

Dzhankeldy 500MW Wind Farm Republic of Uzbekistan



Environmental and Social Impact Assessment Volume 4 – Appendices: Part C

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APPENDIX C-1: OHTL TERRESTRIAL ECOLOGY REPORT

DZHANKELDY TO BASH OHTL – BIODIVERSITY REPORTS – DIGITAL APPENIDIX

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1. Botanical survey report
2. Interim report of the VP bird monitoring
3. Final report of the VP bird monitoring
4. Bat roost search
5. Mammal survey
6. Herpetological survey report
7. Invertebrates report

Botanical survey report

Report Title	Botanical survey
Scope	BOTANY
Areas Covered	DZHANKELDY WF / DZHANKELDY TO BASH OHTL / BASH WF / BASH TO KARAKOL OHTL
Seasons Covered	SPRING 2021 / SUMMER 2021
Notes	

Botanical survey

**BASH WIND FARM PROJECT
DZANKELDY WIND FARM PROJECT**

CLIENT: 5 CAPITALS

Date: June 2021

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1. Aims and objectives

In accordance with TOR, the main tasks of expert-botanist are following:

- carrying out a field botanical survey at springtime and summer (April and early June) and processing of field data; particular attention should be given to the proposed turbine locations and any areas where new roads can be constructed;
- analysis of any previous botanical surveys and other available data (publications, reports, etc.) compared with the results of the field survey conducted in 2021;
- detailed description and GIS-based mapping of habitat types present within the project sites, compilation of Habitat map and LULC (Land Use – Land Cover) map;
- compilation of the check-list of plant species recorded within the project site (in particular, threatened species included in the Red Data Book of Uzbekistan and/or the IUCN Red List);
- reporting.

2. Background

2.1. Project area

The project area is situated in south-western part of the desert Kyzylkum, in Gizhduvan and Peshku administrative districts of the Bukhara Province of Uzbekistan, and consists of two sites and power lines between these two sites and Karakul substation (Figure 1). The distance between two sites is about 90 km. The 1st project site named “Dzhankeldy” covers an area of 26x20 km in the western part of insular low mountains Kuldzhuktau, in surroundings of the village Dzhankeldy. Within this area, preliminary locations of 125 wind turbines and 10 vantage points for the ornithological survey have been selected (Figure 2). The 2nd site named “Bash” is located in surroundings of depression Ayakagytm, to the east of the lake Ayakagytm, and covers an area of 18x18 km; locations of 105 wind turbines and 9 bird survey plots have been selected there (Figure 3).

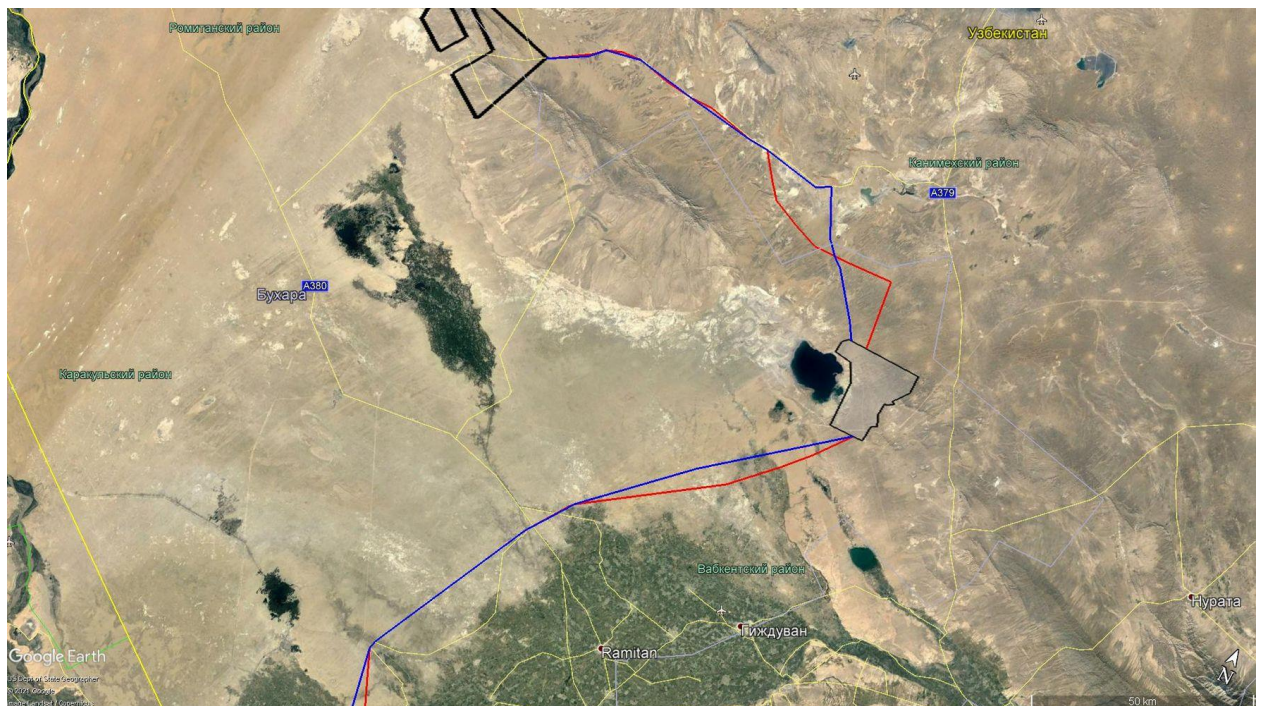


Figure 1. Project sites and proposed power lines

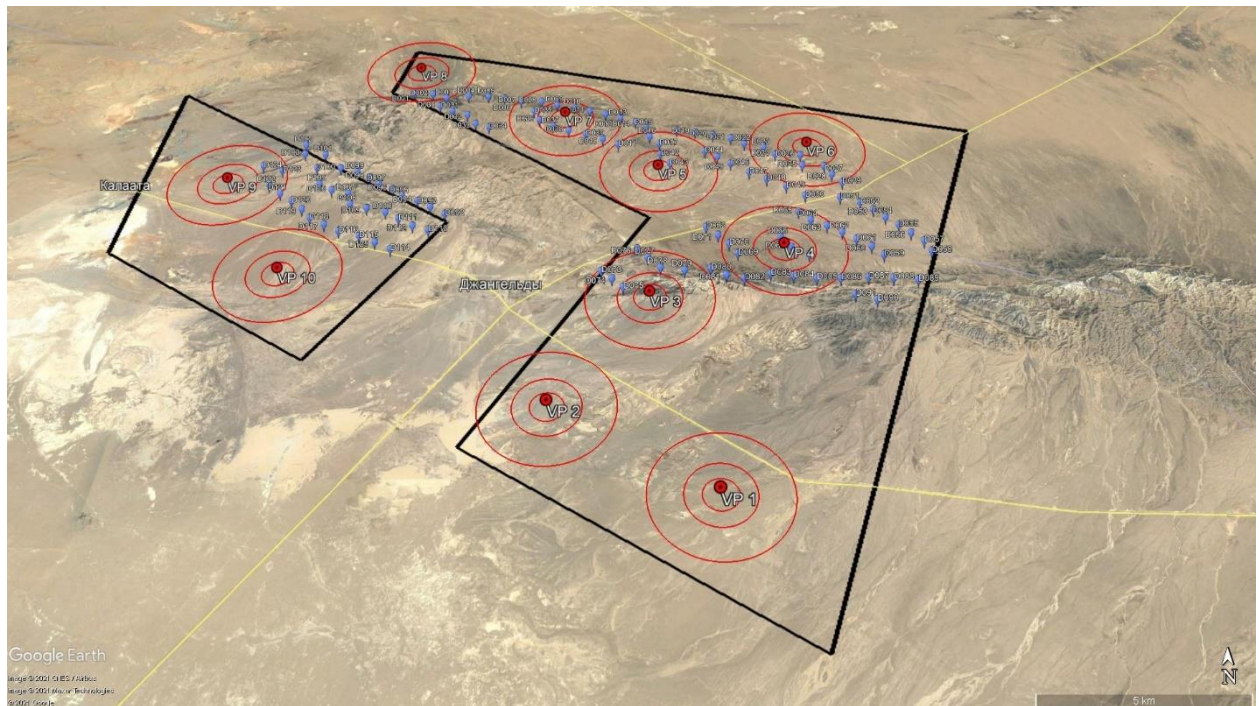


Figure 2. Project site “Dzhankeldy”. Symbols: VP 1–VP 10 – ornithological vantage points, D001–D125 – proposed turbine locations.

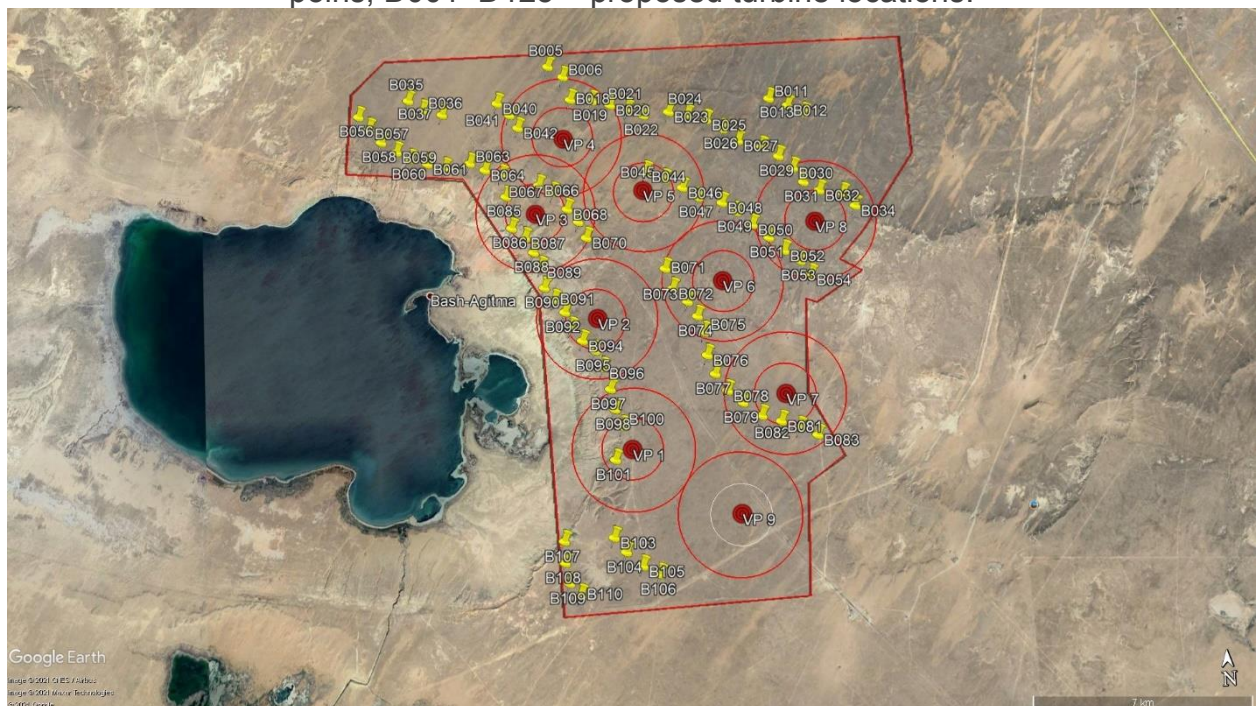


Figure 3. Project site “Bash”. Symbols: VP 1–VP 9 – ornithological vantage points, B005–B110 – proposed turbine locations.

2.2. Literature review

The flora of the south-western Kyzylkum has been well studied. The history of botanical research in this region has about 200 years. The first scientific data on landscapes and plant diversity of this region have been obtained in the 19th Century by European and Russian naturalists who took part in several Russian diplomatic missions to Bukhara Khanate (E.A. Ewersmann and G. von Meyendorff in 1820–1821, and A. Lehmann in 1841–1842, A.P. Khoroshkhin in 1872, M.N. Bogdanov and F.I. Lobyshevich in 1873, N. Barbot-de-Marni in 1874, and others). In 1887–1903, Russian botanist

Vladimir Lipsky performed large-scale expeditions in Central Asia, including surroundings of Bukhara, and provided one of the first scientific descriptions of the flora and vegetation, as well as published detailed history of botanical research in this region in the 19th Century and early 20th Century in his work “Flora of Central Asia, i.e. Russian Turkestan and Bukhara and Khiva Khanates” (1902–1905). Many naturalists and officials of Russian Empire, who worked in Central Asia or visited this region in the late 19th and early 20th Century, also collected herbarium specimens and contributed to the accumulation of floristic data. E.g., Nikolay Korolkow, general of Russian army and naturalist-amateur collected herbarium, living plants, seeds and bulbs on the way from Tashkent to Khiva during the Khivan campaign of 1873, and sent these materials to the Imperial Botanical Garden in Saint Petersburg. Herbarium collections made by above mentioned pioneers of the study of Central Asian flora laid the basis for our contemporary knowledge on the plant diversity of the great desert Kyzylkum.

In 1908–1917, the Migration Department of Russian government organized a number of expeditions for investigation of soils and vegetation of Central Asia within the framework of colonization of this region. Thus, in 1913–1916, zoologist N.A. Zarudny and botanists E.P. Korovin and M.G. Popov studied some areas of the south-western Kyzylkum. As a result of these large-scale surveys, a huge amount of herbarium was collected, numerous new taxa and a diversity of plant communities were described for the first time, the first geobotanical maps were compiled, and the outlines of the theory of the genesis of Central Asian flora and vegetation were laid.

In 1918, the Turkestan State University was established in Tashkent (it was given a name of Central Asian State University from 1923 to 1960, Tashkent State University in 1960–2000, and National University of Uzbekistan since 2000). Several prominent botanists including M.G. Popov, E.P. Korovin, M.V. Kultiasow and A.I. Vvedensky began to work there since 1920. The department of botany and geography headed by Mikhail Popov, the herbarium headed by Aleksei Vvedensky and the Institute of Soil Science and Geobotany headed by Nikolay Dima have been created at the university in the initial period. Since early 1920s, botanists of the University performed field surveys covering the entire territory of Central Asia and focused mainly on the inventory of the flora, investigation of the vegetation cover and identification of plant resources. In the 1930–1940s, geobotanical studies (first of all, survey of pastures) were also carried out in different regions of Uzbekistan by special expeditions of the Committee of Sciences (which in 1940 was reorganized into the Academy of Sciences of Uzbekistan); the results were used for creation of the first geobotanical map of Uzbekistan. As a result of these expeditions, dozens of new species and genera were found and described from different regions of Central Asia.

In 1934–1936, the Kenimekh complex expedition led by prominent expert in phytosociology I.I. Granitov explored the south-western part of Kyzylkum, Kenimekhchul and the western piedmonts of the Nuratau Mountains. The mission of this expedition was a comprehensive study the climate, soil, vegetation, flora and fauna of this region. The Kenimekh expedition collected extensive data were on the natural conditions and biodiversity of the territory, including a huge amount of herbarium (currently kept at the National Herbarium of Uzbekistan, TASH).

After the completion of the Kenimekh expedition, I.I. Granitov continued studies of the flora and vegetation of south-western Kyzylkum; the results of his long-term research have been summarized in a 2-volume monograph “Vegetation cover of the South-Western Kyzylkum” (1964, 1967). I.I. Granitov provided the list of flora with 580 species from 290 genera and 55 families (272 species of them were reported for relic mountains Kuldzhuktau). Until now, this work remains the most fundamental publication on the plant diversity of south-western Kyzylkum. The monograph contains an essay of the history of botanical research, description of the physiographical and environmental conditions of

the region, provides the analysis of the flora and vegetation, and a scheme of phytogeographical division of the territory, as well as the assessment of the influence of humans and wildlife on the vegetation.

A significant amount of material was collected by the subsequent geobotanical expeditions of the 1950–1970s focused mainly on the investigation of rangelands. At that period, the specialists of the Institute of Botany of the Academy of Sciences of the Uzbek SSR experimented there with different methods of pastures restoration and improvement. Several prominent botanists from Uzbekistan and Russia, as T.A. Adylov, V.P. Botschantzev, R.V. Kamelin, E.V. Kljuykov, M.G. Pimenov, U.P. Prатов, M.I. Pryakhin, A.I. Vvedensky, I.F. Momotov, A.D. Lee, P.K. Zakirov and others performed numerous field expeditions in Kyzylkum. These scientists made a significant contribution to the knowledge of the flora and vegetation of this region.

The most important publications of the second half of the 20th Century containing the data on flora and vegetation of the south-western Kyzylkum also are the two-volume monograph by K.Z. Zakirov “Flora and vegetation of the Zeravshan River basin” (1955, 1961) and the monograph of his son P.K. Zakirov “The botanical geography of Nuratau Range and low mountains of Kyzylkum” (1971). K.Z. Zakirov compiled a summary checklist (with reference to herbarium collections) of 2588 plant species recorded for the entire Zeravshan River basin covering several phytogeographical regions of Mountain Central Asian and Turan provinces, among them, 320 species have been cited for lower reaches and ancient delta of Zeravshan River with adjacent areas of south-western Kyzylkum. PK Zakirov published a detailed description of the vegetation and a summary checklist of the flora of all relic mountains of Kyzylkum and the range Nuratau; it contains 983 species of vascular plants belonging to 312 genera and 65 families, 679 species of them recorded for relic mountains. Among them, 452 species from 233 genera and 46 families have been listed for the all insular low mountains of Central and South-Western Kyzylkum, including Kuldzhuktau.

“Weed vegetation of the Bukhara region and measures of its control” (Guzairov, 1951, 1968), I.F. Momotov “Theoretical foundations and methods of phytomelioration of desert pastures in south-western Kyzylkum” (Momotov, 1973) and “Guide to a botanical excursion to the southern edge of Western Kyzylkum” (Saidov et al., 1975) should also be mentioned among the important publications on the flora and vegetation of this area.

Several new botanical studies have been performed in the south-western Kyzylkum and Bukhara Oasis since 2000 (Tojibaev, Beshko, 2007; Khassanov et al., 2011; Esanov, 2017, 2019; Abduraimov, 2017; Akhmedov, 2018; Shomurodov et al., 2018; Shomurodov, 2018, etc.). In particular, F.O. Khassanov et al. (2011) estimated the entire flora of the Kyzylkum desert to be no less than 1043 species with 41 endemic and 11 sub-endemic species and noted that most of endemic species are localized in the relic mountains. However, the most actual data show that some species previously considered to be endemic to Kyzylkum have been found in neighboring areas and should be regarded as sub-endemics (Tojibaev et al., 2017).

The most important results of botanical research in the project region are summarized in recently published monographs, “Coenopopulations of rare and endangered plant species of remnant low mountains of Kyzylkum” (Shomurodov et al., 2018) which contains detailed data on populations of 12 threatened species, “Inventory of the flora of Uzbekistan: Navoi Province” (Tojibaev et al., 2019), and “Inventory of the flora of Uzbekistan: Bukhara Province” (Tojibaev et al., 2020). The “Inventory of the flora of Uzbekistan: Bukhara Province” contains a checklist of 764 species vascular plants growing in the wild in this large administrative region. The following information for each species is provided: life form, habitat, distribution within the Bukhara Province, conservation status, and economic use. Among them, 543 species are listed for the desert plain of Kyzylkum, 546 species – for lower reaches and ancient delta of Zeravshan

River (Bukhara Oasis), and 463 species are recorded for the remnant low mountains Kuldzhuktau; 25 species are red-listed at the national level (15 of them grow in the Kuldzhuktau Mountains); descriptions, photographs and distribution maps for threatened plant species are included.

Fundamental taxonomical treatments, as “Flora of the U.S.S.R.” (1934–1964, in 30 volumes), “Flora of Kazakhstan” (1956–1966, in 9 volumes), 1st edition of the “Flora of Uzbekistan” (1941–1962, in 6 volumes), “Conspectus Florae Asiae Mediae” (1963–2015, in 11 volumes), and recently published first three volumes of the 2nd edition of the “Flora of Uzbekistan” (2016, 2017, 2019), should also be mentioned among the most important sources of information on the plant diversity of the project zone. In the new “Flora of Uzbekistan” the treatment of 15 families with 58 genera and 375 species performed to date (8.6% of the national flora); for each species, herbarium specimens are cited and a distribution map based on their georeferencing is given. “Vegetation of Central Asia and South Kazakhstan” by E.P. Korovin (1934; 1961, 1962), “Vegetation cover of Uzbekistan and the ways of its practical use” (1971–1984, in 4 volumes), “Rangelands of the arid and semi-arid zones in Uzbekistan” (Gintzburger et al., 2003) and “Botanical geography of Kazakhstan and Middle Asia” by E.I. Rachkovskaya et al. (2003) also contains useful data about the flora and vegetation of the south-western Kyzylkum and their genesis. In particular, the general patterns of vegetation and a description of the main plant communities of Kyzylkum are given in the 2nd volume of the “Vegetation cover of Uzbekistan” (1973). The “Botanical Geography of Central Asia and Kazakhstan” by Rachkovskaya et al. (2003) describes in the main plant formations of the whole desert zone of Central Asia.

A huge amount of herbarium material collected from the south-western Kyzylkum and Bukhara Oasis during about two centuries is kept mainly in the National Herbarium of Uzbekistan in Tashkent (TASH), Herbarium of the Komarov Botanical Institute in St. Petersburg (LE), Herbarium of the Lomonosov Moscow State University (MW).

The list of plants of the Bukhara Province included in the Red Data Book of Uzbekistan (2019) and a map of their distribution in the project region (Figure 4) is presented below.

1. *Acanthophyllum cyrtostegium* Vved. UzbRDB Category 3. The Kuldzhuktau Mountains and their piedmonts. National endemic, endemic to south-western Kyzylkum and Zirabulak-Ziadin Mountains.

2. *Astragalus adylovii* F.O. Khass., Ergashev & Kadyrov. UzbRDB Category 1. The Kuldzhuktau Mountains. National endemic, endemic to Kuldzhuktau Mountains.

3. *Calligonum mattheianum* Drobow. IUCN EN B2ab(iii,v). UzbRDB Category 1. Sundukli Sands. Endemic to sandy deserts of southern part of Central Asia.

4. *Calligonum molle* Litv. IUCN EN B2ab(iii,v). UzbRDB Category 2. Sundukli Sands. Endemic to southern Central Asian deserts.

5. *Calligonum paletzkianum* Litv. IUCN (VU B2ab(iii,v). UzbRDB Category 3. Sundukli Sands. Endemic to Irano-Turanian deserts.

6. *Calligonum zakirovii* (Khalk.) Czerep. UzbRDB Category 1. The Kuldzhuktau Mountains and their piedmonts. National endemic, endemic to relic mountains of Kyzylkum.

7. *Climacoptera amblyostegia* (Botsch.) Botsch. UzbRDB Category 2. Lower reaches and ancient delta of Zeravshan River.

8. *Climacoptera merkulowiczii* (Zakirov) Botsch. UzbRDB Category 2. Lower reaches and ancient delta of Zeravshan River. National endemic.

9. *Eremosparton flaccidum* Litv. UzbRDB Category 2. Sands of Kyzylkum. Endemic to sandy deserts of Central Asia.

10. *Eremostachys eriolarynx* Pazij & Vved. UzbRDB Category 1. South-western Kyzylkum, southern piedmonts of insular low mountains Kokchatau. National endemic, endemic to Kyzylkum.

11. *Ferula kyzylkumica* Korovin. UzbRDB Category 3. The Kuldzhuktau Mountains. National endemic, endemic to relic mountains of Kyzylkum with a disjunction in the Nuratau Mountains.

12. *Iris hippolyti* (Vved.) Kamelin. UzbRDB Category 1. Insular low mountains Kokchatau. National endemic, endemic to Kokchatau.

13. *Jurinea psammophila* Iljin. UzbRDB Category 3. The Kuldzhuktau Mountains and their piedmonts. National endemic, endemic to relic mountains of Kyzylkum.

