed Snake Eagle (1), Cinereous Vulture (3), Egyptian Vulture (5) and White-tailed Sea Eagle (4).

10 MacQueen's Bustards have likely nested in the Project Areas.

Table 5: Registered bird orders in Project Areas with number of species (and number of birds in brackets) recorded in each order. Birds of prey are shown in **bold**. Shading intensity indicates relevant diversity of each order.

Presence of bird orders	Project Areas				
	Teren oi	Kanagat	Rahym	Talap	Enbek
Galliformes (hen like)		1(3)		1(138)	2(9)
Anseriformes (goose like)	2(7)	3(9)	1(8)		1(3)
Phoenicopteriformes (flamingo like)					1(6)
Gruiformes (crane like)			1(9)		2(208)
Charadriiformes (shore birds)	12(93)	6(49)	1(2)	4(15)	13(87)
Otidiformes (bustard like)	1(1)	3(77)	2(70)		2(53)
Cuculiformes (cuckoo like)		1(1)			
Columbiformes (dove like)			1(1)	2(19)	2(50)
Pteroclidiformes (sandgrouse like)	2(54)	2(196)	2(999)	3(451)	2(825)
Caprimulgiformes (nighthawk like)			1(4)		1(1)
Apodiformes (swift like)	1(15)	1(1)		2(23)	1(51)
Gaviiformes (gavia like)	1(3)				
Suliformes (flap legged)	1(3)				1(32)
Pelicaniformes (pelican like)	1(7)	2(4)	1(2)		1(4)
Accipitriformes (hawk like)	1(4)	3(8)	4(4)	3(8)	2(12)
Strigiformes (owl like)	1(3)	1(4)	2(8)		4(22)
Bucerotiformes (horny nose like)	1(16)	1(36)	1(9)	1(11)	4(109)
Falconiformes (falcon like)	12(111)	18(165)	12(80)	8(38)	9(77)
Passeriformes (sparrow like)	41(3795)	46(6162)	32(5037)	26(2548)	41(9155)

3.1.2 Expected Birds Mortality

Birds' mortality can be calculated using Scottish Natural Heritage Guidance ¹⁴. It provides a methodology recognized by the international finance institutions and allows comparison of the results with the industry statistics. However, to use it, all the windfarm area must be covered with observation points. At this time, and using the results from the previous calculations, it is possible to say that the number of birds observed in the risk window is very low.

Moreover, out of the 586 birds that flew in the risk window, 218 were passerines. From 34 birds from species listed in the Red Book of Kazakhstan, 27 were migratory.

The total number of seconds that a particular species spent in the risk window shown in Table 6 relates to the probability of this species being hit by the blade, while the number of birds and its protection status relates to impact severity. The following most risky occurrences should be noted:

- MacQueen's bustard entered the risk window on 11 occasions (17 birds) through the year at 3 areas (Kanagat, Rahym, Enbek), while only one Little Bustard was noted in the risk window at a VP in Rahym in April 2024;
- Steppe Eagle entered the risk window on 16 occasions in spring and autumn migration but in Kanagat, Rahym and Teren oi areas only. It was also noted at one VP at Talap and Enbek, respectively, but above the risk window;

¹⁴ Scottish Natural Heritage Guidance Wind farms and Birds: Calculating a Theoretical Collision Risk Assuming no Avoiding Action. 2000

- The resident Black-Bellied Sandgrouse entered the risk window for 10-30 seconds only but on 90 occasions.
- Pallas's Sandgrouse entered the risk window on 27 occasions for 9-17 seconds but a flock of 180 birds entered the risk window in December 2023, increasing considerably the risk for this species.

A large flock of Demoiselle Crane flew 100 m above the risk window of one VP in Enbek on 29.03.24 for 15 seconds. This flock could descend into the risk window in unfavorable weather conditions but the mortality calculation methodology does not account for such events.

Table 6: Birds in the risk window noticed during the field observations from 18.10.2023 to 21.10.2024. Kazakhstan Red Book species are shown in **red** and prey birds in **bold**. Birds that flew above the risk window but could descend in unfavourable weather conditions are *shaded in grey*.