14. *Lagochilus inebrians* Bunge. UzbRDB Category 3. The Kuldzhuktau and Kokchatau Mountains and their piedmonts. Endemic to western Pamir-Alay and adjacent areas including Kyzylkum, Karshi Steppe, valley of the river Zeravshan and Fergana valley.

15. *Lagochilus vvedenskyi* Kamelin & Zukerw. UzbRDB Category 3. The Kuldzhuktau Mountains and their piedmonts. National endemic, endemic to relic mountains of Kyzylkum.

16. *Lepidium subcordatum* Botsch. & Vved. UzbRDB Category 2. The Kuldzhuktau Mountains. National endemic, endemic to relic mountains of Kyzylkum and plateau Ustyurt.

17. *Oligochaeta vvedenskyi* (Popov) Tscherneva. UzbRDB Category 3. South-western Kyzylkum, Karnabchul. National endemic, endemic to Kyzylkum, Sundukli Sands and Karshi Steppe.

18. *Onobrychis tavernierifolia* Stocks ex Boiss. UzbRDB Category 1. The Kuldzhuktau Mountains and their piedmonts. Very rare species with fragmented range in Iran, Afghanistan and the Kuldzhuktau Mountains in Uzbekistan.

19. *Phlomoides aralensis* (Bunge) Salmaki (*Paraeremostachys aralensis* (Bunge) Adylov, Kamelin & Makhm.). UzbRDB Category 2. South-western Kyzylkum. National endemic, endemic to Kyzylkum desert.

20. *Phlomoides transoxana* (Bunge) Salmaki (*Paraeremostachys transoxana* (Bunge) Adylov, Kamelin & Makhm.). UzbRDB Category 2. South-western Kyzylkum. National endemic, endemic to Kyzylkum desert.

21. *Silene tomentella* Schischk. UzbRDB Category 2. The Kuldzhuktau Mountains. National endemic, endemic to relic mountains of Kyzylkum.

22. *Stipa aktauensis* Roshev. UzbRDB Category 2. The Kuldzhuktau Mountains. National endemic, endemic to relic mountains of Kyzylkum.

23. *Tulipa korolkowii* Regel. UzbRDB Category 3. Insular low mountains Kokchatau. Rare species of south-western Tien Shan and Pamir-Alay, Kokchatau is the most western site of distribution of this species.

24. *Tulipa lehmanniana* Merckl. UzbRDB Category 3. The Kuldzhuktau and Kokchatau Mountains and their piedmonts, south-western Kyzylkum, Karnabchul. Vulnerable species of Irano-Turanian deserts with decreasing range and populations.

25. *Tulipa micheliana* Th. M. Hoog. UzbRDB Category 3. Insular low mountains Kokchatau. Vulnerable species of Western Pamir-Alay and Kopetdag with decreasing range and populations.

Following species are endemic to the Kyzylkum desert: *Allium oxianum* F.O. Khass. et Tojibaev, *Allium rinae* F.O. Khass., Shomuradov & Tojibaev, *Astragalus adylovii* F.O.Khass., Ergashev & Kadyrov, *Astragalus centralis* Sheld., *Astragalus holargyreus* Bunge, *Astragalus kuldzhuktauense* F.O.Khass., Shomur. & Esankulov, *Astragalus leiophysa* Bunge, *Astragalus remanens* Nabiev, *Bryonia melanocarpa* Nabiev, *Calligonum zakirovii* (Khalk.) F.O. Khass., *Cleome quinquenervia* DC., *Convolvulus affanasevii* Luferov, *Cousinia juzepczukii* Tscherneva, *Cousinia dolichoclada* Juz.,

Cousinia sylvicola Bunge, *Cousinia umbilicata* Juz., *Diarrhron macrorhachis* (Pobed.) Kit Tan (*Dendrostellera macrorhachis* Pobed.), *Eremostachys eriolarinx* Pazij & Vved., *Eremurus korolkowii* Regel, *Evax arenaria* Smoljan., *Gagea deserticola* Levichev, *Jurinea psammophila* Iljin, *Lagochilus vvedenskyi* Kamelin & Tzukerv., *Lappula aktaviensis* Popov & Zakirov, *Lappula parvula* Nabiev & Zakirov, *Phlomoides aralensis* (Bunge) Salmaki, *Phlomoides transoxana* (Bunge) Salmaki, *Psylliostachys x androssovii* Roshkova, *Salsola androssovii* Litv., *Salsola angusta* Botsch., *Salsola deserticola* Iljin, *Scorzonera gageoides* Boiss., *Silene tomentella* Schischk., *Scrophularia rudolfii* F.O. Khass., Serekeeva & Kadyrov, *Stipa aktauensis* Roshev.

Sub-endemic species reported for south-western Kyzylkum are *Allium karakense* Regel, *Allium kysylkumi* Kamelin and *Ferula kyzylkumica* Korovin (fragmented range in relic mountains of Kyzylkum and western part of the Nuratau Mountains), *Calligonum matteianum* Drobow, *Calligonum molle* Litv. and *Eremosparton flaccidum* Litv. (sandy deserts of southern part of Central Asia), *Halimocnemis latifolia* Iljin (Kyzylkum and Karshi Steppe), *Cousinia sogdiana* Bornm. and *Oligochaeta vvedenskyi* (Popov) Tscherneva (Kyzylkum, Sundukli Sands and Karshi Steppe), *Lepidium subcordatum* Botsch. & Vved. (fragmented range in relic mountains Kyzylkum and plateau Ustyurt), *Jurinea derderioides* C. Winkl. and *Tulipa sogdiana* Bunge (Central Asian deserts), etc.

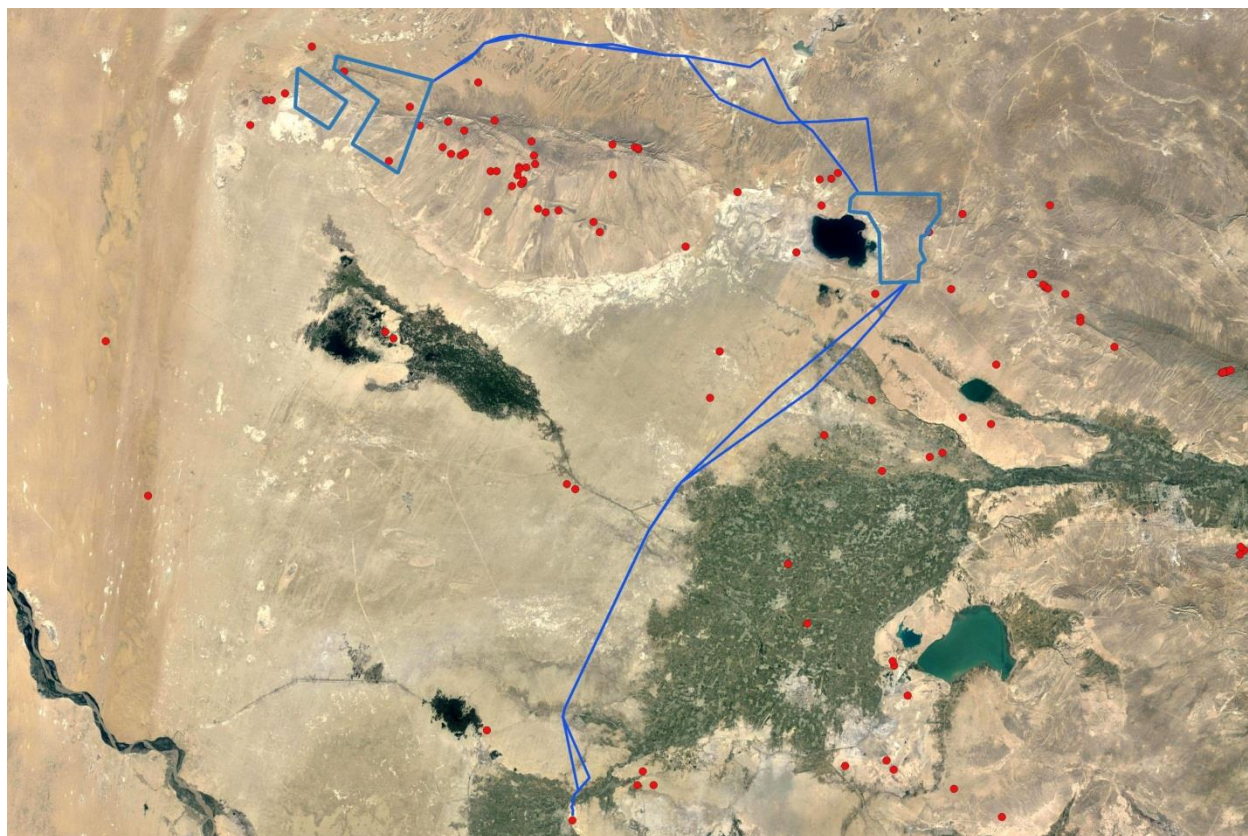


Figure 4. Distribution of nationally red-listed plants in the project region (according to “Inventory of the flora of Uzbekistan: Navoi Province”, 2019, and “Inventory of the flora of Uzbekistan: Bukhara Province”, 2020). Known locations of rare plants showed by red dots.

Since a number of threatened, endemic and restricted range plant species occurs in the project area, the Critical Habitat Assessment is required, according to IFC Performance Standard 6 (PS6) and EBRD Performance Requirement 6 (PR6).

An analysis of published data shows, that similar assessments of areas with high biodiversity conservation significance have been performed in Uzbekistan within the framework of UNDP-GEF project “Strengthening Sustainability of the National Protected

Area System by Focusing on Strictly Protected Areas” and CEPF project “Mountains of Central Asia Biodiversity Hotspot”. According to results of the first project published in the “Recommendations for protected areas system development in Uzbekistan” (Ismatov, 2013), 17 sites important for plant diversity were identified within Uzbekistan, among them, the insular range Kuldzhuktau was qualified as one of priority areas for conservation of diversity of natural landscapes, flora and fauna, and recommended for protected area. The second international project has been focused on the assessment of Key Biodiversity Areas within Mountains of Central Asia Global Biodiversity Hotspot using the KBA standards, and the region of south-western Kyzylkum was not included in this analysis (Mountains of Central Asia Biodiversity Hotspot, 2017).

At the global level, the screening of critical habitats was performed by UNEP-WCMC (2017) and Brauner et al. (2018). For Uzbekistan, potential critical habitats have been identified by authors mainly on the basis of assessment of Important Bird Areas (2008).

3. Materials and methods

The field studies were conducted 9–11 April, 12–20 May and 18–30 June 2021 by traditional methods of botanical survey commonly used for sampling and mapping of native non-forest vegetation, recognition of floristic composition and spatial patterns of plant communities (Field geobotany, 1959–1976; Granitov, 1980; Kent, 2011). All vantage points (bird survey circles) and the majority of proposed turbine locations within two project sites were inspected, as well as a strip about 100 m in width along the planned electric lines. The check-lists of plant species recorded for each project site were compiled.

Plant species were identified using special literature, as “Conspectus Florae Asiae Mediae” (1963–1993), “Flora of Uzbekistan” (1941–1963, 2016, 2017, 2019) and “Flora of USSR” (1934–1964). Available publications and online databases (Nikitin, 1983; IUCN/ISSG, 2014; CABI, 2017; Sennikov et al., 2018) were used for identification of alien species, while the Red Data Book of Uzbekistan (1984, 1998, 2006, 2009, 2019) and the IUCN Red List (www.iucnredlist.org) were used for identification of threatened species. Other relevant published data on flora and vegetation of the region also has been analyzed (listed below in References).

In the general check-lists and check-lists compiled for survey plots and habitat types, species are arranged in alphabetic order. Accepted names of species are provided in accordance with the online global databases Plants of the World Online (www.plantsoftheworldonline.org/), International Plant Names Index (www.ipni.org) and Catalogue of Life (www.catalogueoflife.org), as well as with recently published treatments of different taxonomical groups of the flora of Uzbekistan (Sennikov, 2016, 2017, 2019).

The draft habitat maps for “Bash” and “Dzhankeldy” project sites were created on the basis of visual interpretation of free satellite imagery from USGS Earth Explorer (<https://earthexplorer.usgs.gov/>), Google Earth and Bing Maps, a topographic map (1:100,000, available online for free at <http://loadmap.net/>) and a soil map of the Bukhara Province (Geographical atlas of Uzbekistan, 2012). QGIS 3.18 free software was used for habitat mapping. During the field survey, all habitat types were inspected; their descriptions, boundaries and character of land use have been clarified and corrected.

The structure of vegetation communities was described on 50x50 m geobotanical sample plots (squares) chosen in an area with homogeneous vegetation, representative for each habitat type, as well as in proposed turbine locations. For each sample plot, photographs of the landscape and vegetation were taken using a digital camera, and following data were recorded: location and physical environment (including GPS coordinates, elevation, topography, and soil type), state of vegetation, landuse type and disturbance factors (grazing, roads, etc.), plant association, canopy cover (%), canopy height, all plant species present at the plot, their cover and abundance, phenological stage and height.

Coordinates of populations of endemic, redlisted or alien plant species, number of individuals and area occupied by population also were recorded.

Species cover and abundance was determined using the Braun-Blanquet cover-abundance scale (1965) widely used in geobotanical and ecological studies as rapid visual assessment technique, but robust and highly repeatable, minimizing among-observer differences:

- + – occasional and less than 1% cover of the sample plot area;
- 1 – abundant with low cover, or less abundant but with higher cover, 1–5% of the sample plot area;
- 2 – abundant with >5–25% of the sample plot area, irrespective of the number of individuals;

3 – >25–50% cover of the sample plot area, irrespective of the number of individuals;

4 – >50–75% cover of the sample plot area, irrespective of the number of individuals;

5 – >75% cover of the sample plot area, irrespective of the number of individuals.

The relative abundance of each species also was assessed using the DAFOR scale: D = Dominant; A = Abundant, F = Frequent, O = Occasional, R = Rare.

The conservation status of plant species is given according the Red Data Book of Uzbekistan (2019). National categories of threatened plants are follows: 0 (probably extinct species) – corresponds to EX or EW categories of the IUCN Red List (www.iucnredlist.org), 1 (endangered, disappearing species) – meets CR or EN categories of IUCN, 2 (rare species) – meets VU category of IUCN and 3 (vulnerable, declining species) – corresponds to NT category of IUCN. To date, 5 editions of the Red Data Book of Uzbekistan have been published. The first (1984) included 163 plant species, the second (1998) – 301, the third (2006) – 302, the fourth (2009) – 321, and an actual, fifth edition (2019), includes 314 plant species.

IUCN Red List (www.iucnredlist.org) is unapplicable in our case because currently only 236 taxa (5.4%) of more than 4380 species recorded for the flora of Uzbekistan were assessed by IUCN, 16 species of them were included in the IUCN Red List as threatened (CR, EN and VU categories), and only 5 of them are red-listed at the national level. The rest 94.6% of species have not yet been assessed by IUCN and belong to NE category – Not Evaluated. 350 plant species of 112 genera are national endemics of Uzbekistan (including all endemics of relic low mountains of Kyzylkum), 137 of them are red-listed at the national level, and none of them assessed as threatened (CR, EN, VU) in the IUCN Red List.

As defined by the International Finance Corporation (IFC) Performance Standard 6 (PS6) and EBRD Performance Requirement 6 (PR6), critical habitats are areas with high biodiversity value, including (i) habitat of significant importance to Critically Endangered and/or Endangered species; (ii) habitat of significant importance to endemic and/or restricted-range species; (iii) habitat supporting globally significant concentrations of migratory species and/or congregatory species; (iv) highly threatened and/or unique ecosystems; and/or (v) areas associated with key evolutionary processes. Numerical thresholds have been defined for the first four critical habitat criteria (i.e., CR/EN species; endemic/restricted-range species; migratory/congregatory species; threatened and unique ecosystems); these thresholds are based on these published by IUCN in “A Global Standard for the Identification of Key Biodiversity Areas” (2016) and “IUCN Red List Categories and Criteria” (2012). For Criterion 5, there are no numerical thresholds.

Criterion 1 is triggered by species listed as CR or EN on the IUCN Red List, and nationally/regionally listed species assessed using similar criteria. Criterion 2 is triggered by habitats of significant importance for endemic or restricted-range species. Criterion 3 (migratory species) is unapplicable for plants. As for Criterion 4, unfortunately, the officially approved national list of highly threatened and/or unique ecosystems and habitats does not exist in Uzbekistan. But the National Biodiversity Conservation Strategy (1998), National reports on biodiversity conservation (2006, 2015) and other documents (Ismatov, 2013) indicated that the problem of conservation of all types of forest ecosystems (including shrublands) is a very critical issue in Uzbekistan. A specific legislation, management and forest protection measures are present at the national level. Forests and shrublands are key habitats for the conservation of many rare animals and plants in Central Asia. In the sandy desert, psammophilous shrublands and saxaul stands have essential importance for sand fixation and combat desertification. But these ecosystems are under serious threat from over-exploitation and over-grazing. Therefore, natural and planted desert “forests” must be taken into account.

4. Results of the field survey

4.1. Bash site

A total check-list of vascular plants recorded within the project site “Bash” during the field survey in April and June includes 49 species (Appendix 1). In June, the same species were found in each survey area, the only difference was their phenological stage (all ephemers and ephemeroïds were fruiting or dried). Following habitat types (map units) were identified for the “Bash” site:

4.1.1. Sandy and sandy-loamy desert plain

The field survey showed that the main habitat type in the western part of “Bash” area (to the west of railway) is sandy and sandy-loamy desert plain with flat and flat-wavy terrain, covered with native ephemeroïd-sagebrush (*Artemisia diffusa*, *Poa bulbosa*, *Carex subphysodes*) and saltwort-ephemeroïd-sagebrush vegetation (*Artemisia diffusa*, *Poa bulbosa*, *Carex subphysodes*, *Caroxylon orientale* (*Salsola orientalis*)) on sandy desert soil and sabulous-loamy grey-brown desert soil. *Ferula foetida* and *Iris songarica* are subdominants on local areas. There is no clear boundary between sandy and sandy-loamy desert plain, and between ephemeroïd-sagebrush and saltwort-ephemeroïd-sagebrush communities; thus, they can be combined into one type of habitat.

The plant species diversity is low (8 to 18 species). The canopy cover is 20–50%. The vegetation is more or less uniform (with local abundance of saltworts, *Ferula foetida* and *Iris songarica*). One moss species (*Tortula desertorum*) has been found in all plots; on some local areas it covers up to 5%. One nationally red-listed species, *Tulipa lehmanniana*, occurs sporadically within all territory of this habitat type, its abundance is R to O, population density varies from solitary specimens to 900–1000 per 1 hectare. Tulips were recorded mainly in April. In middle May and June, only solitary specimens were recorded because they finished the vegetation, and their aboveground part completely withered away.

The main type of land use is pasture; an impact of grazing is medium; several shepherds houses are situated in this territory. Local impact is connected with several ground roads, and with an underground gas pipeline that runs across the southern part of the project site.

Within this habitat type, following geobotanical sample plots were described.

B027, B028, B029, B030

40.671945 – 40.662653° N, 64.70655 – 64.727453° E, 315–333 m.s.l. Sandy desert plain with hilly-wavy terrain and native ephemeroïd-sagebrush vegetation (*Artemisia diffusa*, *Poa bulbosa*, *Carex subphysodes*) (Photo 1–3). 13 plant and 1 moss species were recorded (Table 1), none of them are red-listed or alien. The canopy cover is 25–30%. The differences between these 4 survey plots are negligible, species diversity is very low, and the vegetation cover is uniform.

Table 1. Check-list of plants recorded in survey plots B027–B030

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
<i>Alyssum desertorum</i>	annual	5–6	O	+	flowering
<i>Artemisia diffusa</i>	semishrub	15–20	D	2–3	vegetation
<i>Carex subphysodes</i>	Perennial	12–15	A	1	flowering
<i>Caroxylon orientale</i> (<i>Salsola orientalis</i>)	dwarf shrub	35–40	R	+	vegetation

<i>Ceratocarpus arenarius</i>	annual	15-20	R	+	Dried
<i>Convolvulus hamadae</i>	semishrub	25-30	R	+	vegetation
<i>Cousinia hamadae</i>	Perennial	15-20	R	+	vegetation
<i>Ferula foetida</i>	Perennial	30-35	R	+	vegetation
<i>Holosteum umbellatum</i>	annual	6-8	R	+	flowering
<i>Hypecoum pendulum</i>	annual	12-15	R	+	flowering
<i>Iris songarica</i>	Perennial	30-35	O	+	vegetation
<i>Peganum garmala</i>	Perennial	15-20	R	+	vegetation
<i>Poa bulbosa</i>	Perennial	15-17	A	1	vegetation
<i>Tortula desertorum</i>	moss	0.3-0.5	O	+	vegetation



Photo 1. Plot B027 (above). Sandy plain with hilly-wavy terrain and ephemeroïd-sagebrush vegetation



Photo 2. Plot B030 (below). Sandy plain with hilly-wavy terrain and ephemeroid-sagebrush vegetation



Photo 3. Sagebrush (*Artemisia diffusa*), a dominant plant of ephemeroid-sagebrush communities of the south-western Kyzylkum

B035

40.690406° N, 64.576697° E, 271 m.s.l. Wavy sandy-stony desert plain with native ephemeroid-sagebrush-saltwort vegetation (*Xylosalsola arbuscula*, *Caroxylon orientale*, *Artemisia diffusa*, *Poa bulbosa*, *Carex physodes*) (Photo 4–5). 20 plant and 1 moss species were recorded (Table 2). The canopy cover is 35–40%. 6 generative and 17 pre-

generative specimens of red-listed *Tulipa lehmanniana* were found within the survey square.



Photo 4. Plot B035. Sandy plain with saltwort-ephemeroid-sagebrush vegetation



Photo 5. *Xylosalsola arbuscula* (*Salsola arbuscula*), or white saltwort

Table 2. Check-list of plants recorded in survey plot B035

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
<i>Acanthophyllum elatius</i>	Perennial	40–45	R	+	vegetation
<i>Alyssum desertorum</i>	annual	5–6	O	+	flowering

<i>Artemisia diffusa</i>	semishrub	15–20	A	1	vegetation
<i>Astragalus villosissimus</i>	dwarf shrub	35–40	O	+	vegetation
<i>Carex physodes</i>	Perennial	12–15	A	1	flowering
<i>Caroxylon orientale</i> (<i>Salsola orientalis</i>)	dwarf shrub	35–40	D	2	vegetation
<i>Ceratocarpus arenarius</i>	annual	15–20	R	+	Dried
<i>Ceratocephala falcata</i>	annual	3–4	R	+	flowering
<i>Convolvulus hamadae</i>	semishrub	25–30	O	+	vegetation
<i>Cousinia hamadae</i>	Perennial	15–20	R	+	vegetation
<i>Ferula foetida</i>	Perennial	30–35	R	+	vegetation
<i>Halothamnus subaphyllus</i>	semishrub	40–45	R	+	vegetation
<i>Holosteum umbellatum</i>	annual	6–8	O	+	flowering
<i>Hypecoum pendulum</i>	annual	12–15	O	+	flowering
<i>Iris songarica</i>	Perennial	30–35	O	+	vegetation
<i>Peganum garmala</i>	Perennial	15–20	R	+	vegetation
<i>Poa bulbosa</i>	Perennial	15–17	A	1	vegetation
<i>Streptoloma desertorum</i>	annual	6–7	R	+	flowering
<i>Tortula desertorum</i>	moss	0.3–0.5	O	+	vegetation
<i>Tulipa lehmanniana</i>	Perennial	10–15	R	+	vegetation
<i>Xylosalsola arbuscula</i> (<i>Salsola arbuscula</i>)	shrub	40–50	A	1	vegetation

B036, B037

40.68719 – 40.685428° N, 64.582273 – 64.589908° E, 270–272 m.s.l.

Sandy plain with native ephemeroid-sagebrush-saltwort (*Xylosalsola arbuscula*, *Caroxylon orientale*, *Artemisia diffusa*, *Poa bulbosa*, *Carex physodes*) (photo 6–7); 18 plant and 1 moss species were recorded (Table 3). The canopy cover is 30–40%. 11 generative and 78 pre-generative specimens of red-listed *Tulipa lehmanniana* were found within the B037 survey square, and solitary pre-generative specimens were found within the B036 plot. Alien plants are absent. The terrain is somewhat wavy.



Photo 6. Plot B037. Sandy plain with saltwort-ephemeroid-sagebrush vegetation



Photo 7. Plot B036 (below). Sandy plain with saltwort-ephemeroid-sagebrush vegetation

Table 3. Check-list of plants recorded in survey plots B036–B037

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
<i>Acanthophyllum elatius</i>	Perennial	40–45	O	+	vegetation
<i>Alyssum desertorum</i>	annual	5–6	O	+	flowering
<i>Artemisia diffusa</i>	semishrub	15–20	A	1	vegetation

<i>Astragalus villosissimus</i>	dwarf shrub	35-40	O	+	vegetation
<i>Carex physodes</i>	Perennial	12-15	A	1	flowering
<i>Caroxylon orientale</i> (<i>Salsola orientalis</i>)	dwarf shrub	35-40	D	2	vegetation
<i>Ceratocarpus arenarius</i>	annual	15-20	R	+	Dried
<i>Ceratocephala falcata</i>	annual	3-4	O	+	flowering
<i>Convolvulus hamadae</i>	semishrub	25-30	O	+	vegetation
<i>Cousinia hamadae</i>	Perennial	15-20	R	+	vegetation
<i>Cousinia resinosa</i>	Perennial	30-35	R	+	vegetation
<i>Ferula foetida</i>	Perennial	30-35	R	+	vegetation
<i>Halothamnus subaphyllus</i>	semishrub	40-45	R	+	vegetation
<i>Holosteum umbellatum</i>	annual	6-8	O	+	flowering
<i>Hypecoum pendulum</i>	annual	12-15	O	+	flowering
<i>Iris songarica</i>	Perennial	30-35	O	+	vegetation
<i>Ixiolirion tataricum</i>	Perennial	12-15	R	+	vegetation
<i>Peganum garmala</i>	Perennial	15-20	R	+	vegetation
<i>Poa bulbosa</i>	Perennial	15-17	A	1	vegetation
<i>Tortula desertorum</i>	moss	0.3-0.5	O	+	vegetation
<i>Tulipa lehmanniana</i>	Perennial	10-15	R	+	vegetation
<i>Xylosalsola arbuscula</i> (<i>Salsola arbuscula</i>)	shrub	40-50	A	1	vegetation

B061, B062, B063, B064, B065

40.665857 – 40.670540° N, 64.612417 – 64.583322° E, 260–267 m.s.l. Native saltwort-ephemeroid-sagebrush community (*Artemisia diffusa*, *Poa bulbosa*, *Carex physodes*, *Xylosalsola arbuscula*, *Caroxylon orientale*) on sandy desert soil (photo 8); 23 plant and 1 moss species were recorded (Table 4), including nationally red-listed *Tulipa lehmanniana* (numerous mainly pre-generative specimens occurs sporadically within and between survey plots). The canopy cover is 40–50%. Alien plants are absent. The differences between these 5 plots are negligible. The terrain is somewhat hilly-wavy.



Photo 8. Plot B065. Sandy plain with saltwort-ephemeroid-sagebrush vegetation. In the foreground – *Ferula foetida*.

Table 4. Check-list of plants recorded in survey plots B061–B065

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
<i>Acanthophyllum elatius</i>	Perennial	40–45	O	+	vegetation
<i>Alyssum desertorum</i>	annual	5–6	O	+	flowering
<i>Artemisia diffusa</i>	semishrub	25–30	A	1	vegetation
<i>Astragalus villosissimus</i>	dwarf shrub	35–40	A	1	vegetation
<i>Bromus tectorum</i>	annual	12–15	O	+	flowering
<i>Carex physodes</i>	Perennial	12–15	D	1	flowering
<i>Caroxylon orientale</i> (<i>Salsola orientalis</i>)	dwarf shrub	35–40	D	2	vegetation
<i>Ceratocarpus arenarius</i>	annual	15–20	R	+	Dried
<i>Ceratocephala falcata</i>	annual	3–4	O	+	flowering
<i>Convolvulus hamadae</i>	semishrub	25–30	A	1	vegetation
<i>Cousinia hamadae</i>	Perennial	15–20	R	+	vegetation
<i>Ferula foetida</i>	Perennial	50–60	O	1	flowering
<i>Halothamnus subaphyllus</i>	semishrub	40–45	O	1	vegetation
<i>Haplophyllum sp.</i>	Perennial	10–15	R	+	vegetation
<i>Holosteum umbellatum</i>	annual	6–8	O	+	flowering
<i>Hypocoum pendulum</i>	annual	12–15	O	+	flowering
<i>Iris longiscapa</i>	perennial	17–20	R	+	flowering
<i>Iris songarica</i>	Perennial	30–35	R	+	vegetation
<i>Mausolea eriocarpa</i>	semishrub	45–50	O	1	vegetation
<i>Peganum garmala</i>	Perennial	15–20	R	+	vegetation

<i>Poa bulbosa</i>	Perennial	15–17	A	1	vegetation
<i>Tortula desertorum</i>	moss	0.3–0.5	O	+	vegetation
<i>Tulipa lehmanniana</i>	Perennial	10–15	O	+	vegetation
<i>Xylosansola arbuscula</i> (<i>Salsola arbuscula</i>)	shrub	40–50	A	1	vegetation

B066

40.662056° N, 64.626846° E, 255 m.s.l.

Sandy plain with native saltwort-ephemeroid-sagebrush community (*Artemisia diffusa*, *Poa bulbosa*, *Carex physodes*, *Xylosalsola arbuscula*, *Caroxylon orientale*) (photo 9); 23 plant and 1 moss species were recorded (Table 5), including nationally red-listed *Tulipa lehmanniana* (solitary mainly pre-generative specimens). The canopy cover is 50%. Alien plants are absent.

Table 5. Check-list of plants recorded in survey plot B066

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
<i>Acanthophyllum elatius</i>	Perennial	40–45	R	+	vegetation
<i>Alyssum desertorum</i>	annual	5–6	O	+	flowering
<i>Artemisia diffusa</i>	semishrub	25–30	D	2	vegetation
<i>Astragalus flexus</i>	perennial	15–17	R	+	flowering
<i>Astragalus villosissimus</i>	dwarf shrub	35–40	O	+	vegetation
<i>Bromus tectorum</i>	annual	12–15	O	+	flowering
<i>Calligonum microcarpum</i>	shrub	50–70	R	+	vegetation
<i>Carex physodes</i>	Perennial	12–15	D	1	flowering
<i>Caroxylon orientale</i> (<i>Salsola orientalis</i>)	dwarf shrub	40–50	D	1	vegetation
<i>Ceratocarpus arenarius</i>	annual	15–20	R	+	Dried
<i>Ceratocephala falcata</i>	annual	3–4	O	+	flowering
<i>Convolvulus hamadae</i>	semishrub	25–30	A	1	vegetation
<i>Cousinia hamadae</i>	Perennial	15–20	R	+	vegetation
<i>Ferula foetida</i>	Perennial	50–60	O	1	flowering
<i>Halothamnus subaphyllus</i>	semishrub	40–45	R	+	vegetation
<i>Holosteum umbellatum</i>	annual	6–8	O	+	flowering
<i>Hypecoum pendulum</i>	annual	12–15	O	+	flowering
<i>Iris songarica</i>	Perennial	30–35	R	+	vegetation
<i>Mausolea eriocarpa</i>	semishrub	45–50	O	1	vegetation
<i>Peganum garmala</i>	Perennial	15–20	R	+	vegetation
<i>Poa bulbosa</i>	Perennial	15–17	A	1	vegetation
<i>Tortula desertorum</i>	moss	0.3–0.5	O	+	vegetation
<i>Tulipa lehmanniana</i>	Perennial	10–15	R	+	vegetation
<i>Xylosalsola arbuscula</i> (<i>Salsola arbuscula</i>)	shrub	40–50	O	+	vegetation



Photo 9. Plot B066. Sandy plain with saltwort-ephemeroid-sagebrush vegetation

B069

40.650226 ° N, 64.641662 ° E, 263 m.s.l.

Native saltwort-ephemeroid-sagebrush community (*Artemisia diffusa*, *Poa bulbosa*, *Carex subphysodes*, *Xylosalsola arbuscula*, *Caroxylon orientale*, *Ferula foetida*) (photo 10); 18 plant and 1 moss species were recorded (Table 6). The canopy cover is 40%. 23 generative and 131 pre-generative specimens of red-listed *Tulipa lehmanniana* were found within the survey square. Alien plants are absent. The terrain is somewhat wavy.

Table 6. Check-list of plants recorded in survey plot B069

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
<i>Artemisia diffusa</i>	semishrub	25–30	A	1	vegetation
<i>Astragalus flexus</i>	perennial	15-17	R	+	flowering
<i>Astragalus villosissimus</i>	dwarf shrub	35-40	O	+	vegetation
<i>Carex subphysodes</i>	Perennial	12–15	A	1	flowering
<i>Caroxylon orientale</i> (<i>Salsola orientalis</i>)	dwarf shrub	35-40	A	1	vegetation
<i>Ceratocarpus arenarius</i>	annual	15-20	R	+	Dried
<i>Ceratocephala falcata</i>	annual	3–4	O	+	flowering
<i>Convolvulus hamadae</i>	semishrub	25–30	O	+	vegetation
<i>Ferula foetida</i>	Perennial	50–60	O	1	flowering
<i>Holosteum umbellatum</i>	annual	6–8	O	+	flowering
<i>Hypecoum pendulum</i>	annual	12–15	O	+	flowering
<i>Iris songarica</i>	Perennial	30–35	O	+	vegetation
<i>Peganum garmala</i>	Perennial	15-20	R	+	vegetation

<i>Phlomoides desertotum</i>	Perennial	15-20	R	+	vegetation
<i>Poa bulbosa</i>	Perennial	15–17	A	1	vegetation
<i>Salsola paulsenii</i>	annual	30–40	R	+	Dried
<i>Tortula desertorum</i>	moss	0.3–0.5	A	1	vegetation
<i>Tulipa lehmanniana</i>	Perennial	10–15	R	+	vegetation
<i>Xylosalsola arbuscula</i> (<i>Salsola arbuscula</i>)	shrub	40–50	A	2	vegetation



Photo 10. Plot B069. Sandy plain with saltwort-ephemeroid-sagebrush vegetation

B070

40.645274 ° N, 64.644478 ° E, 260 m.s.l.

This survey plot is situated near the border of flat sandy desert plain and steep slopes of saline depression. Native saltwort-ephemeroid-sagebrush community (*Artemisia diffusa*, *Poa bulbosa*, *Carex subphysodes*, *Caroxylon orientale*, *Ferula foetida*) (photo 11); 16 plant and 1 moss species were recorded (Table 7). The canopy cover is 40%. 25 generative and 121 pre-generative specimens of red-listed *Tulipa lehmanniana* were found within the survey square. Alien plants are absent. The the terrain is somewhat wavy.

Table 7. Check-list of plants recorded in survey plot B070

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
<i>Artemisia diffusa</i>	semishrub	25–30	D	2	vegetation
<i>Astragalus rubromarginatus</i>	perennial	12-15	R	+	vegetation
<i>Astragalus villosissimus</i>	dwarf shrub	35-40	R	+	vegetation
<i>Carex subphysodes</i>	Perennial	12–15	A	1	flowering

<i>Caroxylon orientale</i> (<i>Salsola orientalis</i>)	dwarf shrub	35-40	D	2	vegetation
<i>Caroxylon scleranthum</i> (<i>Salsola sclerantha</i>)	annual	20-25	R	+	Dried
<i>Ceratocarpus arenarius</i>	annual	15-20	R	+	Dried
<i>Ceratocephala falcata</i>	annual	3-4	R	+	flowering
<i>Convolvulus hamadae</i>	semishrub	25-30	A	1	vegetation
<i>Ferula foetida</i>	Perennial	50-60	O	1	flowering
<i>Holosteum umbellatum</i>	annual	6-8	R	+	flowering
<i>Iris songarica</i>	Perennial	30-35	O	+	vegetation
<i>Peganum garmala</i>	Perennial	15-20	R	+	vegetation
<i>Poa bulbosa</i>	Perennial	15-17	A	1	vegetation
<i>Tortula desertorum</i>	moss	0.3-0.5	A	1	vegetation
<i>Tulipa lehmanniana</i>	Perennial	10-15	R	+	vegetation
<i>Xylosalsola arbuscula</i> (<i>Salsola arbuscula</i>)	shrub	40-50	R	+	vegetation



Photo 11. Plot B070. Sandy plain with saltwort-ephemeroid-sagebrush vegetation. In the foreground – *Ferula foetida*.

B085

40.659246° N, 64.613665° E, 230 m.s.l. A flat sandy desert plain, near the border of saline depression. Native ephemeroid-saltwort community with canopy cover of 30% on sandy desert soil (Photo 12). 17 plant and 1 moss species were recorded (Table 8), including 3 generative and 18 pre-generative specimens of nationally red-listed *Tulipa lehmanniana*. Alien plants are absent.

Table 8. Check-list of plants recorded in survey plot B085

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	

<i>Acanthophyllum elatius</i>	Perennial	35-40	R	+	vegetation
<i>Alyssum desertorum</i>	annual	5-6	O	+	flowering
<i>Artemisia diffusa</i>	semishrub	20-25	D	2	vegetation
<i>Astragalus rubromarginatus</i>	Perennial	12-15	R	+	vegetation
<i>Astragalus villosissimus</i>	dwarf shrub	35-40	R	+	vegetation
<i>Caroxylon orientale</i> (<i>Salsola orientalis</i>)	dwarf shrub	35-40	A	1	vegetation
<i>Ceratocarpus arenarius</i>	annual	15-20	R	+	Dried
<i>Ceratocephala falcate</i>	annual	3-4	O	+	flowering
<i>Convolvulus hamadae</i>	semishrub	25-30	O	+	vegetation
<i>Ferula foetida</i>	Perennial	30-35	O	+	flowering
<i>Halothamnus subaphyllus</i>	semishrub	40-45	R	+	vegetation
<i>Hypecoum pendulum</i>	annual	12-15	O	+	flowering
<i>Ixiolirion tataricum</i>	Perennial	12-15	R	+	vegetation
<i>Oreosalsola arbusculiformis</i> (<i>Salsola arbusculiformis</i>)	dwarf shrub	35-40	O	+	vegetation
<i>Peganum garmala</i>	Perennial	15-20	R	+	vegetation
<i>Poa bulbosa</i>	Perennial	15-17	A	1	vegetation
<i>Tortula desertorum</i>	moss	0.3-0.5	O	+	vegetation
<i>Tulipa lehmanniana</i>	Perennial	12-15	R	+	vegetation



Photo 12. B085. Flat sandy desert plain with ephemeroid-saltwort vegetation, near the edge of the cliffs of saline depression

40.623187° N, 64.648509° E, 264 m.s.l. Native saltwort-ephemeroid-sagebrush community (*Artemisia diffusa*, *Poa bulbosa*, *Carex subphysodes*, *Caroxylon orientale*, *Ferula foetida*) on sabulous soil (photo 13); 11 plant and 1 moss species were recorded (Table 9). 9 pre-generative specimens of red-listed *Tulipa lehmanniana* were found. Alien plants are absent.

Table 9. Check-list of plants recorded in survey plot VP2

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
<i>Artemisia diffusa</i>	semishrub	25–30	D	2	vegetation
<i>Astragalus villosissimus</i>	dwarf shrub	35-40	R	+	vegetation
<i>Bassia prostrata</i> (<i>Kochia prostrata</i>)	semishrub	15–20	R	+	vegetation
<i>Carex subphysodes</i>	Perennial	12–15	A	1	flowering
<i>Caroxylon orientale</i> (<i>Salsola orientalis</i>)	dwarf shrub	35-40	A	1	vegetation
<i>Convolvulus hamadae</i>	semishrub	25–30	R	+	vegetation
<i>Ferula foetida</i>	Perennial	40–50	O	1	Vegetation, flowering
<i>Peganum garmala</i>	Perennial	15-20	R	+	vegetation
<i>Poa bulbosa</i>	Perennial	15–17	A	1	vegetation
<i>Tortula desertorum</i>	moss	0.3–0.5	O	+	vegetation
<i>Tulipa lehmanniana</i>	Perennial	10–15	R	+	vegetation
<i>Xylosalsola arbuscula</i> (<i>Salsola arbuscula</i>)	shrub	40–50	R	+	vegetation



Photo 13. Plot VP2. Sandy plain with saltwort-ephemeroid-sagebrush vegetation

B092, B093, B094, B095, B096

40.606105 – 40.623301° N, 64.648188 – 64.634463° E, 264 m.s.l. The same native ephemeroïd-sagebrush community (*Artemisia diffusa*, *Poa bulbosa*, *Carex subphysodes*) was described on 4 survey plots situated along the border of flat sandy desert plain and steep slopes of saline depression (photo 14–15); the differences between these areas are negligible. 12 plant and 1 moss species were recorded (Table 10), including solitary specimens of red-listed *Tulipa lehmanniana*. The second tulip species, *Tulipa sogdiana*, has been included in first, second and third editions of the Red Data Book of Uzbekistan (1984, 1998, 2006). As a result of field surveys performed during the last 20 years, it has been revealed that *Tulipa sogdiana* is common in desert zone of Uzbekistan, and it has been removed from the national Red Data Book. Alien plants are absent. The soil is sabulous and somewhat gravelly, and the terrain is flat.

Table 10. Check-list of plants recorded in survey plots B092–B096

Species	Life form	Height, cm	Abundance		Phenol. stage
			DAFOR	Braun-Blanquet	
<i>Artemisia diffusa</i>	semishrub	25–30	D	2	vegetation
<i>Astragalus villosissimus</i>	dwarf shrub	35–40	R	+	vegetation
<i>Bassia prostrata</i> (<i>Kochia prostrata</i>)	semishrub	15–20	R	+	vegetation
<i>Carex subphysodes</i>	Perennial	12–15	A	1	flowering
<i>Caroxylon orientale</i> (<i>Salsola orientalis</i>)	dwarf shrub	35–40	O	+	vegetation
<i>Ceratocarpus arenarius</i>	annual	15–20	R	+	Dried
<i>Convolvulus hamadae</i>	semishrub	25–30	R	+	vegetation
<i>Ferula foetida</i>	Perennial	30–35	O	+	Vegetation, flowering
<i>Peganum garmala</i>	Perennial	15–20	R	+	vegetation
<i>Poa bulbosa</i>	Perennial	15–17	A	1	vegetation
<i>Tortula desertorum</i>	moss	0.3–0.5	A	1	vegetation
<i>Tulipa lehmanniana</i>	Perennial	10–5	R	+	vegetation
<i>Tulipa sogdiana</i>	Perennial	7–10	R	+	vegetation



Photo 14. B096. Flat sandy desert plain with ephemeroid-sagebrush vegetation



Photo 15. B093. Flat sandy desert plain with ephemeroid-sagebrush vegetation

B097

40.599784° N, 64.650479° E, 262 m.s.l.

Native ephemeroid-sagebrush community (*Artemisia diffusa*, *Poa bulbosa*, *Carex subphysodes*) (photo 16); 11 plant and 1 moss species were recorded (Table 11). 3 specimens of red-listed *Tulipa lehmanniana* were found. Alien plants are absent. The soil is sabulous and somewhat gravelly, and the terrain is somewhat hilly-wavy.

Table 11. Check-list of plants recorded in survey plot B097

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
<i>Artemisia diffusa</i>	semishrub	25–30	D	2	vegetation
<i>Astragalus villosissimus</i>	dwarf shrub	35-40	R	+	vegetation
<i>Bassia prostrata</i> (<i>Kochia prostrata</i>)	semishrub	15–20	R	+	vegetation
<i>Carex subphysodes</i>	Perennial	12–15	A	1	flowering
<i>Caroxylon orientale</i> (<i>Salsola orientalis</i>)	dwarf shrub	35-40	O	+	vegetation
<i>Caroxylon scleranthum</i> (<i>Salsola sclerantha</i>)	annual	20-25	R	+	Dried
<i>Ceratocarpus arenarius</i>	annual	15-20	R	+	Dried
<i>Convolvulus hamadae</i>	semishrub	25–30	R	+	vegetation
<i>Peganum garmala</i>	Perennial	15-20	R	+	vegetation
<i>Poa bulbosa</i>	Perennial	15–17	O	+	vegetation
<i>Tortula desertorum</i>	moss	0.3–0.5	O	+	vegetation
<i>Tulipa lehmanniana</i>	Perennial	10–15	R	+	vegetation



Photo 16. B097. Hilly-wavy sandy desert plain with ephemeroid-sagebrush vegetation

B098

40.593737° N, 64.651792° E, 259 m.s.l. Native ephemeroid-sagebrush community (*Artemisia diffusa*, *Poa bulbosa*, *Carex subphysodes*) (photo 17); 11 plant and 1 moss species were recorded (Table 12), red-listed and alien plants are absent. The soil is sabulous and somewhat gravelly, and the terrain is somewhat wavy.

Table 12. Check-list of plants recorded in survey plot B098

Species	Life form	Height, cm	Abundance	Phenol. stage
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			DAFOR	Braun-Blanquet	
<i>Artemisia diffusa</i>	semishrub	25–30	D	2	vegetation
<i>Astragalus villosissimus</i>	dwarf shrub	35–40	R	+	vegetation
<i>Bassia prostrata</i> (<i>Kochia prostrata</i>)	semishrub	15–20	R	+	vegetation
<i>Carex subphysodes</i>	Perennial	12–15	A	1	flowering
<i>Caroxylon orientale</i> (<i>Salsola orientalis</i>)	dwarf shrub	35–40	O	+	vegetation
<i>Ceratocarpus arenarius</i>	annual	15–20	R	+	Dried
<i>Convolvulus hamadae</i>	semishrub	25–30	R	+	vegetation
<i>Ferula foetida</i>	Perennial	50–60	R	+	flowering
<i>Peganum garmala</i>	Perennial	15–20	O	+	vegetation
<i>Poa bulbosa</i>	Perennial	15–17	O	+	vegetation
<i>Tortula desertorum</i>	moss	0.3–0.5	O	+	vegetation
<i>Tulipa sogdiana</i>	Perennial	7–10	R	+	vegetation



Photo 17. B098. Sandy desert plain with ephemeroid-sagebrush vegetation

B101

40.57905° N, 64.65094° E, 259 m.s.l.

Native ephemeroid-sagebrush community (*Artemisia diffusa*, *Poa bulbosa*, *Carex subphysodes*) (photo 18); 8 plant and 1 moss species were recorded (Table 13), red-listed and alien plants are absent. The soil is sabulous and somewhat gravelly. The same vegetation is in the center of bird monitoring point VP1.

Table 13. Check-list of plants recorded in survey plot B101

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
<i>Artemisia diffusa</i>	semishrub	25–30	D	2	vegetation

<i>Astragalus villosissimus</i>	dwarf shrub	35-40	R	+	vegetation
<i>Carex subphysodes</i>	Perennial	12–15	A	1	flowering
<i>Caroxylon orientale</i> (<i>Salsola orientalis</i>)	dwarf shrub	25-30	R	+	vegetation
<i>Ceratocarpus arenarius</i>	annual	15-20	R	+	Dried
<i>Convolvulus hamadae</i>	semishrub	25–30	R	+	vegetation
<i>Peganum garmala</i>	Perennial	15-20	R	+	vegetation
<i>Poa bulbosa</i>	Perennial	15–17	O	+	vegetation
<i>Tortula desertorum</i>	moss	0.3–0.5	A	1	vegetation



Photo 18. B101. Flat sandy desert plain with ephemeroid-sagebrush vegetation

B103

40.556723° N, 64.648712° E, 263 m.s.l.