Latin Name	Common Name	No. of Birds	In risk window, seconds
<i>Neophron percnopterus</i>	Egyptian vulture	3	60
<i>Aquila chrysaetos</i>	Golden eagle	11	174
<i>Aquila heliaca</i>	Eastern imperial eagle	15	360
<i>Aquila nipalensis</i>	Steppe Eagle	36	565
<i>Aquila sp.</i>	Eagle	3	24
<i>Haliaeetus albicilla</i>	White-tailed Sea-Eagle	5	98
<i>Hieraaetus pennatus</i>	Booted eagle	1	20
<i>Falco columbarius</i>	Merlin	5	109
<i>Falco naumanni</i>	Lesser Kestrel	67	2 010
<i>Falco cherrug</i>	Saker Falcon	2	20
<i>Falco subbuteo</i>	Eurasian hobby	1	5
<i>Falco tinnunculus</i>	Common kestrel	22	552
<i>Accipiter nisus</i>	Sparrowhawk	2	30
<i>Milvus migrans</i>	Black kite	7	180
<i>Circaetus gallicus</i>	Short-toed Snake-Eagle	1	20
<i>Buteo buteo</i>	Common buzzard	1	8
<i>Buteo rufinus</i>	Long-legged buzzard	30	709
<i>Circus cyaneus</i>	Hen Harrier	9	278
<i>Circus macrourus</i>	Pallid harrier	6	80
<i>Circus pygargus</i>	Montagu's harrier	3	41
<i>Circus sp.</i>	Harrier	1	30
<i>Apus apus</i>	Common swift	30	90
<i>Apus melba</i>	Alpine swift	1	60
<i>Ardea cinerea</i>	Grey heron	7	70
<i>Ardea purpurea</i>	Purple heron	5	75
<i>Chlamydotis macqueenii</i>	MacQueen's bustard	17	295
<i>Anthropoides virgo</i>	Demoiselle crane	150	2250
<i>Tetrax tetrax</i>	Little bustard	1	20
<i>Fringilla coelebs</i>	Eurasian Chaffinch	1	30
<i>Fringilla montifringilla</i>	Brambling	8	150
<i>Phoenicopterus roseus</i>	Greater Flamingo	3	60
<i>Phoenicurus ochruros</i>	Black Redstart	1	60
<i>Egretta alba</i>	Great egret	2	30
<i>Coturnix coturnix</i>	Common quail	1	20

Latin Name	Common Name	No. of Birds	In risk window, seconds
<i>Anas crecca</i>	Eurasian teal	7	70
<i>Anas platyrhynchos</i>	Mallard	2	22
<i>Anas querquedula</i>	Garganey	2	30
<i>Anas strepera</i>	Gadwall	5	75
<i>Cygnus olor</i>	Mute swan	2	20
<i>Granativora bruniceps</i>	Red-headed bunting	1	8
<i>Himantopus himantopus</i>	Black-winged stilt	60	900
<i>Larus ridibundus</i>	Black-headed Gull	3	60
<i>Phalacrocorax carbo</i>	Great cormorant	10	168
<i>Phalaropus lobatus</i>	Red-necked phalarope	5	100
<i>Pterocles alchata</i>	Pin-tailed sandgrouse	1	5
<i>Pterocles orientalis</i>	Black-Bellied Sandgrouse	1070	15 636
<i>Sterna hirundo</i>	Common Tern	10	175
<i>Syrrhaptes paradoxus</i>	Pallas's Sandgrouse	431	4629
<i>Tringa glareola</i>	Wood sandpiper	13	5
<i>Upupa epops</i>	Eurasian hoopoe	3	70
<i>Columba livia</i>	Rock dove	12	212
<i>Corvus corax</i>	Common raven	7	168
<i>Corvus cornix</i>	Hooded crow	32	960
<i>Corvus frugilegus</i>	Rook	20	600
<i>Alaudidae sp.</i>	Lark	707	38171
<i>Alauda arvensis</i>	Eurasian Skylark	38	428
<i>Calandrella brachydactyla</i>	Greater short-toed lark	14	10 931
<i>Calandrella rufescens</i>	Lesser Short-toed Lark	777	1 318 002
<i>Alaudala cheleensis</i>	Asian short-toed lark	24	259 200
<i>Eremophila alpestris</i>	Horned lark	23	253
<i>Galerida cristata</i>	Crested lark	1	8
<i>Melanocorypha bimaculata</i>	Bimaculated Lark	46	281 020
<i>Melanocorypha calandra</i>	Calandra Lark	448	500 683
<i>Melanocorypha leucoptera</i>	White-winged lark	17	149
<i>Melanocorypha yeltoniensis</i>	Black Lark	88	1210