Native ephemeroid-sagebrush community (*Artemisia diffusa*, *Poa bulbosa*, *Carex subphysodes*) (photo 19); 14 plant and 1 moss species were recorded (Table 14), one of them is nationally red-listed (*Tulipa lehmanniana*, photo 20); alien plants are absent. 1 generative and 8 pre-generative specimens of *Tulipa lehmanniana* have been count. A colony of gerbils (*Meriones sp.*) is situated on the area. The sandy soil is somewhat gravelly.

Table 14. Check-list of plants recorded in survey plot B103

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
<i>Artemisia diffusa</i>	semishrub	25–30	D	2	vegetation
<i>Astragalus villosissimus</i>	dwarf shrub	35-40	R	+	vegetation
<i>Carex subphysodes</i>	Perennial	12–15	A	1	flowering
<i>Caroxylon orientale</i> (<i>Salsola orientalis</i>)	dwarf shrub	25-30	R	+	vegetation

<i>Ceratocarpus arenarius</i>	annual	15-20	R	+	Dried
<i>Convolvulus hamadae</i>	semishrub	25–30	O	+	vegetation
<i>Cousinia hamadae</i>	Perennial	15–20	R	+	vegetation
<i>Ferula foetida</i>	Perennial	50–60	O	+	flowering
<i>Iris songarica</i>	Perennial	30–35	R	+	vegetation
<i>Oreosalsola arbusculiformis</i> (<i>Salsola arbusculiformis</i>)	dwarf shrub	35-40	O	+	vegetation
<i>Peganum garmala</i>	Perennial	15-20	R	+	vegetation
<i>Poa bulbosa</i>	Perennial	15–17	A	1	vegetation
<i>Tortula desertorum</i>	moss	0.3–0.5	A	1	vegetation
<i>Tulipa lehmanniana</i>	Perennial	7–10	R	+	vegetation
<i>Tulipa sogdiana</i>	Perennial	7–10	R	+	vegetation



Photo 19. B103. Flat sandy desert plain with ephemeroid-sagebrush vegetation



Photo 20. Plot B103. Non-flowering generative specimen of nationally red-listed *Tulipa lehmanniana*

B104

40.552364° N, 64.653046° E, 265 m.s.l.

Native saltwort-ephemeroid-sagebrush community (*Artemisia diffusa*, *Poa bulbosa*, *Carex subphysodes*, *Salsola orientalis*) (photo 21); 13 plant species were recorded (Table 15), red-listed or alien plants are absent.

Table 15. Check-list of plants recorded in survey plot B104

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
<i>Artemisia diffusa</i>	semishrub	25–30	D	2	vegetation
<i>Astragalus campylorrhynchus</i>	annual	10-12	R	+	vegetation
<i>Astragalus villosissimus</i>	dwarf shrub	35-40	R	+	vegetation
<i>Bassia prostrata</i> (<i>Kochia prostrata</i>)	semishrub	15–20	R	+	vegetation
<i>Carex subphysodes</i>	Perennial	12–15	A	1	flowering
<i>Caroxylon orientale</i> (<i>Salsola orientalis</i>)	dwarf shrub	25–30	A	1	vegetation
<i>Ceratocarpus arenarius</i>	annual	15-20	R	+	Dried
<i>Convolvulus hamadae</i>	semishrub	25–30	R	+	vegetation
<i>Ferula foetida</i>	Perennial	50–60	O	+	flowering
<i>Iris songarica</i>	Perennial	30–35	O	+	vegetation
<i>Oreosalsola arbusculiformis</i> (<i>Salsola arbusculiformis</i>)	dwarf shrub	35-40	R	+	vegetation
<i>Poa bulbosa</i>	Perennial	15–17	A	1	vegetation
<i>Tortula desertorum</i>	moss	0.3–0.5	O	+	vegetation
<i>Tulipa sogdiana</i>	Perennial	7–10	R	+	vegetation



Photo 21. Plot B104. Flat sandy plain with saltwort-ephemeroid-sagebrush vegetation

B105

40.548117° N, 64.658976° E, 267 m.s.l. Native saltwort-ephemeroid-sagebrush community (*Artemisia diffusa*, *Poa bulbosa*, *Carex subphysodes*, *Ferula foetida*, *Iris songarica*, *Caroxylon orientale*) (photo 22); 17 plant species and 1 moss species (*Tortula desertorum*) were recorded (Table 16), one of them is nationally red-listed (*Tulipa lehmanniana*) (photo 23); alien plants are absent. Number of specimens of *Tulipa lehmanniana* is 16: 4 generative, 12 pre-generative. 22 generative and 34 pre-generative specimens also have been counted on 190–300 m from the plot. A colony of gerbils (*Meriones sp.*) is situated on the area.



Photo 22. Plot B105. Flat sandy plain with saltwort-ephemeroid-sagebrush vegetation with local abundance of giant umbelliferous *Ferula foetida*.



Photo 23. Non-flowering generative specimen of nationally red-listed species *Tulipa lehmanniana*.

Table 16. Check-list of plants recorded in survey plot B105

Species	Life form	Height, cm	Abundance	
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			DAFOR	Braun-Blanquet	Phenol. Stage
<i>Artemisia diffusa</i>	semishrub	25–30	D	2	vegetation
<i>Astragalus campylorrhynchus</i>	annual	10-12	R	+	vegetation
<i>Astragalus rubromarginatus</i>	perennial	12-15	R	+	vegetation
<i>Astragalus villosissimus</i>	dwarf shrub	35-40	R	+	vegetation
<i>Bassia prostrata</i> (<i>Kochia prostrata</i>)	semishrub	15–20	R	+	vegetation
<i>Carex subphysodes</i>	Perennial	12–15	A	1	flowering
<i>Caroxylon orientale</i> (<i>Salsola orientalis</i>)	dwarf shrub	35-40	A	1	vegetation
<i>Ceratocarpus arenarius</i>	annual	15-20	R	+	Dried
<i>Convolvulus hamadae</i>	semishrub	25–30	R	+	vegetation
<i>Cousinia hamadae</i>	Perennial	15–20	R	+	vegetation
<i>Ferula foetida</i>	Perennial	50–60	A	1	flowering
<i>Iris songarica</i>	Perennial	30–35	A	1	vegetation
<i>Peganum garmala</i>	Perennial	15-20	R	+	vegetation
<i>Poa bulbosa</i>	Perennial	15–17	D	2	vegetation
<i>Tortula desertorum</i>	moss	0.3–0.5	A	1	vegetation
<i>Tulipa lehmanniana</i>	Perennial	7–10	R	+	vegetation
<i>Tulipa sogdiana</i>	Perennial	7–10	R	+	Vegetation
<i>Xylosalsola arbuscula</i> (<i>Salsola arbuscula</i>)	Shrub	50–60	R	+	vegetation

B106

40.545494° N, 64.66536° E, 269 m.s.l. Native ephemeroid-sagebrush community (*Artemisia diffusa*, *Poa bulbosa*, *Carex subphysodes*) on sabulous, somewhat gravelly desert soil (photo 24). The canopy cover is 20–25%. One moss and 9 plant species were recorded (Table 17), none of them are red-listed or alien.

Table 17. Check-list of plants recorded in survey plot B106

Species	Life form	Height, cm	Abundance		Phenol. stage
			DAFOR	Braun-Blanquet	
<i>Artemisia diffusa</i>	semishrub	25–30	D	2	vegetation
<i>Bassia prostrata</i> (<i>Kochia prostrata</i>)	semishrub	15–20	R	+	vegetation
<i>Carex subphysodes</i>	Perennial	12–15	A	1	flowering
<i>Cousinia hamadae</i>	Perennial	15–20	R	+	vegetation
<i>Ferula foetida</i>	Perennial	50–60	O	+	flowering
<i>Iris songarica</i>	Perennial	30–35	R	+	vegetation
<i>Poa bulbosa</i>	Perennial	15–17	A	1	vegetation
<i>Tortula desertorum</i>	moss	0.3–0.5	A	1	vegetation
<i>Tulipa sogdiana</i>	Perennial	7–10	R	+	vegetation
<i>Xylosalsola arbuscula</i> (<i>Salsola arbuscula</i>)	Shrub	50–60	R	+	vegetation



Photo 24. B106. Flat sandy plain with ephemeroid-sagebrush vegetation

B108

40.550329° N, 64.62948° E, 266 m.s.l. Native ephemeroid-sagebrush community (*Artemisia diffusa*, *Poa bulbosa*, *Carex subphysodes*) on sabulous, somewhat gravelly desert soil. One moss and 9 plant species were recorded (Table 18), none of them are red-listed or alien.

Table 18. Check-list of plants recorded in survey plot B108

Species	Life form	Height, cm	Abundance		Phenol. stage
			DAFOR	Braun-Blanquet	
<i>Artemisia diffusa</i>	semishrub	25–30	D	2	vegetation
<i>Astragalus villosissimus</i>	dwarf shrub	35–40	R	+	vegetation
<i>Carex subphysodes</i>	Perennial	12–15	A	1	flowering
<i>Caroxylon orientale</i> (<i>Salsola orientalis</i>)	dwarf shrub	35–40	R	+	vegetation
<i>Convolvulus hamadae</i>	semishrub	25–30	R	+	vegetation
<i>Ferula foetida</i>	Perennial	50–60	F	+	flowering
<i>Iris songarica</i>	Perennial	30–35	R	+	vegetation
<i>Poa bulbosa</i>	Perennial	15–17	A	1	vegetation
<i>Tortula desertorum</i>	moss	0.3–0.5	A	1	vegetation
<i>Zygophyllum macrophyllum</i>	Perennial	10–12	R	+	flowering

B109

40.544428° N, 64.6308° E, 265 m.s.l. Native ephemeroid-sagebrush community (*Artemisia diffusa*, *Poa bulbosa*, *Carex subphysodes*) (photo 25). One moss and 11 plant species were recorded (Table 19), none of them are red-listed or alien.

Table 20. Check-list of plants recorded in survey plot B109

Species	Life form	Height, cm	Abundance		Phenol. stage
			DAFOR	Braun-Blanquet	
<i>Artemisia diffusa</i>	semishrub	25–30	D	2	vegetation
<i>Astragalus villosissimus</i>	dwarf shrub	35–40	R	+	vegetation
<i>Bassia prostrata</i> (<i>Kochia prostrata</i>)	semishrub	15–20	R	+	vegetation
<i>Carex subphysodes</i>	Perennial	12–15	A	1	flowering
<i>Caroxylon orientale</i> (<i>Salsola orientalis</i>)	dwarf shrub	35–40	O	+	vegetation
<i>Convolvulus hamadae</i>	semishrub	25–30	R	+	vegetation
<i>Ferula foetida</i>	Perennial	50–60	R	+	flowering
<i>Iris songarica</i>	Perennial	30–35	R	+	vegetation
<i>Peganum garmala</i>	Perennial	15–20	R	+	vegetation
<i>Poa bulbosa</i>	Perennial	15–17	A	1	vegetation
<i>Tortula desertorum</i>	moss	0.3–0.5	O	+	vegetation
<i>Tulipa sogdiana</i>	Perennial	7–10	R	+	vegetation



Photo 25. B109. Flat sandy plain with ephemeroïd-sagebrush vegetation

B110

40.54095° N, 64.63479° E, 263 m.s.l. Native ephemeroïd-sagebrush community (*Artemisia diffusa*, *Poa bulbosa*, *Carex subphysodes*, *Ferula foetida*). One moss and 18 plant species were recorded (Table 21), none of them are red-listed or alien.

Table 21. Check-list of plants recorded in survey plot B110

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
<i>Alyssum desertorum</i>	annual	5–6	R	+	Flowering, fruiting
<i>Artemisia diffusa</i>	semishrub	25–30	D	2	vegetation

<i>Astragalus campylorrhynchus</i>	annual	10-12	R	+	vegetation
<i>Astragalus villosissimus</i>	dwarf shrub	35-40	R	+	vegetation
<i>Carex subphysodes</i>	Perennial	12–15	A	1	flowering
<i>Caroxylon orientale</i> (<i>Salsola orientalis</i>)	dwarf shrub	35-40	O	+	vegetation
<i>Ceratocarpus arenarius</i>	annual	15-20	R	+	Dried
<i>Climacoptera sp.</i>	annual	7–10	R	+	vegetation
<i>Convolvulus hamadae</i>	semishrub	25–30	R	+	vegetation
<i>Cousinia hamadae</i>	Perennial	15–20	R	+	vegetation
<i>Ferula foetida</i>	Perennial	50–60	A	1	flowering
<i>Hypecoum pendulum</i>	annual	12–15	R	+	flowering
<i>Iris songarica</i>	Perennial	30–35	R	+	vegetation
<i>Peganum garmala</i>	Perennial	15-20	R	+	vegetation
<i>Poa bulbosa</i>	Perennial	15–17	D	2	vegetation
<i>Suaeda sp.</i>	annual	7–10	R	+	vegetation
<i>Tortula desertorum</i>	moss	0.3–0.5	A	1	vegetation
<i>Tulipa sogdiana</i>	Perennial	7–10	R	+	vegetation
<i>Xylosalsola arbuscula</i> (<i>Salsola arbuscula</i>)	Shrub	50–60	R	+	vegetation



Photo 26. B110. Flat-wavy sandy plain with ephemeroid-sagebrush vegetation

4.1.2. Cliffs and eroded slopes of saline depression

B086, 087, 088, 089, and VP3

40.637241 – 40.649545° N, 64.626063 – 64.615312 ° E, 256–210 m.s.l. Slopes and bottom of saline depression. Native sparse ephemeroid-saltwort community was described on 4 survey plots on steep eroded sandstone slopes and bottom of saline depression (canopy cover is 0–10%); the differences between these areas are negligible.

17 plant and 1 moss species were recorded (Table 22), including solitary specimens of red-listed *Tulipa lehmanniana*. Alien plants are absent.

Table 22. Check-list of plants recorded in survey plots B086-B089 and VP3, April 2021.

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
<i>Artemisia diffusa</i>	semishrub	20–25	O	+	vegetation
<i>Astragalus ammotrophus</i>	Perennial	12–15	R	+	vegetation
<i>Astragalus villosissimus</i>	dwarf shrub	35–40	R	+	vegetation
<i>Atraphaxis spinosa</i>	shrub	20–25	R	+	vegetation
<i>Bassia prostrata</i> (<i>Kochia prostrata</i>)	semishrub	15–20	R	+	vegetation
<i>Caroxylon orientale</i> (<i>Salsola orientalis</i>)	dwarf shrub	35–40	O	+	vegetation
<i>Ceratocarpus arenarius</i>	annual	15–20	R	+	Dried
<i>Climacoptera</i> sp.	annual	15–20	R	+	Dried
<i>Convolvulus hamadae</i>	semishrub	25–30	O	+	vegetation
<i>Cousinia hamadae</i>	Perennial	15–20	R	+	vegetation
<i>Ferula foetida</i>	Perennial	30–35	R	+	flowering
<i>Oreosalsola arbusculiformis</i> (<i>Salsola arbusculiformis</i>)	dwarf shrub	35–40	A	1	vegetation
<i>Peganum garmala</i>	Perennial	15–20	R	+	vegetation
<i>Poa bulbosa</i>	Perennial	15–17	A	1	vegetation
<i>Tortula desertorum</i>	moss	0.3–0.5	O	+	vegetation
<i>Tulipa lehmanniana</i>	Perennial	12–15	R	+	vegetation
<i>Tulipa sogdiana</i>	Perennial	7–10	R	+	vegetation
<i>Zygophyllum macrophyllum</i>	Perennial	10–12	R	+	flowering



Photo 27. B089. Eroded sandstone slopes of saline depression with very sparse saltwort vegetation



Photo 28. B087. Eroded sandstone slopes of saline depression with very sparse saltwort vegetation

B090

40.630992° N, 64.62699° E, 210 m.s.l. Slopes of saline depression.

Native sparse saltwort community on steep eroded sandstone slopes and bottom of saline depression (canopy cover is 0–10%). One moss and 13 plant species were

recorded (Table 23), none of them are alien. 7 generative and 18 non-generative specimens of nationally red-listed *Tulipa lehmanniana* were found within the sample plot.

Table 23. Check-list of plants recorded in survey plot B090, April 2021.

Species	Life form	Height, cm	Abundance		Phenol. stage
			DAFOR	Braun-Blanquet	
<i>Artemisia diffusa</i>	semishrub	25–30	D	2	vegetation
<i>Astragalus villosissimus</i>	dwarf shrub	35–40	O	+	vegetation
<i>Atraphaxis spinosa</i>	shrub	20–25	R	+	vegetation
<i>Bassia prostrata</i> (<i>Kochia prostrata</i>)	semishrub	15–20	R	+	vegetation
<i>Carex subphysodes</i>	Perennial	12–15	A	1	flowering
<i>Caroxylon orientale</i> (<i>Salsola orientalis</i>)	dwarf shrub	35–40	O	+	vegetation
<i>Ceratocarpus arenarius</i>	annual	15–20	R	+	Dried
<i>Convolvulus hamadae</i>	semishrub	25–30	R	+	vegetation
<i>Ferula foetida</i>	Perennial	50–60	R	+	flowering
<i>Oreosalsola arbusculiformis</i> (<i>Salsola arbusculiformis</i>)	dwarf shrub	35–40	O	+	vegetation
<i>Peganum garmala</i>	Perennial	15–20	R	+	vegetation
<i>Poa bulbosa</i>	Perennial	15–17	A	1	vegetation
<i>Tortula desertorum</i>	moss	0.3–0.5	O	+	vegetation
<i>Tulipa lehmanniana</i>	Perennial	12–15	R	+	vegetation





Photo 29, 30. B090. Flat sandy desert plain with sparse saltwort-ephemeroid-sagebrush vegetation intensively grazed by livestock on the top of cliff (above). Eroded steep sandstone slopes of saline depression with very sparse saltwort vegetation (below).

B091

40.627159° N, 64.630565° E, 223 m.s.l. A border of flat sandy desert plain and steep slopes of saline depression.

Intensively grazed by livestock native saltwort-ephemeroid-sagebrush community (*Artemisia diffusa*, *Poa bulbosa*, *Carex subphysodes*, *Caroxylon orientale*) with canopy cover of 10–15% on saline sabulous-loamy grey-brown desert soil on the top of cliff, and very sparse saltwort community on steep eroded sandstone slopes and bottom of saline depression (canopy cover is 0–10%). One moss and 14 plant species were recorded (Table 24), none of them are alien. 4 generative and 21 non-generative specimens of nationally red-listed *Tulipa lehmanniana* were found within the sample plot.

Table 24. Check-list of plants recorded in survey plot B091.

Species	Life form	Height, cm	Abundance		Phenol. stage
			DAFOR	Braun-Blanquet	
<i>Artemisia diffusa</i>	semishrub	25–30	A	1 to 2	vegetation
<i>Astragalus ammotrophus</i>	Perennial	12–15	R	+	vegetation
<i>Astragalus villosissimus</i>	dwarf shrub	35-40	O	+	vegetation
<i>Atraphaxis spinosa</i>	shrub	20–25	R	+	vegetation
<i>Bassia prostrata</i> (<i>Kochia prostrata</i>)	semishrub	15–20	R	+	vegetation
<i>Carex subphysodes</i>	Perennial	12–15	A	+	flowering
<i>Caroxylon orientale</i> (<i>Salsola orientalis</i>)	dwarf shrub	35-40	A	+ to 1	vegetation
<i>Ceratocarpus arenarius</i>	annual	15-20	R	+	Dried
<i>Convolvulus hamadae</i>	semishrub	25–30	O	+	vegetation

<i>Cousinia hamadae</i>	Perennial	15–20	R	+	vegetation
<i>Ferula foetida</i>	Perennial	30–35	R	+	vegetation
<i>Oreosalsola arbusculiformis</i> (<i>Salsola arbusculiformis</i>)	dwarf shrub	35-40	A	+ to 1	vegetation
<i>Peganum garmala</i>	Perennial	15-20	R	+	vegetation
<i>Poa bulbosa</i>	Perennial	15–17	A	1	vegetation
<i>Tortula desertorum</i>	moss	0.3–0.5	O	+	vegetation
<i>Tulipa lehmanniana</i>	Perennial	12–15	R	+	vegetation
<i>Zygophyllum macrophyllum</i>	Perennial	10–12	R	+	flowering





Photo 31, 32, 33. B091. Eroded steep sandstone slopes of saline depression with very sparse saltwort vegetation (above and in the center). Flat sandy desert plain with sparse saltwort-ephemeroid-sagebrush vegetation intensively grazed by livestock on the top of cliff (below).

B100

80 m to the south-west of B100 turbine location. 40.58805° N, 64.65367° E, 251 m.s.l. A border of flat sandy desert plain and steep slopes of saline depression.

Native ephemeroid-sagebrush community (*Artemisia diffusa*, *Poa bulbosa*, *Carex subphysodes*) with canopy cover of 30% on the top of cliff and very sparse saltwort community on steep eroded sandstone slopes (canopy cover is 0–10%). One moss and

13 plant species were recorded (Table 25), none of them are alien. 6 generative and 8 non-generative specimens of nationally red-listed *Tulipa lehmanniana* were found within the sample plot. A colony of gerbils (*Meriones sp.*) is situated on the area of turbine location.

Table 25. Check-list of plants recorded in survey plot B100.

Species	Life form	Height, cm	Abundance		Phenol. stage
			DAFOR	Braun-Blanquet	
<i>Artemisia diffusa</i>	semishrub	25–30	D	2	vegetation
<i>Astragalus villosissimus</i>	dwarf shrub	35–40	R	+	vegetation
<i>Atraphaxis spinosa</i>	shrub	20–25	R	+	vegetation
<i>Bassia prostrata</i> (<i>Kochia prostrata</i>)	semishrub	15–20	R	+	vegetation
<i>Carex subphysodes</i>	Perennial	12–15	A	1	flowering
<i>Caroxylon orientale</i> (<i>Salsola orientalis</i>)	dwarf shrub	35–40	O	+	vegetation
<i>Ceratocarpus arenarius</i>	annual	15–20	R	+	Dried
<i>Convolvulus hamadae</i>	semishrub	25–30	R	+	vegetation
<i>Ferula foetida</i>	Perennial	50–60	R	+	flowering
<i>Oreosalsola arbusculiformis</i> (<i>Salsola arbusculiformis</i>)	dwarf shrub	35–40	O	+	vegetation
<i>Peganum garmala</i>	Perennial	15–20	R	+	vegetation
<i>Poa bulbosa</i>	Perennial	15–17	A	1	vegetation
<i>Tortula desertorum</i>	moss	0.3–0.5	O	+	vegetation
<i>Tulipa lehmanniana</i>	Perennial	7–10	R	+	vegetation





Photo 34, 35. B100. Flat sandy desert plain with ephemeroid-sagebrush vegetation on the top of cliff (above). Eroded steep sandstone slopes of saline depression with very sparse saltwort vegetation (below). Parallel paths trampled by livestock are visible in the foreground

B107

100 m to the north-west of B107 turbine location. 40.557216° N, 64.629407° E, 251 m.s.l. A border of sandy desert plain and steep eroded slopes of saline depression.

Native ephemeroid-sagebrush community (*Artemisia diffusa*, *Poa bulbosa*, *Carex subphysodes*) on the top of cliff and very sparse saltwort community on steep sandstone slopes (canopy cover is less than 5%). One moss and 17 plant species were recorded (Table 26), none of them are alien. 4 generative and 11 non-generative specimens of nationally red-listed *Tulipa lehmanniana* were found.

Table 26. Check-list of plants recorded in survey plot B107.

Species	Life form	Height, cm	Abundance		Phenol. stage
			DAFOR	Braun-Blanquet	
<i>Artemisia diffusa</i>	semishrub	25–30	D	2	vegetation
<i>Astragalus villosissimus</i>	dwarf shrub	35–40	R	+	vegetation
<i>Atraphaxis spinosa</i>	shrub	20–25	R	+	vegetation
<i>Bassia prostrata</i> (<i>Kochia prostrata</i>)	semishrub	15–20	R	+	vegetation
<i>Carex subphysodes</i>	Perennial	12–15	A	1	flowering
<i>Caroxylon orientale</i> (<i>Salsola orientalis</i>)	dwarf shrub	35–40	O	+	vegetation
<i>Climacoptera</i> sp.	annual	12–15	R	+	vegetation
<i>Convolvulus hamadae</i>	semishrub	25–30	R	+	vegetation
<i>Ferula foetida</i>	Perennial	50–60	R	+	flowering
<i>Iris falcifolia</i>	Perennial	12–15	R	+	flowering
<i>Iris songarica</i>	Perennial	30–35	R	+	vegetation

<i>Oreosalsola arbusculiformis</i> (<i>Salsola arbusculiformis</i>)	dwarf shrub	35-40	O	+	vegetation
<i>Peganum garmala</i>	Perennial	15-20	R	+	vegetation
<i>Poa bulbosa</i>	Perennial	15-17	A	1	vegetation
<i>Tortula desertorum</i>	moss	0.3-0.5	O	+	vegetation
<i>Tulipa lehmanniana</i>	Perennial	7-10	R	+	vegetation
<i>Tulipa sogdiana</i>	Perennial	7-10	R	+	vegetation
<i>Zygophyllum macrophyllum</i>	Perennial	10-12	R	+	flowering



Photo 36. Plot B107. Steep sandstone slopes of saline depression with very sparse saltwort vegetation

4.1.3. Fixed and semi-fixed sands

Fixed and semi-fixed ridge-hilly sands prevail in the north-eastern part of “Bash” area. The vegetation of this habitat type is represented with native calligonum-saltwort-ephemeroid-sagebrush community (*Artemisia diffusa*, *Poa bulbosa*, *Carex physodes*, *Salsola arbuscula*, *Calligonum leucocladum*, *C. microcarpum*) and saltwort-ephemeroid-sagebrush vegetation (*Artemisia diffusa*, *Poa bulbosa*, *Carex physodes*, *Caroxylon orientale*). Psammophilous vegetation, particularly desert shrubs and saxaul woodlands, plays an important ecological role forming a unique landscape of sandy deserts of Central Asia and fixing sands.

The plant species diversity is higher than on flat and flat-wavy sandy desert plain (up to 30–31 species). The canopy cover is 40–50%. The vegetation is more or less uniform, only local abundance of saltworts and *Calligonum* varies on different areas. One moss species (*Tortula desertorum*) has been found in all plots; on some local areas it covers up to 5%. One nationally red-listed species, *Tulipa lehmanniana*, occurs sporadically within all territory of this habitat type, its abundance is R to O, population density varies from solitary specimens to 900–1000 per 1 hectare. The main type of land

use is pasture; an impact of grazing is medium; several shepherds houses are situated in this territory. Local impact is connected with several ground roads, railway and with electric lines. Within this habitat type, following geobotanical sample plots were described.

B005, B006

40.698465 – 40.694972° N, 64.63287 – 64.638676° E, 281–291 m.s.l.

Fixed hilly sands covered with native ephemeroïd-sagebrush vegetation (*Artemisia diffusa*, *Poa bulbosa*, *Carex physodes*), with psammophilous shrubs (*Calligonum leucocladum*, *C. microcarpum*) on the tops. The canopy cover is 30–40%. 25 plant and 1 moss species were recorded (Table 27), including solitary specimens of nationally red-listed *Tulipa lehmanniana*. Endemic to Central Asian deserts *Cousinia sogdiana* previously also was included in the Red Data Book of Uzbekistan (1984, 1998, 2006, 2009), but as a result of field surveys performed during the last 20 years, it has been revealed that this species is common in desert zone of Uzbekistan, and it has been removed from the 5th edition of the national Red Data Book. Alien plants are absent. Several colonies of gerbils (*Meriones sp.*) are situated on the area.

Table 27. Check-list of plants recorded in survey plots B005–B006.

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
<i>Alyssum desertorum</i>	annual	5–6	O	+	flowering
<i>Artemisia diffusa</i>	semishrub	25–30	D	2	vegetation
<i>Astragalus villosissimus</i>	dwarf shrub	35–40	O	+	vegetation
<i>Bromus tectorum</i>	annual	12–15	O	+	flowering
<i>Calligonum leucocladum</i>	shrub	50–70	R	+	vegetation
<i>Calligonum microcarpum</i>	shrub	50–70	R	+	vegetation
<i>Carex physodes</i>	Perennial	12–15	D	1	flowering
<i>Caroxylon orientale</i> (<i>Salsola orientalis</i>)	dwarf shrub	35–40	O	+	vegetation
<i>Caroxylon scleranthum</i> (<i>Salsola sclerantha</i>)	annual	30–35	R	+	Dried
<i>Ceratocarpus arenarius</i>	annual	15–20	O	+	Dried
<i>Ceratocephala falcata</i>	annual	3–4	O	+	flowering
<i>Convolvulus divaricatus</i>	semishrub	25–30	O	+	vegetation
<i>Convolvulus hamadae</i>	semishrub	25–30	O	1	vegetation
<i>Cousinia sogdiana</i>	biennial	20–35	R	+	vegetation
<i>Ferula foetida</i>	Perennial	50–60	O	1	flowering
<i>Holosteum umbellatum</i>	annual	6–8	O	+	flowering
<i>Hypecoum pendulum</i>	annual	12–15	O	+	flowering
<i>Iris longiscapa</i>	perennial	17–20	R	+	flowering
<i>Peganum garmala</i>	Perennial	15–20	R	+	vegetation
<i>Poa bulbosa</i>	Perennial	15–17	A	1	vegetation
<i>Salsola paulsenii</i>	annual	40–45	R	+	Dried
<i>Sophora pachycarpa</i>	Perennial	15–20	R	+	vegetation
<i>Stipagrostis pennata</i>	Perennial	30–35	R	+	vegetation
<i>Tortula desertorum</i>	moss	0.3–0.5	O	+	vegetation
<i>Tulipa lehmanniana</i>	Perennial	10–15	R	+	vegetation

<i>Xylosalsola arbuscula</i> (<i>Salsola arbuscula</i>)	shrub	40–50	O	+	vegetation
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Photo 37, 38. Plots B005 (above) and B006 (below). Fixed hilly sands with ephemeroïd-sagebrush vegetation, and with psammophilous shrubs (*Calligonum leucocladum*, *C. microcarpum*) on the tops

B040, B041, B042, and VP4

40.68791 – 40.678088° N, 64.611974 – 64.638916° E, 270–282 m.s.l.

Native calligonum-saltwort-ephemeroïd-sagebrush community (*Artemisia diffusa*, *Poa bulbosa*, *Carex physodes*, *Xylosalsola arbuscula*, *Calligonum leucocladum*, *C.*

microcarpum) on fixed hilly sands; 30 plant and 1 moss species were recorded (Table 28), including nationally red-listed *Tulipa lehmanniana* (occurs sporadically within and between plots). The canopy cover is 40–50%. Alien plants are absent. Several colonies of gerbils (*Meriones* sp.) are situated on the territory.

Table 28. Check-list of plants recorded in survey plots B040–B042 and VP4.

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
<i>Acanthophyllum elatius</i>	Perennial	40–45	R	+	vegetation
<i>Alhagi pseudalhagi</i>	Perennial	35–40	O	+	Dried
<i>Alyssum desertorum</i>	annual	5–6	O	+	flowering
<i>Artemisia diffusa</i>	semishrub	25–30	A–D	1–2	vegetation
<i>Astragalus flexus</i>	perennial	15–17	R	+	flowering
<i>Astragalus villosissimus</i>	dwarf shrub	35–40	A	1	vegetation
<i>Bromus tectorum</i>	annual	12–15	O	+	flowering
<i>Calligonum leucocladum</i>	shrub	50–100	A–O	1–2	vegetation
<i>Calligonum microcarpum</i>	shrub	50–100	A–O	1–2	vegetation
<i>Carex physodes</i>	Perennial	12–15	D	1	flowering
<i>Caroxylon orientale</i> (<i>Salsola orientalis</i>)	dwarf shrub	35–40	O	+	vegetation
<i>Caroxylon scleranthum</i> (<i>Salsola sclerantha</i>)	annual	30–35	R	+	Dried
<i>Ceratocarpus arenarius</i>	annual	15–20	O	+	Dried
<i>Ceratocephala falcata</i>	annual	3–4	O	+	flowering
<i>Convolvulus divaricatus</i>	semishrub	25–30	O	+	vegetation
<i>Convolvulus hamadae</i>	semishrub	25–30	O	+	vegetation
<i>Cousinia hamadae</i>	Perennial	15–20	R	+	vegetation
<i>Cousinia sogdiana</i>	biennial	20–35	R	+	vegetation
<i>Ferula foetida</i>	Perennial	50–60	O	1	flowering
<i>Heliotropium arguzioides</i>	Perennial	25–30	R	+	vegetation
<i>Holosteum umbellatum</i>	annual	6–8	O	+	flowering
<i>Hypecoum pendulum</i>	annual	12–15	O	+	flowering
<i>Iris longiscapa</i>	perennial	17–20	R	+	flowering
<i>Iris songarica</i>	Perennial	30–35	R	+	vegetation
<i>Mausolea eriocarpa</i>	semishrub	45–50	O	1	vegetation
<i>Peganum garmala</i>	Perennial	15–20	R	+	vegetation
<i>Poa bulbosa</i>	Perennial	15–17	A	1	vegetation
<i>Salsola paulsenii</i>	annual	40–45	R	+	Dried
<i>Stipagrostis pennata</i>	Perennial	30–35	O	+	vegetation
<i>Tortula desertorum</i>	moss	0.3–0.5	O	+	vegetation
<i>Tulipa lehmanniana</i>	Perennial	10–15	O	+	vegetation

<i>Xylosalsola arbuscula</i> (<i>Salsola arbuscula</i>)	shrub	40–50	A–O	1–+	vegetation
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Photo 39, 40. Plots B040 (above) and B041 (below). Fixed sands with calligonum-saltwort-ephemeroid-sagebrush vegetation



Photo 41. Plot B040. Flowering and non-flowering generative specimens of *Tulipa lehmanniana*, nationally red-listed plant

B044, B045, and VP5

40.664263 – 40.661484° N, 64.669446 – 64.676604° E, 290–300 m.s.l.

Native saltwort-ephemeroid-sagebrush community (*Artemisia diffusa*, *Poa bulbosa*, *Carex physodes*, *Xylosalsola arbuscula*, *Caroxylon orientale*) on fixed hilly sands; 24 plant and 1 moss species were recorded (Table 29), including nationally red-listed *Tulipa lehmanniana* (solitary specimens occur sporadically within and between plots). The canopy cover is 30–40%. Alien plants are absent. A shepherd's house is situated on this territory, but the impact of grazing is medium.

Table 29. Check-list of plants recorded in survey plots B044–B045 and VP5.

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
<i>Alhagi pseudalhagi</i>	Perennial	35–40	R	+	Dried
<i>Alyssum desertorum</i>	annual	5–6	O	+	flowering
<i>Artemisia diffusa</i>	semishrub	25–30	D	2	vegetation
<i>Astragalus villosissimus</i>	dwarf shrub	35–40	R	+	vegetation
<i>Bromus tectorum</i>	annual	12–15	O	+	flowering
<i>Calligonum microcarpum</i>	shrub	50–100	R	+	vegetation
<i>Carex physodes</i>	Perennial	12–15	D	1	flowering
<i>Caroxylon orientale</i> (<i>Salsola orientalis</i>)	dwarf shrub	35–40	A	1	vegetation
<i>Ceratocarpus arenarius</i>	annual	15–20	R	+	Dried
<i>Ceratocephala falcata</i>	annual	3–4	O	+	flowering
<i>Convolvulus divaricatus</i>	semishrub	25–30	R	+	vegetation

<i>Convolvulus hamadae</i>	semishrub	25–30	R	+	vegetation
<i>Cousinia hamadae</i>	Perennial	15–20	R	+	vegetation
<i>Cousinia sogdiana</i>	biennial	20–35	R	+	vegetation
<i>Ferula foetida</i>	Perennial	50–60	O–A	1	flowering
<i>Holosteum umbellatum</i>	annual	6–8	O	+	flowering
<i>Hypecoum pendulum</i>	annual	12–15	O	+	flowering
<i>Iris longiscapa</i>	perennial	17–20	R	+	flowering
<i>Iris songarica</i>	Perennial	30–35	R	+	vegetation
<i>Peganum garmala</i>	Perennial	15–20	R	+	vegetation
<i>Poa bulbosa</i>	Perennial	15–17	A	1	vegetation
<i>Salsola paulsenii</i>	annual	40–45	R	+	Dried
<i>Tortula desertorum</i>	moss	0.3–0.5	O	+	vegetation
<i>Tulipa lehmanniana</i>	Perennial	10–15	R	+	vegetation
<i>Xylosalsola arbuscula</i> (<i>Salsola arbuscula</i>)	shrub	40–50	O	+	vegetation





Photo 42, 43. Plot B044. Fixed sands with saltwort-ephemeroid-sagebrush vegetation, and a shepherd's house (below)

B067, B068

40.654247 – 40.659515° N, 64.637586 – 64.632302° E, 263 m.s.l.

Native calligonum-saltwort-ephemeroid-sagebrush community (*Artemisia diffusa*, *Poa bulbosa*, *Carex physodes*, *Xylosalsola arbuscula*, *Calligonum leucocladum*, *C. microcarpum*) on fixed small-hilly sands; 31 plant and 1 moss species were recorded (Table 30), including nationally red-listed *Tulipa lehmanniana* (numerous mainly pre-generative specimens occurs sporadically within survey squares and between plots). The canopy cover is 40–50%. Alien plants are absent. Several colonies of gerbils (*Meriones* sp.) are situated on the area.

Table 30. Check-list of plants recorded in survey plots B067–B068.

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
<i>Acanthophyllum elatius</i>	Perennial	40–45	R	+	vegetation
<i>Alyssum desertorum</i>	annual	5–6	O	+	flowering
<i>Artemisia diffusa</i>	semishrub	25–30	A	1	vegetation
<i>Astragalus chiwensis</i>	perennial	25–30	R	+	vegetation
<i>Astragalus flexus</i>	perennial	15–17	R	+	flowering
<i>Astragalus rubromarginatus</i>	Perennial	12–15	R	+	vegetation
<i>Astragalus villosissimus</i>	dwarf shrub	35–40	A	1	vegetation
<i>Bromus tectorum</i>	annual	12–15	O	+	flowering
<i>Calligonum leucocladum</i>	shrub	50–100	A	1	vegetation
<i>Calligonum microcarpum</i>	shrub	50–100	A	1	vegetation

<i>Carex physodes</i>	Perennial	12–15	D	1	flowering
<i>Caroxylon orientale</i> (<i>Salsola orientalis</i>)	dwarf shrub	35–40	O	+	vegetation
<i>Ceratocarpus arenarius</i>	annual	15–20	R	+	Dried
<i>Ceratocephala falcata</i>	annual	3–4	O	+	flowering
<i>Convolvulus divaricatus</i>	semishrub	25–30	O	+	vegetation
<i>Convolvulus hamadae</i>	semishrub	25–30	A	1	vegetation
<i>Cousinia hamadae</i>	Perennial	15–20	R	+	vegetation
<i>Cousinia sogdiana</i>	biennial	20–35	R	+	vegetation
<i>Ferula foetida</i>	Perennial	50–60	O	1	flowering
<i>Heliotropium arguzioides</i>	Perennial	25–30	R	+	vegetation
<i>Holosteum umbellatum</i>	annual	6–8	O	+	flowering
<i>Hypecoum pendulum</i>	annual	12–15	O	+	flowering
<i>Iris longiscapa</i>	perennial	17–20	R	+	flowering
<i>Iris songarica</i>	Perennial	30–35	R	+	vegetation
<i>Mausolea eriocarpa</i>	semishrub	45–50	O	1	vegetation
<i>Peganum garmala</i>	Perennial	15–20	R	+	vegetation
<i>Phlomis desertorum</i>	Perennial	15–20	R	+	vegetation
<i>Poa bulbosa</i>	Perennial	15–17	A	1	vegetation
<i>Salsola paulsenii</i>	annual	40–45	R	+	Dried
<i>Stipagrostis pennata</i>	Perennial	30–35	O	+	vegetation
<i>Tortula desertorum</i>	moss	0.3–0.5	A	1	vegetation
<i>Tulipa lehmanniana</i>	Perennial	10–15	O	+	vegetation
<i>Xylosalsola arbuscula</i> (<i>Salsola arbuscula</i>)	shrub	40–50	A	1	vegetation

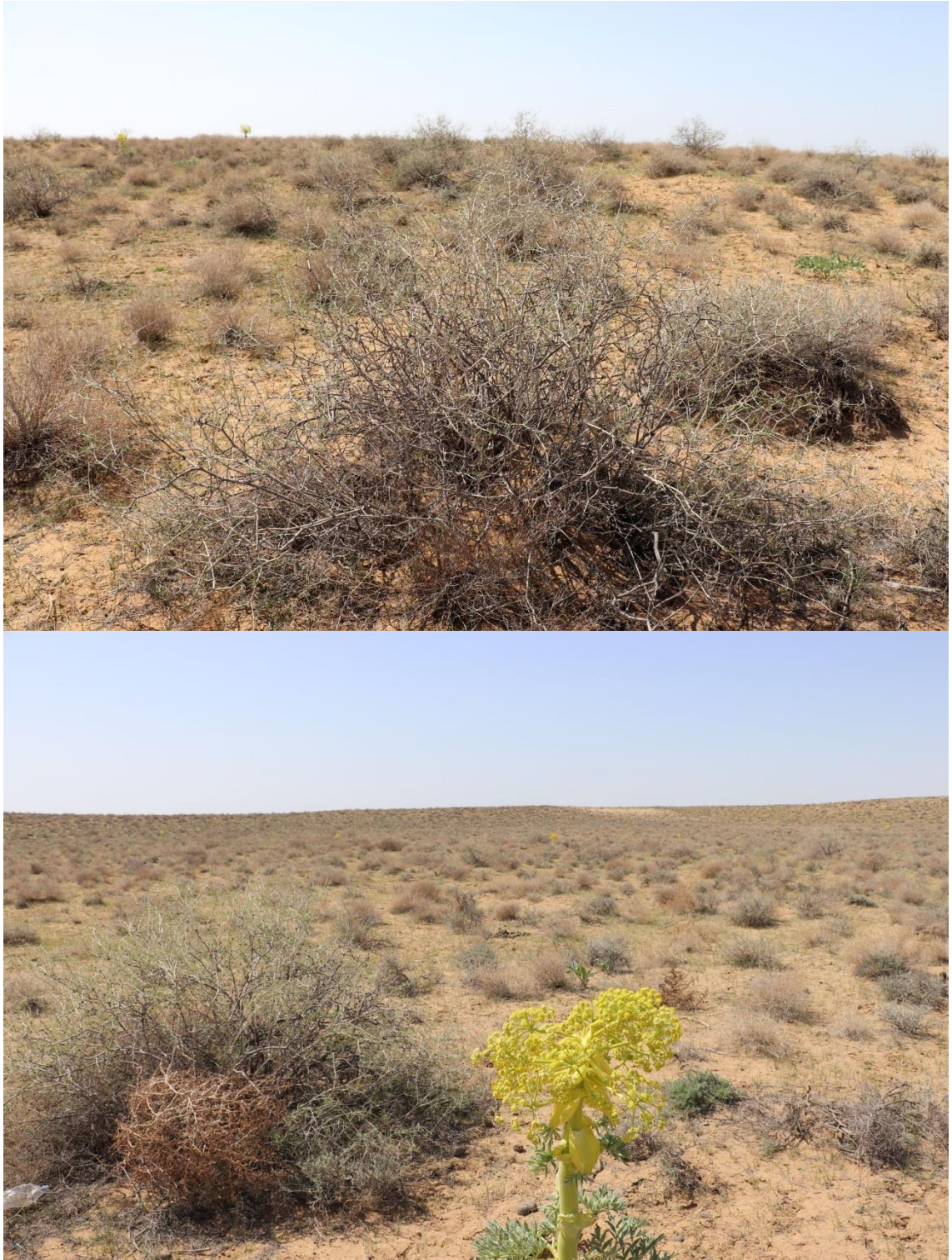


Photo 44, 45. Plots B068 (above) and B067 (below). Fixed sands with calligonum-saltwort-ephemeroid-sagebrush vegetation



Photo 46. *Calligonum microcarpum*, one of main dominant species of psammophilous shrubs of the Kyzylkum

B071–B083, and VP7

40.634589 – 40.582794° N, 64.674604 – 64.729295° E, 254–262 m.s.l.

The plantation of white saxaul (*Haloxylon persicum*), native dominant species of Central Asian sandy deserts, covers an area of 9x3 km of hilly sands between railway and electric line in the south-eastern part of project site. This plantation has been created in the past for fixation of sands. The saxaul stands are rather sparse, unclosed or partially closed on local areas; dominant plants of the herbaceous layer are sagebrush (*Artemisia diffusa*), desert sedge (*Carex physodes*), and *Ferula foetida*; 25 plant and 1 moss species were recorded in total within this area (Table 31), including nationally red-listed *Tulipa lehmanniana* (numerous generative and pre-generative specimens occur sporadically within and between survey squares). The canopy cover is 40–50%. Alien plants are absent. Several colonies of gerbils (*Meriones sp.*) are situated on the area.

Table 31. Check-list of plants recorded in survey plots B071–B083, and VP7.