3.2 Bats

The survey of bats was started on 18.03.24 and continued until 21.10.24. In the course of the survey, one mast with the detector was stolen and another mast and the detector got damaged by camels. Despite bat detector use training of the involved zoologists, further problems were encountered due to improper setup and maintenance of the detectors, which led to data gaps in the initial bat survey. A gap filling monitoring is therefore ongoing since April and will continue until October 2025.

No bats were detected visually or reported by the local residents. One bat was recorded with a walk-by Wildlife Acoustics bat detector in September 2024 at night at M28 (Enbek), 12 km from the Karagie Depression.

Analysis of the passive bat detectors data in the Kaleidoscope software showed that from the 11 points where records were obtained in 2024 (Table 7), bats were identified at 6 of them. The largest number of passages was at the VP M27 near the Karagie Depression cliff. There, 59 bats passages were recorded in 20 nights of the summer and 120 passages in 9 nights of the autumn. Sixty-one passages were also recorded at the VP Z3 in 10 nights of the autumn. Much less were recorded at the VPs M17, M19 and M23 and only 2 passages over 22 nights at the VP U5.

Table 7: The passive bat detectors data collected from the vantage points. The highest results are shown in **bold**.

Nights recorded/Number of bat calls				Number of records						Max. active Recording hours		
	Spring (18.03-31.05)	Summer (01.06-31.08)	Autumn (01.09-12.09)	Spring		Summer		Autumn		Spring	Summer	Autumn
				FS	ZC	FS	ZC	FS	ZC			
B17	19/0			35						0,1		
U5	37/0	22/2		214		187				0,9	0,8	
U7/9		41/0					336				1,4	
U11			3/0					501				2,1
U13	37/0			6						0,02		
Z3			10/ 61					147	147			0,6
M17		43/6				501					2,1	
M19		33/9				8818					36,7	
M21		2/0					147				0,6	
M23		33/8				1	13652				56,9	
M27		20/ 59	9/ 120			216		97			0,9	0,4

FS/ZC Full spectrum or zero crossing recordings¹⁵. Maximum active recorded hours is derived by multiplying the max number of records by 15sec maximum recording length =0,0042 hours

3.3 Mammals (Excluding Bats)

In total three protected mammal species (according to Kazakh regulation) have been recorded in the Project Areas: Honey Badger, Caracal and Goitered Gazelle. Signs of presence of the Honey Badger were found on 39 occasions in all areas albeit more in Teren oi, Kanagat and Rahym. Camera traps placed along the border east of Rahym area by a wildlife research project also fixated 2 badgers. Tracks attributed to two Caracals were found twice by two observers: once in February at Kanagat vantage point B3 and again in July in Teren oi at K6. The Goitered Gazelle was sighted on 54 occasions in the Project Area, mostly in small herds ranging from three to fourteen animals. Pairs were recorded four times, single gazelles three times, and one herd consisted of 30 gazelles. Sightings were equally divided between Rahym (27) and Kanagat (27) Project Areas, with tracks and droppings observed 18 times in all other Project Areas, including two instances at the Talap Project Area cliffs on 01.08.24.

¹⁵ zero crossing is a simple method for estimating frequency primarily used for basic tone detection, while full spectrum analysis provides a detailed and comprehensive frequency examination of a signal, suitable for more complex signal processing tasks. Both are suitable methods for the collection of bat call data.

Two found borrows were thought to belong to an Old-World Porcupine but this was not confirmed.