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
<i>Acanthophyllum elatius</i>	Perennial	40–45	R	+	vegetation
<i>Alyssum desertorum</i>	annual	5–6	O	+	flowering
<i>Artemisia diffusa</i>	semishrub	25–30	A	1	vegetation
<i>Astragalus flexus</i>	perennial	15–17	R	+	flowering
<i>Astragalus villosissimus</i>	dwarf shrub	35–40	O	+	vegetation
<i>Bromus tectorum</i>	annual	12–15	O	+	flowering
<i>Calligonum microcarpum</i>	shrub	50–100	R	+	vegetation
<i>Carex physodes</i>	Perennial	12–15	D	1	flowering

<i>Caroxylon orientale</i> (<i>Salsola orientalis</i>)	dwarf shrub	35-40	O	+	vegetation
<i>Ceratocarpus arenarius</i>	annual	15-20	R	+	Dried
<i>Ceratocephala falcata</i>	annual	3-4	O	+	flowering
<i>Convolvulus divaricatus</i>	semishrub	25-30	O	+	vegetation
<i>Convolvulus hamadae</i>	semishrub	25-30	O	+	vegetation
<i>Ferula foetida</i>	Perennial	50-60	D-O	2-+	flowering
<i>Haloxylon persicum</i>	Small tree	180-200	A-D	1-3	
<i>Heliotropium arguzioides</i>	Perennial	25-30	R	+	vegetation
<i>Holosteum umbellatum</i>	annual	6-8	O	+	flowering
<i>Hypecoum pendulum</i>	annual	12-15	O	+	flowering
<i>Iris longiscapa</i>	perennial	17-20	R	+	flowering
<i>Iris songarica</i>	Perennial	30-35	O	+	vegetation
<i>Peganum garmala</i>	Perennial	15-20	R	+	vegetation
<i>Poa bulbosa</i>	Perennial	15-17	A-O	1-+	vegetation
<i>Salsola paulsenii</i>	annual	40-45	R	+	Dried
<i>Tortula desertorum</i>	moss	0.3-0.5	O	+	vegetation
<i>Tulipa lehmanniana</i>	Perennial	10-15	O	+	vegetation
<i>Xylosalsola arbuscula</i> (<i>Salsola arbuscula</i>)	shrub	40-50	O	+	vegetation



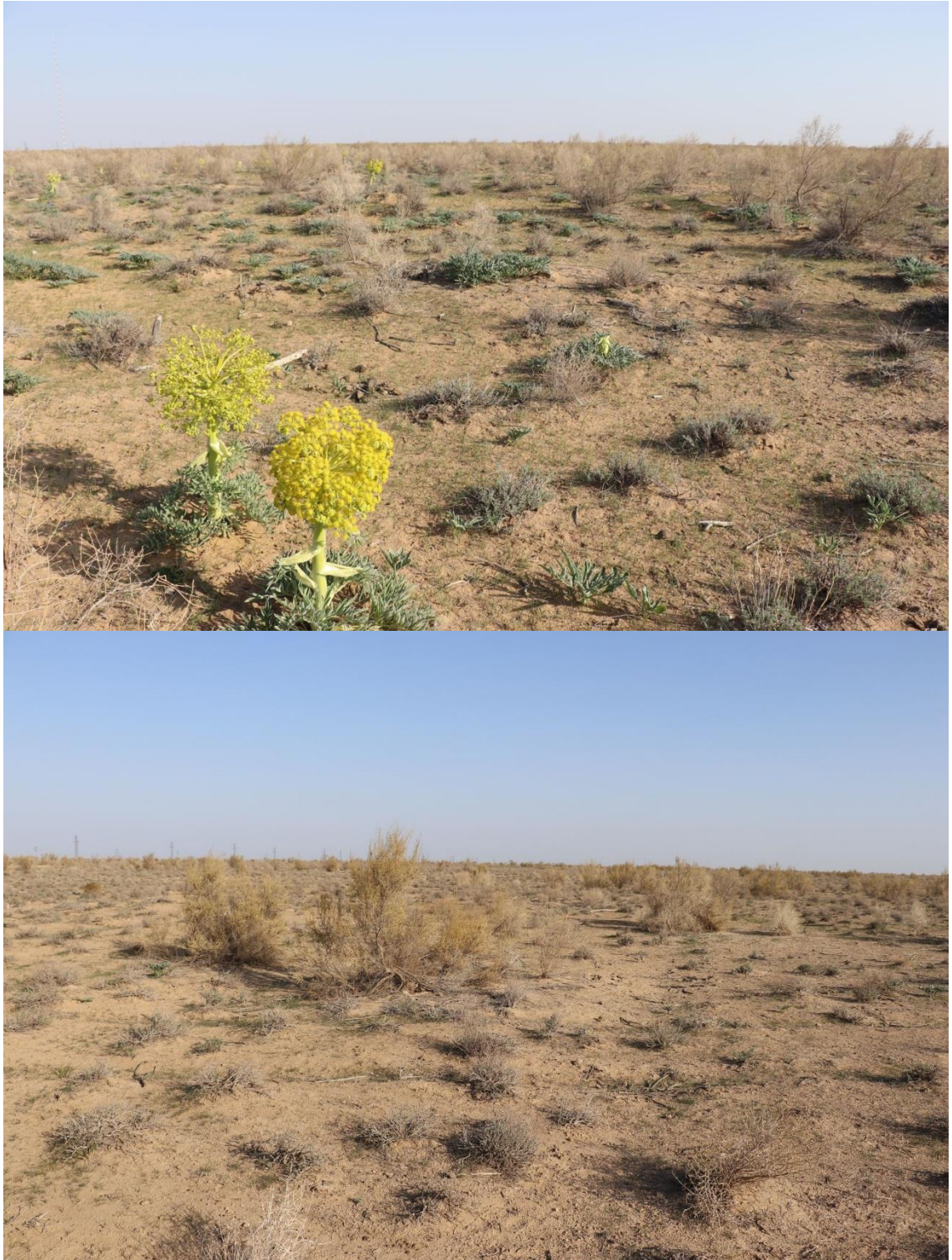


Photo 47, 48, 49. Plots B072 (above), B078 (middle) and B082 (below). Fixed sands with plantations of white saxaul and ephemeroid-sagebrush herbaceous layer



Photo 50. Plot B079. Flowering generative specimen of *Tulipa lehmanniana*, nationally red-listed plant

4.1.4. Relic uplands

Gently sloping stony relic hills with blown sandy cover are situated in the eastern part of the project site, and small insular uplands are found in the north-western part, at the border of saline depression Ayakagyta. The landscape of its sabulous slopes covered with ephemeroid-sagebrush and ephemeroid-sagebrush-saltwort vegetation is similar with neighboring sandy desert plain. On the small areas with outcrops of beds, the stony desert with ephemeroid-dwarf shrub-sagebrush-saltwort vegetation is represented. The canopy cover varies from 10–20% on stony areas to 30–40% on sabulous places. As in other types of landscapes of the project site, the main type of land use is rangeland; an impact of grazing is medium; several shepherds houses are situated here. Local impact is connected with several ground roads and electric lines. Within this habitat type, following geobotanical sample plots were described.

B032, B033, B034

40.655382 – 40.650094° N, 64.737142 – 64.750785° E, 304–317 m.s.l.

Gently sloping sandy-stony relics hills with eroded slopes, small outcrops of beds, and with native ephemeroid-sagebrush vegetation (*Artemisia diffusa*, *Poa bulbosa*, *Carex subphysodes*); species diversity is low; 12 plant and 1 moss species were recorded (Table 32). The canopy cover is 25–30%. The impact of grazing is medium to low.

Table 32. Check-list of plants recorded in survey plots B032–B034.

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
<i>Artemisia diffusa</i>	semishrub	15–20	D	2–3	vegetation
<i>Carex subphysodes</i>	Perennial	12–15	A	1	flowering
<i>Caroxylon orientale</i> (<i>Salsola orientalis</i>)	dwarf shrub	35–40	R	+	vegetation
<i>Ceratocarpus arenarius</i>	annual	15–20	R	+	Dried

<i>Convolvulus hamadae</i>	semishrub	25–30	R	+	vegetation
<i>Cousinia hamadae</i>	Perennial	15–20	R	+	vegetation
<i>Ferula foetida</i>	Perennial	30–35	R–O	+	vegetation
<i>Holosteum umbellatum</i>	annual	6–8	R	+	flowering
<i>Iris songarica</i>	Perennial	30–35	R	+	vegetation
<i>Meniocus linifolius</i>	annual	6–7	O	+	Flowering, fruiting
<i>Oreosalsola arbusculoformis</i> (<i>Salsola arbusculiformis</i>)	dwarf shrub	35–40	R	+	vegetation
<i>Poa bulbosa</i>	Perennial	15–17	A	1	vegetation
<i>Tortula desertorum</i>	moss	0.3–0.5	O–A	+–1	vegetation



Photo 51. Plot B034. Gently sloping sandy-stony relic hills with ephemeroid-sagebrush vegetation

B048, B049

40.653361 – 40.650308° N, 64.69859 – 64.704047° E, 293–300 m.s.l.

Gently sloping stony relic hill with sandy cover and with native ephemeroid-saltwort-sagebrush vegetation (*Oreosalsola arbusculiformis*, *Caroxylon orientale*, *Artemisia diffusa*, *Poa bulbosa*, *Carex subphysodes*). 16 plant and 1 moss species were recorded (Table 33), including solitary specimens of nationally red-listed *Tulipa lehmanniana*. The canopy cover is 40%.

Table 33. Check-list of plants recorded in survey plots B048 and B049.

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
<i>Alyssum desertorum</i>	annual	5–6	O	+	flowering

<i>Artemisia diffusa</i>	semishrub	15–20	D	2	vegetation
<i>Astragalus villosissimus</i>	dwarf shrub	35–40	O	+	vegetation
<i>Carex subphysodes</i>	Perennial	12–15	A	1	flowering
<i>Caroxylon orientale</i> (<i>Salsola orientalis</i>)	dwarf shrub	35–40	A	1	vegetation
<i>Ceratocarpus arenarius</i>	annual	15–20	R	+	Dried
<i>Convolvulus divaricatus</i>	semishrub	25–30	R	+	vegetation
<i>Convolvulus hamadae</i>	semishrub	25–30	O	+	vegetation
<i>Cousinia hamadae</i>	Perennial	15–20	R	+	vegetation
<i>Ferula foetida</i>	Perennial	30–35	R	+	vegetation
<i>Holosteum umbellatum</i>	annual	6–8	O	+	flowering
<i>Iris songarica</i>	Perennial	30–35	R	+	vegetation
<i>Oreosalsola arbusculiformis</i> (<i>Salsola arbusculiformis</i>)	dwarf shrub	35–40	A	1	vegetation
<i>Poa bulbosa</i>	Perennial	15–17	A	1	vegetation
<i>Tortula desertorum</i>	moss	0.3–0.5	O	+	vegetation
<i>Tulipa lehmanniana</i>	Perennial	10–15	R	+	vegetation
<i>Tulipa sogdiana</i>	Perennial	7–10	R	+	vegetation



Photo 52. Plot 048. Gently sloping sandy-stony relic hill with ephemeroid-saltwort-sagebrush vegetation

B050, B051, B052, B053, B054, and VP8

40.646213 – 40.630183° N, 64.709880 – 64.731321° E, 274–300 m.s.l.

Gently sloping stony relic hill with blown sandy cover, sometimes with local outcrops of beds, and with native ephemeroïd-sagebrush vegetation (*Artemisia diffusa*, *Poa bulbosa*, *Carex subphysodes*). 16 plant and 1 moss species were recorded (Table 34), including solitary specimens of nationally red-listed *Tulipa lehmanniana*. The giant umbelliferous *Ferula foetida* is abundant on local areas on top of the hills. The canopy cover is 25–30%. The impact of grazing is medium to low. Colonies of gerbils (*Meriones* sp.) occur sporadically on the area, and nationally red-listed Central Asian turtles (*Testudo horsfieldii*) are very numerous on this part of project site.

Table 34. Check-list of plants recorded in survey plots B050–B054, and VP8.

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
<i>Acanthophyllum elatius</i>	Perennial	25–30	R	+	vegetation
<i>Alyssum desertorum</i>	annual	5–6	O	+	flowering
<i>Artemisia diffusa</i>	semishrub	15–20	D	2–3	vegetation
<i>Astragalus villosissimus</i>	dwarf shrub	30–35	R	+	vegetation
<i>Carex subphysodes</i>	Perennial	12–15	O–A	+–1	flowering
<i>Caroxylon orientale</i> (<i>Salsola orientalis</i>)	dwarf shrub	35–40	R	+	vegetation
<i>Ceratocarpus arenarius</i>	annual	15–20	R	+	Dried
<i>Convolvulus hamadae</i>	semishrub	25–30	R	+	vegetation
<i>Cousinia hamadae</i>	Perennial	15–20	R	+	vegetation
<i>Ferula foetida</i>	Perennial	30–35	R–A	+–1	vegetation
<i>Holosteum umbellatum</i>	annual	6–8	R	+	flowering
<i>Iris songarica</i>	Perennial	30–35	R	+	vegetation
<i>Oreosalsola arbusculiformis</i> (<i>Salsola arbusculiformis</i>)	dwarf shrub	35–40	R	+	vegetation
<i>Poa bulbosa</i>	Perennial	15–17	O–A	+–1	vegetation
<i>Tortula desertorum</i>	moss	0.3–0.5	O–A	+–1	vegetation
<i>Tulipa lehmanniana</i>	Perennial	10–15	R	+	vegetation
<i>Tulipa sogdiana</i>	Perennial	7–10	R	+	vegetation





Photo 53, 54, 55. Plots B052 (above), B053(middle) and B054 (below). Gently sloping sandy-stony relic hills with uniform ephemeroid-sagebrush vegetation

B056, B057, B058, B059

40.686278 – 40.674739° N, 64.556687 – 64.571255° E, 272–292 m.s.l.

Rather small, gently sloping stony hill with blown sandy cover and native ephemeroid-dwarf shrub-sagebrush-saltwort vegetation (*Oreosalsola arbusculiformis*, *Caroxylon orientale*, *Artemisia diffusa*, *Astragalus villosissimus*, *Convolvulus hamadae*, *Poa bulbosa*, *Carex subphysodes*). This insular relic hill is situated on the boundary between sandy desert plain and saline depression. 19 plant and 1 moss species were recorded (Table 35). The canopy cover is 20–30%. Solitary generative and numerous pre-generative specimens of nationally red-listed *Tulipa lehmanniana* occurs sporadically within and between the survey squares.

Table 35. Check-list of plants recorded in survey plots B056–B059.

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
<i>Alyssum desertorum</i>	annual	5–6	O	+	flowering
<i>Artemisia diffusa</i>	semishrub	15–20	A	1	vegetation
<i>Astragalus villosissimus</i>	dwarf shrub	35–40	A	1	vegetation
<i>Carex subphysodes</i>	Perennial	12–15	A	1	flowering
<i>Caroxylon orientale</i> (<i>Salsola orientalis</i>)	dwarf shrub	35–40	A	1	vegetation
<i>Ceratocarpus arenarius</i>	annual	15–20	R	+	Dried
<i>Convolvulus hamadae</i>	semishrub	25–30	A	1	vegetation
<i>Cousinia hamadae</i>	Perennial	15–20	O	+	vegetation
<i>Ferula foetida</i>	Perennial	30–35	R	+	vegetation

<i>Halothamnus subaphyllus</i>	semishrub	40–45	R	+	vegetation
<i>Holosteum umbellatum</i>	annual	6–8	O	+	flowering
<i>Iris songarica</i>	Perennial	30–35	R	+	vegetation
<i>Ixiolirion tataricum</i>	Perennial	12–15	R	+	vegetation
<i>Oreosalsola arbusculiformis</i> (<i>Salsola arbusculiformis</i>)	dwarf shrub	35–40	A	1	vegetation
<i>Peganum garmala</i>	Perennial	15–20	R	+	vegetation
<i>Phlomis desertorum</i>	Perennial	15–20	R	+	vegetation
<i>Poa bulbosa</i>	Perennial	15–17	A	1	vegetation
<i>Tortula desertorum</i>	moss	0.3–0.5	O	+	vegetation
<i>Tulipa lehmanniana</i>	Perennial	10–15	R	+	vegetation
<i>Tulipa sogdiana</i>	Perennial	7–10	R	+	vegetation





Photo 56, 57. Plot 056 (above) and an area between plots B058 and B059 (below). Sandy-stony relic hill with ephemeroid- dwarf shrub-sagebrush-saltwort vegetation

4.1.5. Anthropogenic disturbed areas

At the present, technologically disturbed areas occupy only very small part of the project site, mainly in a narrow strip along the railway and underground gas pipeline (approximately 500–100 m wide). Small disturbed areas (construction sites or quarries about 250x150 and 350x250 m in size) with almost completely exterminated vegetation are located also in the south-eastern part of the project site, in surroundings of the survey plot B054. The plant species recorded here are the same that in surroundings of disturbed areas, but the canopy cover is extremely sparse, or the vegetation is almost completely exterminated (photo 58). Alien or red-listed plants are absent.

Such technogenically disturbed areas in the Kyzylkum desert, as well as overgrazed areas around farms, wells and villages, usually become centers of erosion which can lead to the formation of moving sands. Often this process can reach disaster scale. In the past, moving sands have frequently caused the death of cities and oases in desert zone of Central Asia.



Photo 58. Technologically disturbed area (construction site?) with almost completely exterminated vegetation, 1 km to the south of survey plot B054



Photo 59 *Peganum garmala*, an indicator of overgrazing and degradation of pastures

4.2. Dzhankeldy site

A total check-list of vascular plants recorded within the project site “Dzhankeldy” during the field survey in springtime and early summer includes ... species (Appendix 2). Following habitat types (map units) were identified for the “Dzhankeldy” site:

4.2.1. Weakly inclined piedmont plain of relic low mountains

The field survey showed that this habitat type is present mainly in the southern part of “Dzhankeldy” area (on the southern proluvial piedmont trails of the mountains Kuldzhuktau), including the bird survey circles VP1, VP2, VP9 and VP10, as well as in the north-eastern part of the project site. The terrain is flat, wavy or gently hilly, sometimes with dry riverbeds and debris cones. The vegetation is represented with native ephemeroide-sagebrush, ephemeroide-saltwort-sagebrush, sagebrush-saltwort and saltwort plant communities on sabulous, loamy, slightly saline, gypsaceous or skeleton sabulous-loamy grey-brown desert soil. Dominant plants are *Artemisia turanica*, *Artemisia diffusa*, *Poa bulbosa*, *Carex pachystylis*, *Caroxylon orientale* (*Salsola orientalis*) and *Oreosalsola arbusculiformis* (*Salsola arbusculiformis*). The dwarf shrub *Astragalus villosissimus*, giant umbellifer *Ferula foetida* and endemic desert-candle *Eremurus korolkowii* are subdominants on local areas. The canopy cover is sparse (10–30% or less), and plant species diversity is low (8 to 18 species). One moss species (*Tortula desertorum*) has been found in this habitat type; on some local areas it covers up to 1%. One nationally red-listed species, *Tulipa lehmanniana*, occurs sporadically within all territory of this habitat type, its abundance is R to O, population density varies from solitary specimens to 900–1000 per 1 hectare. The main type of land use is pasture; an impact of grazing is medium. Local impact is connected with asphalt road and several ground roads, and with geological exploration. Within this habitat type, following geobotanical sample plots were described.

VP1 and VP2

40.7843° N, 63.404295° E, 236 m.s.l.

Weakly inclined loamy-gravelly piedmont desert plain with native sagebrush-saltwort vegetation on gypsaceous, skeleton grey-brown desert soil (Photo 60–61). The canopy cover is 10–20%; 17 plant and 1 moss species were recorded (Table 36), none of them are alien. One species, *Eremurus korolkowii*, is national endemic of Uzbekistan and endemic to relic mountains of Kyzylkum (Photo 62). This species has been included in second and third editions of the Red Data Book of Uzbekistan (1998, 2006), but later it has been removed from the national Red Data Book (2009, 2019). This plant is not evaluated in the IUCN Red List.

Table 36. Check-list of plants recorded in survey plots VP1 and VP2

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
<i>Artemisia diffusa</i>	semishrub	20–25	A	1	vegetation
<i>Artemisia turanica</i>	semishrub	20–25	A	1	vegetation
<i>Astragalus villosissimus</i>	dwarf shrub	30–35	O	+	vegetation
<i>Atraphaxis spinosa</i>	shrub	30–35	R	+	vegetation
<i>Carex pachystylis</i>	Perennial	12–15	O	+	flowering
<i>Caroxylon orientale</i> (<i>Salsola orientalis</i>)	dwarf shrub	30–35	A	1	vegetation
<i>Ceratocarpus arenarius</i>	annual	15–20	O	+	Dried
<i>Climacoptera</i> sp.	annual	25–30	O	+	Dried
<i>Eremurus korolkowii</i>	Perennial	25–30	O	+	Vegetation, flowering

<i>Ferula foetida</i>	Perennial	50–60	R	+	Vegetation, flowering
<i>Lycium ruthenicum</i>	shrub	40–50	R	+	vegetation
<i>Nanophyton erinaceum</i>	semishrub	7–10	O	+	vegetation
<i>Oreosalsola arbusculiformis</i> (<i>Salsola arbusculiformis</i>)	dwarf shrub	30–35	A	1	vegetation
<i>Peganum garmala</i>	Perennial	20–25	R	+	vegetation
<i>Poa bulbosa</i>	Perennial	15–17	O	+	vegetation
<i>Takhtajaniantha pusilla</i> (<i>Scorzonera pusilla</i>)	Perennial	15–17	R	+	vegetation
<i>Tortula desertorum</i>	moss	0.3–0.5	R	+	vegetation
<i>Zygophyllum miniatum</i>	Perennial	10–15	R	+	Vegetation, flowering



Photo 60. Survey circle VP1. Southern piedmont plain of Kuldzhuktau mountains with sparse sagebrush-saltwort vegetation



Photo 61. Western part of survey circle VP2. Southern piedmont plain of Kuldzhuktau mountains with sparse sagebrush-saltwort vegetation



Photo 62. Korolkow's desert-candle (*Eremurus korolkowii*) national endemic of Uzbekistan and endemic to relic mountains of Kyzylkum

VP9 and VP10

40.87017–40.90958° N, 63.242–63.21672° E, 190–220 m.s.l. Weakly inclined loamy-gravelly piedmont desert plain and gently sloping foothills with native ephemeroid-saltwort-sagebrush and sagebrush-saltwort vegetation on gypsaceous, skeleton or gravelly grey-brown desert soil (Photo 63–64). The canopy cover is 5–20%; 23 plant and 1 moss species were recorded (Table 37), none of them are alien or red-listed. One

species, *Eremurus korolkowii*, is national endemic of Uzbekistan and endemic to relic mountains of Kyzylkum.

Table 37. Check-list of plants recorded in survey plots VP9 and VP10

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
<i>Anabasis eriopoda</i>	semishrub	15–20	R	+	vegetation
<i>Artemisia diffusa</i>	semishrub	20–25	A	1	vegetation
<i>Artemisia turanica</i>	semishrub	20–25	A–D	1	vegetation
<i>Astragalus villosissimus</i>	dwarf shrub	30–35	R–O	+	vegetation
<i>Carex pachystylis</i>	Perennial	12–15	A–D	+–1	flowering
<i>Caroxylon gemmascens</i> (<i>Salsola gemmascens</i>)	dwarf shrub	20–30	R–O	+	vegetation
<i>Caroxylon orientale</i> (<i>Salsola orientalis</i>)	dwarf shrub	30–35	O–A	1	vegetation
<i>Ceratocarpus arenarius</i>	annual	15–20	R–O	+	Dried
<i>Climacoptera</i> sp.	annual	25–30	R	+	Dried
<i>Eremurus korolkowii</i>	Perennial	25–30	R–O	+	Vegetation, flowering
<i>Ferula foetida</i>	Perennial	50–60	R–O	+	Vegetation, flowering
<i>Haloxylon ammodendron</i> (<i>Haloxylon aphyllum</i>)	Small tree	40–70	R	+–1	vegetation
<i>Iris longiscapa</i>	Perennial	15–17	R	+	flowering
<i>Koelpinia linearis</i>	annual	10–12	R	+	fruiting
<i>Lactuca orientalis</i>	semishrub	35–40	R	+	vegetation
<i>Lomelosia olivieri</i> (<i>Scabiosa olivieri</i>)	annual	15–17	R	+	fruiting
<i>Lycium ruthenicum</i>	shrub	35–45	R	+	vegetation
<i>Nanophyton erinaceum</i>	semishrub	7–10	R–O	+	vegetation
<i>Oreosalsola arbusculiformis</i> (<i>Salsola arbusculiformis</i>)	dwarf shrub	30–35	O–A	1	vegetation
<i>Peganum garmala</i>	Perennial	20–25	R	+	vegetation
<i>Poa bulbosa</i>	Perennial	15–17	O	+	vegetation
<i>Takhtajaniantha pusilla</i> (<i>Scorzonera pusilla</i>)	Perennial	15–17	R	+	vegetation
<i>Tortula desertorum</i>	moss	0.3–0.5	R	+	vegetation
<i>Zygophyllum miniatum</i>	Perennial	10–15	R	+	Vegetation, flowering



Photo 63. VP10. Southern piedmont plain of Kuldzhuktau mountains with ephemeroid-saltwort-sagebrush vegetation



Photo 64. VP9. Gravelly southern piedmont plain of Kuldzhuktau mountains with sparse saltwort-sagebrush vegetation



Photo 65. Desert sedge (*Carex pachystylis*), a dominant of ephemeroid-saltwort-sagebrush and ephemeroid-sagebrush communities

D050-D051

Gently inclined northern piedmonts of the mountains Kuldzhuktau with native ephemeroid-saltwort-sagebrush vegetation and solitary black saxaul (remains of plantations) on sandy-loamy grey-brown desert soil (Photo 66–67). The canopy cover is 30%. 25 plant and 1 moss species were recorded (Table 38), none of them are alien or listed in the Red Data Book of Uzbekistan (2019).

Table 38. Check-list of plants recorded in survey plots D050-D051

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
<i>Acanthophyllum elatius</i>	Perennial	25–35	R	+	vegetation
<i>Anabasis eriopoda</i>	semishrub	15–20	R	+	vegetation
<i>Artemisia diffusa</i>	semishrub	20–25	O	+	vegetation
<i>Artemisia turanica</i>	semishrub	20–25	A-D	1-2	vegetation
<i>Astragalus villosissimus</i>	dwarf shrub	30–35	O	+	vegetation
<i>Carex subphysodes</i>	Perennial	10–12	A	1	fruiting
<i>Caroxylon gemmascens</i> (<i>Salsola gemmascens</i>)	dwarf shrub	20–30	R	+	vegetation
<i>Ceratocarpus arenarius</i>	annual	15–20	O–A	+	Dried
<i>Convolvulus hamadae</i>	semishrub	25–30	O	+	vegetation
<i>Ferula foetida</i>	Perennial	50–60	O–A	+–1	Vegetation, flowering
<i>Haloxylon ammodendron</i> (<i>Haloxylon aphyllum</i>)	Small tree	100–150	R	+–1	vegetation
<i>Haplophyllum robustum</i>	perennial	25–30	R	+	vegetation
<i>Nanophyton erinaceum</i>	semishrub	7–10	O	+	vegetation

<i>Oreosalsola arbusculiformis</i> (<i>Salsola arbusculiformis</i>)	dwarf shrub	30–40	A	1	vegetation
<i>Peganum garmala</i>	Perennial	20–25	R	+	vegetation
<i>Poa bulbosa</i>	Perennial	15–17	O	+	vegetation
<i>Tortula desertorum</i>	moss	0.3–0.5	O	1	vegetation
<i>Xylosalsola arbuscula</i> (<i>Salsola arbuscula</i>)	shrub	40–50	R	+	vegetation



Photo 66. D050. Northern piedmonts of the mountains Kuldzhuktau with native ephemeroid-saltwort-sagebrush vegetation and solitary black saxaul



Photo 67. D051. Northern piedmonts of the mountains Kuldzhuktau with native ephemeroïd-saltwort-sagebrush vegetation and solitary black saxaul

D114–D118, D125

40.86467 – 40.87791° N, 63.285775 – 63.252131° E, 219–230 m.s.l.

Weakly inclined southern piedmont plain of and foothills with gently sloping terrain, covered with native ephemeroïd-saltwort-sagebrush vegetation and plantations of black saxaul on gypsaceous, loamy-gravelly grey-brown desert soil, sometimes with outcrops of variegated beds (Photo 68–72). The density of saxaul is up to 500–800 specimens per 1 hectare. The canopy cover is 5–30%. 23 plant and 1 moss species were recorded (Table 39), none of them are alien. One species, *Acanthophyllum cyrtostegium*, is listed in the Red Data Book of Uzbekistan (2019) with the category 3 (reducing); it is endemic to the south-western Kyzylkum and north-western spurs of Pamir-Alay, and national endemic. Solitary specimens of *Acanthophyllum cyrtostegium* occurs sporadically within and between survey plots D114–D118, the density of population is 40–45 individuals per 1 hectare. One species, *Eremurus korolkowii*, is national endemic of Uzbekistan and endemic to relic mountains of Kyzylkum.

Table 39. Check-list of plants recorded in survey plots D114–D118 and D125

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
<i>Acanthophyllum cyrtostegium</i>	Perennial	20–25	R	+	vegetation
<i>Anabasis eriopoda</i>	semishrub	15–20	R	+	vegetation
<i>Artemisia diffusa</i>	semishrub	20–25	A	1	vegetation
<i>Artemisia turanica</i>	semishrub	20–25	A–D	1	vegetation
<i>Astragalus villosissimus</i>	dwarf shrub	30–35	R–O	+	vegetation
<i>Carex pachystylis</i>	Perennial	12–15	O	+	flowering
<i>Caroxylon orientale</i> (<i>Salsola orientalis</i>)	dwarf shrub	30–35	A	1	vegetation
<i>Ceratocarpus arenarius</i>	annual	15–20	O	+	Dried
<i>Climacoptera sp.</i>	annual	25–30	O	+	Dried
<i>Eremurus korolkowii</i>	Perennial	25–30	R–O	+	Vegetation, flowering
<i>Ferula foetida</i>	Perennial	50–60	R	+	Vegetation, flowering
<i>Haloxylon ammodendron</i> (<i>Haloxylon aphyllum</i>)	Small tree	100–180	O–A	1–2	vegetation
<i>Iris longiscapa</i>	Perennial	15–17	R	+	flowering
<i>Koelpinia linearis</i>	annual	10–12	R	+	fruiting
<i>Lycium ruthenicum</i>	shrub	40–50	R	+	vegetation
<i>Nanophyton erinaceum</i>	semishrub	7–10	R	+	vegetation
<i>Oreosalsola arbusculiformis</i> (<i>Salsola arbusculiformis</i>)	dwarf shrub	30–35	A	1	vegetation
<i>Peganum garmala</i>	Perennial	20–25	R	+	vegetation
<i>Poa bulbosa</i>	Perennial	15–17	O	+	vegetation
<i>Scrophularia leucoclada</i>	semishrub	40–50	R	+	vegetation
<i>Takhtajaniantha pusilla</i> (<i>Scorzonera pusilla</i>)	Perennial	15–17	R	+	vegetation

<i>Tortula desertorum</i>	moss	0.3–0.5	R	+	vegetation
<i>Zygophyllum macrophyllum</i>	Perennial	12–15	R	+	Vegetation, flowering
<i>Zygophyllum miniatum</i>	Perennial	10–15	R	+	Vegetation, flowering



Photo 68. D114. Southern piedmont plain of Kuldzhuktau mountains with saltwort-sagebrush vegetation and plantations of black saxaul (April)



Photo 69. D114. Southern piedmont plain of Kuldzhuktau mountains with saltwort-sagebrush vegetation and plantations of black saxaul (June)



Photo 70. D117. Southern piedmont plain of Kuldzhuktau mountains with saltwort-sagebrush vegetation and plantations of black saxaul (June)



Photo 71. Between D114 and D125. Southern piedmont plain of Kuldzhuktau mountains with saltwort-sagebrush vegetation and plantations of black saxaul (April)



Photo 72. D125. Southern piedmont plain of Kuldzhuktau Mountains with saltwort-sagebrush vegetation and plantations of black saxaul (June)

4.2.2. Foothills of relic low mountains

This habitat type is characterized by more or less rugged hilly terrain, and the vegetation is represented with native saltwort-sagebrush vegetation on sandy-loamy, loamy, more or less skeleton grey-brown desert soils. The slopes of foothills are dissected with dry riverbeds.

D022–D029

Gently sloping foothills of the mountains Kuldzhuktau with native saltwort-sagebrush vegetation and solitary black saxaul on sabulous-loamy, skeleton grey-brown desert soil (Photo 73–76). The canopy cover is 20–30%. 31 plant and 1 moss species were recorded (Table 40), none of them are alien, and 3 species, *Acanthophyllum cyrtostegium*, *Ferula kyzylkumica* and *Tulipa lehmanniana*, are listed in the Red Data Book of Uzbekistan (2019) with the category 3 (reducing) (Photo 77–78). 3 generative and 11 pre-generative specimens of *Tulipa lehmanniana* and 6 specimens of *Acanthophyllum cyrtostegium* were count in survey plot D029; 6 generative and 31 pre-generative specimens of *Tulipa lehmanniana* and 4 specimens of *Acanthophyllum cyrtostegium* were count in survey plot D024; 8 specimens of *Ferula kyzylkumica* were found in survey plot D026.

Table 40. Check-list of plants recorded in survey plots D022–D029

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
<i>Acanthophyllum cyrtostegium</i>	Perennial	20–25	R	+	vegetation
<i>Allium protensum</i>	perennial	15-20	R	+	fruiting
<i>Anabasis eriopoda</i>	semishrub	15–20	R	+	vegetation
<i>Artemisia diffusa</i>	semishrub	20–25	O	+	vegetation
<i>Artemisia turanica</i>	semishrub	20–25	A–D	1	vegetation

<i>Astragalus ammotrophus</i>	Perennial	12–15	R	+	vegetation
<i>Astragalus villosissimus</i>	dwarf shrub	30–35	R–O	+	vegetation
<i>Carex pachystylis</i>	Perennial	10–12	O–A	1	fruiting
<i>Carex subphysodes</i>	Perennial	10–12	A	1	fruiting
<i>Caroxylon gemmascens</i> (<i>Salsola gemmascens</i>)	dwarf shrub	20–30	R	+	vegetation
<i>Ceratocarpus arenarius</i>	annual	15–20	A	+	Dried
<i>Ceratocephala falcata</i>	annual	3–4	R	+	fruiting
<i>Convolvulus hamadae</i>	semishrub	25–30	O	+	vegetation
<i>Ferula foetida</i>	Perennial	50–60	O	+	Vegetation
<i>Ferula kyzylkumica</i>	Perennial	10–15	R	+	Vegetation
<i>Fritillaria karelinii</i>	Perennial	10–12	R	+	fruiting
<i>Gagea afghanica</i>	Perennial	10–12	R	+	flowering
<i>Gagea bergii</i>	Perennial	5–7	R	+	flowering
<i>Halimocnemis villosa</i>	annual	10–12	O	+	vegetation
<i>Haloxyton ammodendron</i> (<i>Haloxyton aphyllum</i>)	Small tree	50–70	R	+	vegetation
<i>Haplophyllum robustum</i>	perennial	25–30	R	+	vegetation
<i>Heliotropium arguzioides</i>	Perennial	20–25	R	+	vegetation
<i>Leontice inserta</i>	perennial	10–12	R	+	vegetation
<i>Nanophyton erinaceum</i>	semishrub	7–10	O	+	vegetation
<i>Oreosalsola arbusculiformis</i> (<i>Salsola arbusculiformis</i>)	dwarf shrub	30–40	A	1	vegetation
<i>Peganum garmala</i>	Perennial	20–25	O	+	vegetation
<i>Poa bulbosa</i>	Perennial	15–17	A	1	vegetation
<i>Scorzonera gageoides</i>	Perennial	12–15	R	+	vegetation
<i>Tortula desertorum</i>	moss	0.3–0.5	O	+	vegetation
<i>Tulipa lehmanniana</i>	Perennial	10–20	R	+	Vegetation, flowering
<i>Tulipa sogdiana</i>	Perennial	7–10	R	+	fruiting
<i>Ziziphora tenuior</i>	annual	7–10	R	+	flowering



Photo 73. D029. Gently sloping foothills of Kuldzhuktau Mountains with saltwort-sagebrush vegetation (April)



Photo 74. D029. Gently sloping foothills of Kuldzhuktau Mountains with saltwort-sagebrush vegetation (June)



Photo 75. D026. Gently sloping foothills of Kuldzhuktau Mountains with saltwort-sagebrush vegetation (April)



Photo 76. D026. Gently sloping foothills of Kuldzhuktau Mountains with saltwort-sagebrush vegetation (June)



Photo 77. Plot D026. Pre- generative specimen of nationally red-listed *Ferula kyzylkumica*



Photo 78. Plot D024. One generative and 2 pre-generative specimens of nationally red-listed *Tulipa lehmanniana*

D030–D035

Foothills with rather gently sloping, hilly terrain, covered with native ephemeroïd-saltwort-sagebrush and sagebrush-salthwort vegetation and sometimes with sparse plantations of black saxaul on loamy and skeleton-loamy grey-brown desert soil (Photo 79–81). The canopy cover is 10–30%. 24 plant and 1 moss species were recorded (Table 41), none of them are alien. Three species, *Acanthophyllum cyrtostegium*, *Ferula*

kyzylkumica and *Tulipa lehmanniana*, are listed in the Red Data Book of Uzbekistan (2019) with the category 3 (reducing) (photo 82–83); they occur sporadically within and between survey plots, solitary or in small groups.

Table 41. Check-list of plants recorded in survey plots D030–D035

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
<i>Acanthophyllum cyrtostegium</i>	Perennial	20–25	R	+	vegetation
<i>Anabasis eriopoda</i>	semishrub	15–20	R	+	vegetation
<i>Artemisia diffusa</i>	semishrub	20–25	A-D	1	vegetation
<i>Artemisia turanica</i>	semishrub	20–25	O–D	+1	vegetation
<i>Astragalus ammotrophus</i>	Perennial	12–15	R	+	vegetation
<i>Astragalus villosissimus</i>	dwarf shrub	30–35	R–O	+	vegetation
<i>Atraphaxis spinosa</i>	shrub	50–70	R	+1	fruiting
<i>Carex pachystylis</i>	Perennial	12–15	O–A	+	flowering
<i>Carex subphysodes</i>	Perennial	10–12	O–A	+1	fruiting
<i>Caroxylon gemmascens</i> (<i>Salsola gemmascens</i>)	dwarf shrub	20–30	R–O	+	vegetation
<i>Ceratocarpus arenarius</i>	annual	15–20	O	+	Dried
<i>Climacoptera</i> sp.	annual	25–30	O	+	Dried
<i>Convolvulus divaricatus</i>	semishrub	25–30	R	+	flowering
<i>Convolvulus hamadae</i>	semishrub	25–30	R	+	vegetation
<i>Cousinia hamadae</i>	Perennial	15–20	R	+	vegetation
<i>Eremurus korolkowii</i>	Perennial	25–30	R	+	Vegetation, flowering
<i>Gagea afghanica</i>	Perennial	10–12	R	+	flowering
<i>Ferula foetida</i>	Perennial	50–60	R–O	+	Vegetation, flowering
<i>Ferula kyzylkumica</i>	Perennial	10–15	R	+	Vegetation
<i>Halimocnemis villosa</i>	annual	10–12	R–O	+	vegetation
<i>Haloxylon ammodendron</i> (<i>Haloxylon aphyllum</i>)	Small tree	50–100	R	+1	vegetation
<i>Haplophyllum robustum</i>	perennial	25–30	R	+	vegetation
<i>Koelpinia linearis</i>	annual	10–12	R	+	fruiting
<i>Nanophyton erinaceum</i>	semishrub	7–10	R	+	vegetation
<i>Oreosalsola arbusculiformis</i> (<i>Salsola arbusculiformis</i>)	dwarf shrub	30–50	O–A	+1	vegetation
<i>Peganum garmala</i>	Perennial	20–25	R	+	vegetation
<i>Poa bulbosa</i>	Perennial	15–17	O–A	+1	vegetation
<i>Scorzonera gageoides</i>	Perennial	12–15	R	+	vegetation
<i>Tortula desertorum</i>	moss	0.3–0.5	R–O	+1	vegetation
<i>Tulipa lehmanniana</i>	Perennial	10–20	R	+	Vegetation, flowering
<i>Zygophyllum macrophyllum</i>	Perennial	12–15	R	+	Vegetation, flowering
<i>Zygophyllum miniatum</i>	Perennial	10–15	R	+	Vegetation, flowering



Photo 79. D032. Gently sloping foothills of Kuldzhuktau Mountains with ephemeroïd-saltwort-sagebrush vegetation (April)



Photo 80. D035. Gently sloping foothills of Kuldzhuktau Mountains with ephemeroïd-saltwort-sagebrush vegetation (April)



Photo 81. D034. Gently sloping foothills of Kuldzhuktau Mountains with sagebrush-salthwort vegetation (June)



Photo 82. D034. Dried generative specimen of nationally red-listed endemic *Ferula kyzylkumica* (June)



Photo 83. Plot D035. Flowering specimen of nationally red-listed *Tulipa lehmanniana*

D059–D072

Foothills with rather gentle hilly terrain, covered with native ephemeroid-saltwort-sagebrush vegetation and sparse plantations of black saxaul on sandy-loamy, loamy and skeleton-loamy grey-brown desert soil. The differences between these survey plots are negligible; landscapes and the vegetation cover are uniform (Photo 84–87). The canopy cover is 20–30%. 43 plant and 1 moss species were recorded (Table 42), none of them are alien, 3 species, *Acanthophyllum cyrtostegium*, *Calligonum zakirovii* and *Tulipa lehmanniana* are listed in the Red Data Book of Uzbekistan (2019). Solitary specimens and small groups of *Acanthophyllum cyrtostegium* and *Tulipa lehmanniana* occur sporadically within and between survey plots, the density of population is up to 40–50 individuals per 1 hectare. 23 individuals of *Calligonum zakirovii* (category 1 – endangered, disappearing species; national endemic, endemic to south-western Kyzylkum) were count on an area of 0.5 hectare between D066 and D067 (40.86532° N, 63.43467° E, 335 m.s.l.) (Photo 88).

Table 42. Check-list of plants recorded in survey plots D059–D072

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
<i>Acanthophyllum cyrtostegium</i>	Perennial	20–25	R	+	vegetation
<i>Allium griffithianum</i>	Perennial	7–10	R	+	fruiting
<i>Allium sabulosum</i>	Perennial	15–20	R	+	vegetation
<i>Anabasis eriopoda</i>	semishrub	15–20	R	+	vegetation
<i>Artemisia diffusa</i>	semishrub	20–25	A–D	1	vegetation
<i>Artemisia juncea</i>	semishrub	30–35	O	+–1	vegetation
<i>Artemisia scoparia</i>	biennial	25–30	O	+	vegetation
<i>Artemisia turanica</i>	semishrub	20–25	A–D	1	vegetation
<i>Astragalus ammotrophus</i>	Perennial	12–15	R	+	vegetation

<i>Astragalus villosissimus</i>	dwarf shrub	30–35	R–O	+	vegetation
<i>Atraphaxis spinosa</i>	shrub	50–70	R	+–1	fruiting
<i>Calligonum leucocladum</i>	shrub	50–70	R	+–1	fruiting
<i>Calligonum zakirovii</i>	shrub	40–50	R	+	fruiting
<i>Carex pachystylis</i>	Perennial	7–10	O–A	+–1	flowering
<i>Carex physodes</i>	perennial	12–15	O	+	flowering
<i>Carex subphysodes</i>	Perennial	10–12	O–A	+–1	fruiting
<i>Caroxylon orientale</i> (<i>Salsola orientalis</i>)	dwarf shrub	30–35	O	+	vegetation
<i>Ceratocarpus arenarius</i>	annual	15–20	O	+	Dried
<i>Climacoptera</i> sp.	Annual	25–30	O	+	Dried
<i>Convolvulus hamadae</i>	semishrub	25–30	O–A	+–1	vegetation
<i>Cousinia hamadae</i>	Perennial	15–20	R	+	vegetation
<i>Ephedra strobilacea</i>	shrub	40–50	R	+	vegetation
<i>Eremurus korolkowii</i>	Perennial	25–30	R	+	Vegetation
<i>Ferula foetida</i>	Perennial	50–60	R–O	+	Vegetation, flowering
<i>Gagea afghanica</i>	Perennial	10–12	R	+	flowering
<i>Haloxylon ammodendron</i> (<i>Haloxylon aphyllum</i>)	Small tree	100–150	R–O	1	vegetation
<i>Haplophyllum robustum</i>	perennial	25–30	R	+	vegetation
<i>Holosteum umbellatum</i>	annual	6–8	R	+	fruiting
<i>Hypecoum pendulum</i>	annual	12–15	R	+	fruiting
<i>Iris songarica</i>	Perennial	20–25	R	+	vegetation
<i>Koelpinia linearis</i>	annual	10–12	R	+	fruiting
<i>Nanophyton erinaceum</i>	semishrub	7–10	R	+	vegetation
<i>Oreosalsola arbusculiformis</i> (<i>Salsola arbusculiformis</i>)	dwarf shrub	30–35	O–A	+–1	vegetation
<i>Peganum garmala</i>	Perennial	20–25	R	+	vegetation
<i>Poa bulbosa</i>	Perennial	15–17	O	+	vegetation
<i>Scrophularia leucoclada</i>	semishrub	40–50	R	+	vegetation
<i>Smirnowia turkestanica</i>	Perennial	30–35	R	+	vegetation
<i>Stipa hohenackeriana</i>	Perennial	25–30	R	+	vegetation
<i>Takhtajaniantha pusilla</i> (<i>Scorzonera pusilla</i>)	Perennial	15–17	R	+	vegetation
<i>Tortula desertorum</i>	moss	0.3–0.5	R	+	vegetation
<i>Tulipa lehmanniana</i>	Perennial	10–20	R	+	Vegetation, flowering
<i>Xylosalsola arbuscula</i> (<i>Salsola arbuscula</i>)	shrub	40–50	R	+	vegetation
<i>Ziziphora tenuior</i>	annual	5–7	R	+	flowering



Photo 84. D061. Northern foothills of Kuldzhuktau mountains with saltwort-sagebrush vegetation (June)



Photo 85. D066. Northern foothills of Kuldzhuktau mountains with saltwort-sagebrush vegetation (June)



Photo 86. D067. Northern foothills of Kuldzhuktau mountains with saltwort-sagebrush vegetation (April)



Photo 87. D071. Northern foothills of Kuldzhuktau mountains with saltwort-sagebrush vegetation (June)



Photo 88. *Calligonum zakirovii*, nationally red-listed endemic to the south-western Kyzylkum, between D066 and D067, 40.86532° N, 63.43467° E.

4.2.3. Outcrops of variegated beds

Variegated hills composed with outcrops of gypsaceous red, yellow or white clays, sandstones and limestones are very widely distributed in the southern and northern piedmonts of Kuldzhuktau Mountains.

VP2

40.796053–40.81528° N, 63.385813–64.34925 ° E, 200–230 m.s.l. Variegated southern foothills of Kuldzhuktau mountains within survey circle VP2 and between VP1 and VP2. Very sparse native community of saltworts and gypsophytes with *Artemisia turanica* (canopy cover is 1–10%) (photo 89–91); 22 plant species were recorded (Table 43); red-listed and alien plants are absent. One species, *Eremurus korolkowii*, is national endemic of Uzbekistan and endemic to relic mountains of Kyzylkum.

Table 43. Check-list of plants recorded for outcrops of variegated beds in survey plot VP2

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
<i>Artemisia turanica</i>	semishrub	20–25	O–A	+–1	vegetation
<i>Astragalus ammotrophus</i>	Perennial	12–15	R	+	vegetation
<i>Astragalus villosissimus</i>	dwarf shrub	35–40	R	+	vegetation
<i>Atraphaxis spinosa</i>	shrub	20–25	R	+	vegetation
<i>Bassia prostrata</i> (<i>Kochia prostrata</i>)	semishrub	15–20	R	+	vegetation
<i>Caroxylon orientale</i> (<i>Salsola orientalis</i>)	dwarf shrub	35–40	O	+	vegetation
<i>Ceratocarpus arenarius</i>	annual	15–20	R	+	Dried
<i>Climacoptera</i> sp.	Annual	15–20	R	+	Dried

<i>Convolvulus hamadae</i>	semishrub	25–30	R	+	vegetation
<i>Cousinia hamadae</i>	Perennial	15–20	R	+	vegetation
<i>Eremurus korolkowii</i>	Perennial	25–30	R–O	+	Vegetation, flowering
<i>Ferula foetida</i>	Perennial	30–60	R	+	Vegetation, flowering
<i>Haloxylon ammodendron</i> (<i>Haloxylon aphyllum</i>)	Small tree	40–70	R	1	vegetation
<i>Iris longiscapa</i>	Perennial	15–17	R	+	flowering
<i>Lycium ruthenicum</i>	shrub	40–50	R	+	vegetation
<i>Nanophyton erinaceum</i>	semishrub	7–10	O	+	vegetation
<i>Oreosalsola arbusculiformis</i> (<i>Salsola arbusculiformis</i>)	dwarf shrub	35–40	R–O	+–1	vegetation
<i>Peganum garmala</i>	Perennial	15–20	R–O	+	vegetation
<i>Poa bulbosa</i>	Perennial	15–17	O	+	vegetation
<i>Takhtajaniantha pusilla</i> (<i>Scorzonera pusilla</i>)	Perennial	15–17	R	+	vegetation
<i>Zygophyllum macrophyllum</i>	Perennial	10–15	R	+	flowering
<i>Zygophyllum miniatum</i>	Perennial	10–15	R	+	Vegetation, flowering



Photo 89. VP2. Outcrops of variegated beds with very sparse community of saltworts and gypsophytes in southern piedmonts of Kuldzhuktau mountains.