Table 8: Mammals and reptiles noticed during the field observations from 18.10.2023 to 21.10.2024. The protected species (according to Kazakh regulation) are shown in **red**, species of concern in **bold** and species whose presence was not confirmed are shaded in **grey**

Name	Scientific name	Quantity
African wildcat	<i>Felis lybica</i>	3
Bat	<i>Microchiroptera</i>	1
Caracal	<i>Caracal caracal</i>	2
Cheetah?	<i>Acinonyx jubatus</i>	1
Corsac	<i>Vulpes corsac</i>	> 17
European badger	<i>Meles meles</i>	1
Field mouse	<i>Arvicolinae sp.</i>	Few
Gebril	<i>Gebrillinae</i>	Colonies
Goitered gazelle	<i>Gazella subgutturosa</i>	> 443
Golden jackal	<i>Canis aureus</i>	> 3, sporadic
Great gerbil	<i>Rhombomys opimus</i>	> 11, colonies
Great jerboa	<i>Allactaga major</i>	11
Grey hamster	<i>Cricetulus migratorius</i>	Many
Ground squirrels	<i>Spermophilus sp.</i>	> 69
Hedgehog	<i>Erinaceidae sp.</i>	> 23
Honey badger	<i>Mallivora capensis</i>	> 9
Indian crested porcupine?	<i>Hystrix leucura</i>	1
Jerboa	<i>Pygeretmus sp. Allactaga sp. Stylodipus sp.</i>	> 30
Large jerboa	<i>Allactaga sp.</i>	Sporadic
Meriones	<i>Meriones erythrourus</i>	1
Mustelidae	<i>Mustelidae sp.</i>	> 1, sporadic
Northern mole vole	<i>Ellobius talpinus</i>	> 15, colonies
Old World porcupine?	<i>Hystricidae</i>	2 (burrows)
Polecat	<i>Polecat sp.</i>	Sporadic
Red fox	<i>Vulpes vulpes</i>	> 69
Russet ground squirrel	<i>Spermophilus major</i>	4
Saiga antelope	<i>Saiga tatarica</i>	Few
Small five-toed jerboa	<i>Allactaga elater</i>	6
Small mammals		Many burrows
Steppe polecat	<i>Mustela eversmanii</i>	2
Tolai hare	<i>Lepus tolai</i>	> 169
Weasel	<i>Mustela sp.</i>	Droppings
Wolf	<i>Canis lupus</i>	Many
Yellow ground squirrel	<i>Spermophilus fulvus</i>	26

3.4 Reptiles and Amphibians

No amphibians were encountered over the monitoring period. Singing of European Green Toad was once noticed on May, 2024 in Enbek area but it was not observed visually and was not confirmed by a second observation.

The internationally protected Central Asian Tortoise was abundant in all the observation areas. Although visually it was noted only on around 50 occasions, in total there were 200 encounters of tortoises, borrows, droppings and tracks. Steppe Agama was the second in number but all records were visual.

Table 9: Reptiles and Amphibians noticed during the field observations conducted from 18.10.2023 to 21.10.2024.

Name	Scientific name	Quantity
Central Asian tortoise	<i>Agrionemys horsfieldii</i>	>354
Steppe agama	<i>Trapelus sanguinolentus</i>	160
Agama	-	79
Toadhead agama	<i>Phrynocephalus sp.</i>	131
Lizard	<i>Lacertilia sp.</i>	103
Sunwatcher toadhead agama	<i>Phrynocephalus helioscopus</i>	48
Central Asian racerunner	<i>Eremias velox</i>	39
Central Asian toadhead agama	<i>Phrynocephalus guttatus</i>	4
Snake	<i>Serpentes</i>	5
Eremias	<i>Eremias</i>	3
Gebril	<i>Gekkonidae</i>	2
Arrow snake	<i>Psammophis lineolatus</i>	2
Dwarf sand boa	<i>Eryx miliaris</i>	1
Sheltopusik	<i>Pseudopus apodus</i>	1
Dwarf sand boa	<i>Eryx miliaris</i>	1
European green toad	<i>Bufo viridis</i>	1 (Voice)

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