Photo 90. VP2. Outcrops of variegated beds with very sparse saltworts and gypsophytes in southern piedmonts of Kuldzhuktau mountains.



Photo 91. VP2. Outcrops of variegated beds with very sparse saltworts and gypsophytes in southern piedmonts of Kuldzhuktau mountains.

VP3

40.82622° N, 63.4114° E, 269 m.s.l. Variegated southern foothills of Kuldzhuktau mountains in the southern part of ornithological survey circle VP3. Very sparse native community of saltworts and gypsophytes with *Artemisia turanica* (canopy cover is 1–5%) (photo 92–93); 28 plant species were recorded (Table 44), including one species red-listed at the national level. It is *Calligonum zakirovii* (category 1 – endangered,

disappearing species; national endemic, endemic to south-western Kyzylkum) (photo 94). 17 individuals were count per 1 hectare. One species, *Eremurus korolkowii*, is national endemic of Uzbekistan and endemic to relic mountains of Kyzylkum. Alien plants are absent.

Table 44. Check-list of plants recorded on outcrops of variegated beds in survey circle VP3

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
<i>Anabasis eriopoda</i>	semishrub	15–20	R	+	vegetation
<i>Artemisia turanica</i>	semishrub	20–25	O	+	vegetation
<i>Astragalus ammotrophus</i>	Perennial	12–15	R	+	dried
<i>Astragalus villosissimus</i>	dwarf shrub	35-40	R	+	fruiting
<i>Atraphaxis spinosa</i>	shrub	20–25	R	+	fruiting
<i>Bromus tectorum</i>	annual	12–15	R	+	dried
<i>Calligonum zakirovii</i>	shrub	40–50	R	+	fruiting
<i>Caroxylon orientale</i> (<i>Salsola orientalis</i>)	dwarf shrub	35–40	O	+	vegetation
<i>Ceratocarpus arenarius</i>	annual	10–15	R	+	fruiting
<i>Climacoptera</i> sp.	Annual	10–15	R	+	vegetation
<i>Convolvulus hamadae</i>	semishrub	25–30	R	+	flowering
<i>Cousinia hamadae</i>	Perennial	15–20	R	+	fruiting
<i>Eremopyrum bonaepartis</i>	annual	7–10	R	+	dried
<i>Eremopyrum distans</i>	annual	7–10	R	+	dried
<i>Eremurus korolkowii</i>	Perennial	25–30	R–O	+	dried
<i>Ferula foetida</i>	Perennial	30–60	R	+	dried
<i>Halimocnemis gamocarpa</i>	annual	12–15	R	+	Vegetation
<i>Halimocnemis latifolia</i>	annual	12–15	R	+	Vegetation
<i>Haplophyllum robustum</i>	perennial	25-30	R	+	vegetation
<i>Haloxylon ammodendron</i> (<i>Haloxylon aphyllum</i>)	Small tree	40–70	R	1	vegetation
<i>Lycium ruthenicum</i>	shrub	40–50	R	+	fruiting
<i>Nanophyton erinaceum</i>	semishrub	7–10	O	+	vegetation
<i>Oreosalsola arbusculiformis</i> (<i>Salsola arbusculiformis</i>)	dwarf shrub	35–40	R–O	+–1	vegetation
<i>Peganum garmala</i>	Perennial	15–20	R–O	+	fruiting
<i>Poa bulbosa</i>	Perennial	15–17	O	+	dried
<i>Scrophularia leucoclada</i>	semishrub	40–50	R	+	vegetation
<i>Takhtajaniantha pusilla</i> (<i>Scorzonera pusilla</i>)	Perennial	15–17	R	+	dried
<i>Zygophyllum macrophyllum</i>	Perennial	10–15	R	+	dried



Photo 92. VP3. Outcrops of variegated beds with very sparse saltworts and gypsophytes in southern piedmonts of Kuldzhuktau mountains



Photo 93. VP3. Outcrops of variegated beds with very sparse saltworts and gypsophytes in southern piedmonts of Kuldzhuktau mountains



Photo 94. *Calligonum zakirovii*, nationally red-listed endemic to the south-western Kyzylkum (category 1 – endangered, disappearing species), 40.82622° N, 63.4114° E.

4.2.4. Stony slopes of relic low mountains

This habitat type is characterized by strongly rugged terrain, and the vegetation is represented with native sagebrush-saltwort and ephemeroid-saltwort-sagebrush vegetation on loamy and skeleton grey-brown desert soils with outcrops of bedrocks. The slopes are eroded and dissected with numerous dry riverbeds.

D001–D021, D036–D046

Stony and rocky slopes with rugged terrain, and wide watershed ridges with rather gentle, hilly terrain, covered with native saltwort-sagebrush and sagebrush vegetation on sandy-loamy, skeleton-loamy and skeleton grey-brown desert soil (Photo 95–99). The canopy cover is 5–30%. 43 plant and 1 moss species were recorded (Table 45), none of them are alien. Two species, *Ferula kyzylkumica* and *Tulipa lehmanniana* (photo 100), are listed in the Red Data Book of Uzbekistan (2019) with the category 3 (reducing); both species occur sporadically, solitary or in groups, within and between survey plots. One species, *Eremurus korolkowii*, is national endemic of Uzbekistan and endemic to relic mountains of Kyzylkum; it also occurs sporadically within and between survey plots.

Table 45. Check-list of plants recorded in survey plots D001–D021 and D36–D046

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
<i>Alyssum desertorum</i>	annual	5–6	R–O	+	fruiting
<i>Alyssum linifolium</i> (<i>Meniocus linifolius</i>)	annual	5–7	R–O	+	fruiting
<i>Anabasis eriopoda</i>	semishrub	15–20	R	+	vegetation
<i>Artemisia diffusa</i>	semishrub	20–25	O–A	+–1	vegetation
<i>Artemisia turanica</i>	semishrub	20–25	A–D	1–2	vegetation
<i>Astragalus ammotrophus</i>	Perennial	12–15	R	+	vegetation

<i>Astragalus villosissimus</i>	dwarf shrub	30–35	R–O	+	vegetation
<i>Carex pachystylis</i>	Perennial	10–12	O–A	+–1	Flowering, fruiting
<i>Carex physodes</i>	Perennial	12–15	O	+	fruiting
<i>Carex subphysodes</i>	Perennial	10–12	O–A	+–1	fruiting
<i>Caroxylon gemmascens</i> (<i>Salsola gemmascens</i>)	dwarf shrub	20–30	R–O	+	vegetation
<i>Caroxylon orientale</i> (<i>Salsola orientalis</i>)	dwarf shrub	30–35	O–A	+–1	vegetation
<i>Ceratocarpus arenarius</i>	annual	15–20	R–O	+	Dried
<i>Climacoptera</i> sp.	Annual	25–30	R–O	+	Dried
<i>Convolvulus hamadae</i>	semishrub	25–30	O	+	vegetation
<i>Cousinia hamadae</i>	Perennial	15–20	R	+	fruiting
<i>Eremopyrum bonaepartis</i>	annual	7–10	R	+	dried
<i>Eremopyrum distans</i>	annual	7–10	R	+	dried
<i>Eremurus korolkowii</i>	Perennial	25–30	R	+	Vegetation, flowering
<i>Ferula foetida</i>	Perennial	50–60	R–O	+	Vegetation, flowering
<i>Ferula kyzylkumica</i>	Perennial	15–20	R–O	+	Vegetation
<i>Fritillaria karelinii</i>	Perennial	10–12	R	+	fruiting
<i>Gagea afghanica</i>	Perennial	10–12	R	+	flowering
<i>Gagea bergii</i>	Perennial	5–7	R	+	flowering
<i>Halimocnemis villosa</i>	annual	10–12	R–O	+	vegetation
<i>Haloxylon ammodendron</i> (<i>Haloxylon aphyllum</i>)	Small tree	100–180	R–O	+–1	vegetation
<i>Haplophyllum robustum</i>	perennial	25–30	R	+	vegetation
<i>Koelpinia linearis</i>	annual	10–12	R	+	fruiting
<i>Lactuca orientalis</i>	semishrub	35–40	R	+	vegetation
<i>Leontice inserta</i>	perennial	10–12	R	+	vegetation
<i>Leptaleum filifolium</i>	annual	4–5	R	+	fruiting
<i>Lomelosia olivieri</i> (<i>Scabiosa olivieri</i>)	annual	15–17	R	+	fruiting
<i>Nanophyton erinaceum</i>	semishrub	7–10	R–O	+	vegetation
<i>Oreosalsola arbusculiformis</i> (<i>Salsola arbusculiformis</i>)	dwarf shrub	30–35	O–A	1–2	vegetation
<i>Peganum garmala</i>	Perennial	20–25	R	+	vegetation
<i>Poa bulbosa</i>	Perennial	15–17	O–A	+–1	vegetation
<i>Rheum turkestanicum</i>	Perennial	20–40	R	+	vegetation
<i>Scrophularia leucoclada</i>	semishrub	40–50	R	+	vegetation
<i>Takhtajaniantha pusilla</i> (<i>Scorzonera pusilla</i>)	Perennial	15–17	R	+	vegetation
<i>Tortula desertorum</i>	moss	0.3–0.5	R	+	vegetation
<i>Tulipa lehmanniana</i>	Perennial	10–20	R–O	+	Vegetation, fruiting
<i>Tulipa sogdiana</i>	Perennial	7–10	R	+	fruiting
<i>Ziziphora tenuior</i>	annual	7–10	R	+	flowering
<i>Zygophyllum macrophyllum</i>	Perennial	12–15	R	+	Vegetation, flowering



Photo 95. D001. Watershed of Kuldzhuktau range with gentle terrain and sparse saltwort-sagebrush vegetation (April)

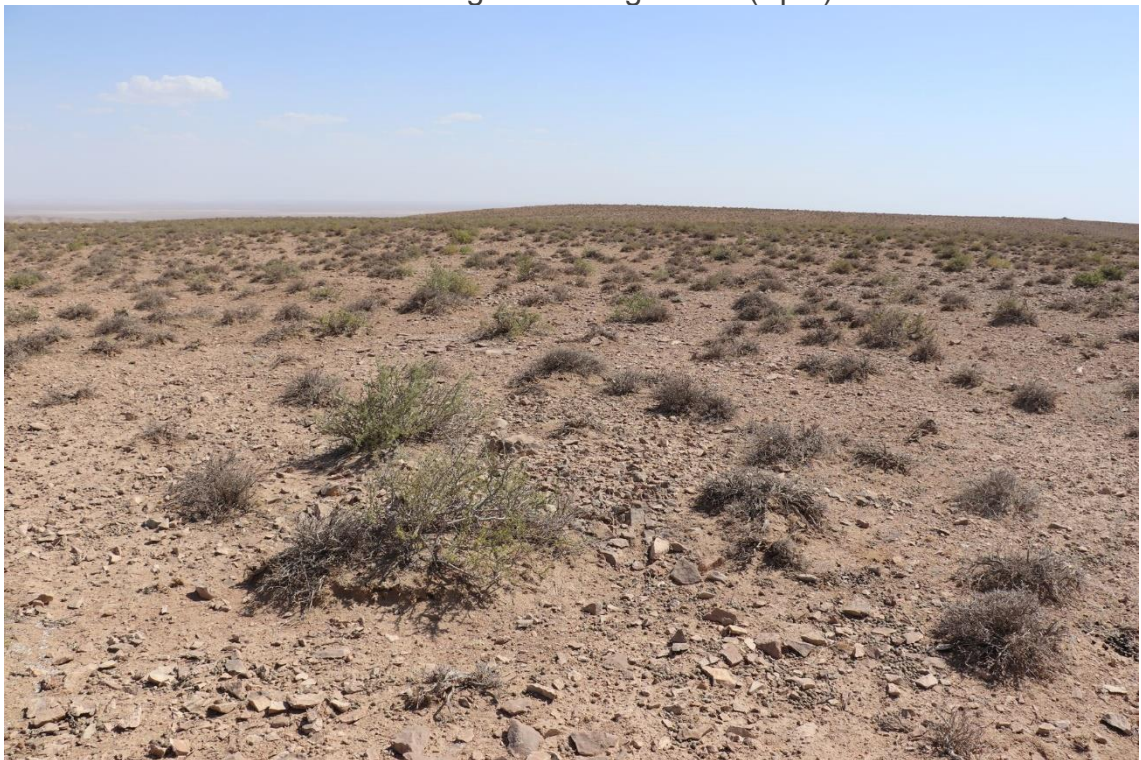


Photo 96. D001. Watershed of Kuldzhuktau range with gentle terrain and saltwort-sagebrush vegetation (June)



Photo 97. Surroundings of D001. Steep rocky northern slopes of Kuldzhuktau range with very sparse vegetation (April)



Photo 98. Surroundings of D001. Steep rocky northern slopes of Kuldzhuktau range with very sparse vegetation (June)



Photo 99. Surroundings of D003. Steep stony slopes of Kuldzhuktau range with sagebrush-saltwort vegetation, intensively grazed by livestock (April)



Photo 100. Plot D042. Flowering specimens of nationally red-listed *Tulipa lehmanniana*

D073–D091

Stony and rocky slopes with rugged terrain, and wide watersheds with rather gentle, hilly terrain, covered with native saltwort-sagebrush and sagebrush vegetation on loamy, skeleton-loamy and skeleton grey-brown desert soil (Photo 101–105). The canopy cover is 5–30%. 56 plant and 1 moss species were recorded (Table 46), none of them are alien. Two species, *Ferula kyzylkumica* and *Tulipa lehmanniana*, are listed in the Red Data Book of Uzbekistan (2019) with the category 3 (reducing) (Photo 106–107). Solitary

specimens and populations of 50–100 individuals occur sporadically within and between survey plots. One species, *Eremurus korolkowii*, is national endemic of Uzbekistan and endemic to relic mountains of Kyzylkum; it also occurs sporadically within and between survey plots D073–D091.

Table 46. Check-list of plants recorded in survey plots D073–D091

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
<i>Allium griffithianum</i>	Perennial	7–10	R	+	fruiting
<i>Allium karakense</i>	Perennial	15–17	R	+	vegetation
<i>Allium sabulosum</i>	Perennial	15–20	R	+	vegetation
<i>Alyssum desertorum</i>	annual	5–6	R–O	+	fruiting
<i>Alyssum linifolium</i> (<i>Meniocus linifolius</i>)	annual	5–7	R–O	+	fruiting
<i>Ammodendron conollyi</i>	Small tree	100–150	R	+	vegetation
<i>Anabasis eriopoda</i>	semishrub	15–20	R	+	vegetation
<i>Anabasis turkestanica</i>	semishrub	20–25	R	+	vegetation
<i>Artemisia diffusa</i>	semishrub	20–25	O	+–1	vegetation
<i>Artemisia juncea</i>	semishrub	30–35	O	+–1	vegetation
<i>Artemisia turanica</i>	semishrub	20–25	A–D	1–2	vegetation
<i>Astragalus ammotrophus</i>	Perennial	12–15	R	+	vegetation
<i>Astragalus villosissimus</i>	dwarf shrub	30–35	R–A	+–1	vegetation
<i>Atraphaxis spinosa</i>	shrub	50–70	O	1	fruiting
<i>Bassia prostrata</i> (<i>Kochia prostrata</i>)	semishrub	20–25	R	+	vegetation
<i>Bromus tectorum</i>	annual	12–15	O	+	fruiting
<i>Carex pachystylis</i>	Perennial	10–12	O–A	+	flowering
<i>Caroxylon gemmascens</i> (<i>Salsola gemmascens</i>)	dwarf shrub	20–30	R–O	+	vegetation
<i>Caroxylon orientale</i> (<i>Salsola orientalis</i>)	dwarf shrub	30–35	O–A	+–1	vegetation
<i>Ceratocarpus arenarius</i>	annual	15–20	R–O	+	Dried
<i>Convolvulus hamadae</i>	semishrub	25–30	O–A	+–1	vegetation
<i>Cousinia hamadae</i>	Perennial	15–20	R	+	fruiting
<i>Eminium lehmannii</i>	Perennial	15–20	R	+	fruiting
<i>Ephedra intermedia</i>	shrub	15–30	R	+	vegetation
<i>Eremopyrum bonaepartis</i>	annual	7–10	R	+	dried
<i>Eremopyrum distans</i>	annual	7–10	R	+	dried
<i>Eremurus korolkowii</i>	Perennial	25–30	R–O	+	Vegetation, flowering
<i>Ferula foetida</i>	Perennial	50–60	R–O	+	Vegetation, flowering
<i>Ferula kyzylkumica</i>	Perennial	15–20	R–O	+	Vegetation
<i>Ferula varia</i>	Perennial	25–30	R	+	Vegetation
<i>Haloxylon ammodendron</i> (<i>Haloxylon aphyllum</i>)	Small tree	100–150	R	+–1	vegetation
<i>Haplophyllum robustum</i>	perennial	25–30	R	+	vegetation
<i>Holosteum umbellatum</i>	annual	6–8	O	+	fruiting
<i>Hypecoum pendulum</i>	annual	12–15	R	+	Flowering, fruiting
<i>Isatis minima</i>	annual	15–17	R	+	fruiting

<i>Iris longiscapa</i>	Perennial	15–17	R	+	flowering
<i>Koelpinia linearis</i>	annual	10–12	R	+	fruiting
<i>Krascheninnikovia ceratoides</i>	semishrub	40–50	R	+	vegetation
<i>Lactuca orientalis</i>	semishrub	35–40	R–O	+–1	vegetation
<i>Lallemantia royleana</i>	annual	7–8	R	+	flowering
<i>Leptaleum filifolium</i>	annual	4–5	R	+	fruiting
<i>Lomelosia olivieri</i> (<i>Scabiosa olivieri</i>)	annual	15–17	R	+	fruiting
<i>Nanophyton erinaceum</i>	semishrub	7–10	R–O	+	vegetation
<i>Oreosalsola arbusculiformis</i> (<i>Salsola arbusculiformis</i>)	dwarf shrub	30–35	A–D	1–2	vegetation
<i>Peganum garmala</i>	Perennial	20–25	R–O	+	vegetation
<i>Poa bulbosa</i>	Perennial	15–17	O–A	+–+1	vegetation
<i>Rheum turkestanicum</i>	Perennial	20–40	R	+	vegetation
<i>Scrophularia leucoclada</i>	semishrub	40–50	R–O	+	vegetation
<i>Scorzonera gageoides</i>	Perennial	12–15	R	+	vegetation
<i>Stipa hohenackeriana</i>	Perennial	25–30	R–O	+	vegetation
<i>Takhtajaniantha pusilla</i> (<i>Scorzonera pusilla</i>)	Perennial	15–17	R	+	vegetation
<i>Tortula desertorum</i>	moss	0.3–0.5	R	+	vegetation
<i>Tulipa sogdiana</i>	Perennial	7–10	R	+	Vegetation, fruiting
<i>Tulipa lehmanniana</i>	Perennial	10–20	R	+	Vegetation, flowering
<i>Ziziphora tenuior</i>	annual	7–8	R	+	flowering
<i>Zygophyllum macrophyllum</i>	Perennial	12–15	R	+	Vegetation, flowering
<i>Zygophyllum miniatum</i>	Perennial	10–15	R	+	Vegetation, flowering



Photo 101. D076. Stony slopes of Kuldzhuktau mountains with sagebrush-saltwort vegetation (June)



Photo 102. D077. Stony slopes of Kuldzhuktau mountains with sagebrush-saltwort vegetation (April)



Photo 103. D079. Stony slopes of Kuldzhuktau mountains with sagebrush-saltwort vegetation (April)



Photo 104. Between D081 and D082. Stony slopes of Kuldzhuktau mountains with sagebrush-saltwort vegetation (April)



Photo 105. D087. Stony northern slopes of Kuldzhuktau mountains with sparse sagebrush-saltwort vegetation (June)



Photo 106. D078. On the foreground – Korolkow's desert-candle (*Eremurus korolkowii*), national endemic of Uzbekistan and endemic to relic mountains of Kyzylkum, and on the background – black saltwort (*Oreosalsola arbusculiformis*), main dominant of sagebrush-saltwort communities of vegetation of relic mountains



Photo 107. D087. Dried generative specimen of nationally red-listed endemic *Ferula kyzylkumica* (June)

D092–D113 and D119–D124

Stony and rocky slopes with rugged terrain, and wide watershed ridges with rather gentle, hilly terrain, covered with native saltwort-sagebrush and sagebrush vegetation on loamy, skeleton-loamy and skeleton grey-brown desert soil (Photo 108–115). The canopy cover is 5–30%. 44 plant and 1 moss species were recorded (Table 47), none of them are alien. One species, *Ferula kyzylkumica*, is listed in the Red Data Book of Uzbekistan (2019) with the category 3 (reducing); it is endemic to the relic mountains of Kyzylkum with a disjunction in the Nuratau Mountains, and national endemic. Solitary specimens and populations of 50–100 individuals occur sporadically within and between survey plots D092–D113 and D119–D124. For example, 94 specimens *Ferula kyzylkumica* were count on a plot 50x10 m of near the D102 (40.9178° N, 63.2387° E, 259 m.s.l.) (photo 116). One species, *Eremurus korolkowii*, is national endemic of Uzbekistan and endemic to relic mountains of Kyzylkum; it also occurs sporadically within and between survey plots D092–D113 and D119–D124.

Table 47. Check-list of plants recorded in survey plots D092–D113 and D119–D124

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
<i>Alyssum desertorum</i>	annual	5–6	R–O	+	fruiting
<i>Alyssum linifolium</i> (<i>Meniocus linifolius</i>)	annual	5–7	R–O	+	fruiting
<i>Anabasis eriopoda</i>	semishrub	15–20	R	+	vegetation
<i>Anabasis turkestanica</i>	semishrub	20–25	R	+	vegetation
<i>Artemisia diffusa</i>	semishrub	20–25	O–A	+–1	vegetation
<i>Artemisia turanica</i>	semishrub	20–25	A–D	1–2	vegetation
<i>Astragalus ammotrophus</i>	Perennial	12–15	R	+	vegetation
<i>Astragalus villosissimus</i>	dwarf shrub	30–35	R–O	+	vegetation

<i>Atraphaxis spinosa</i>	shrub	50-70	R	+ -1	fruiting
<i>Carex pachystylis</i>	Perennial	10-12	O-A	+	flowering
<i>Caroxylon gemmascens</i> (<i>Salsola gemmascens</i>)	dwarf shrub	20-30	R-O	+	vegetation
<i>Caroxylon orientale</i> (<i>Salsola orientalis</i>)	dwarf shrub	30-35	O-A	+ -1	vegetation
<i>Ceratocarpus arenarius</i>	annual	15-20	R-O	+	Dried
<i>Cousinia hamadae</i>	Perennial	15-20	R	+	fruiting
<i>Ephedra intermedia</i>	shrub	15-30	R	+	vegetation
<i>Eremopyrum bonaepartis</i>	annual	7-10	R	+	dried
<i>Eremopyrum distans</i>	annual	7-10	R	+	dried
<i>Eremurus korolkowii</i>	Perennial	25-30	R	+	Vegetation, flowering
<i>Ferula foetida</i>	Perennial	50-60	R-O	+	Vegetation, flowering
<i>Ferula kyzylkumica</i>	Perennial	15-20	R-O	+	Vegetation
<i>Halimocnemis latifolia</i>	annual	12-15	R	+	Vegetation
<i>Haloxylon ammodendron</i> (<i>Haloxylon aphyllum</i>)	Small tree	100-180	R-O	+ -1	vegetation
<i>Hypecoum pendulum</i>	annual	12-15	R	+	Flowering, fruiting
<i>Isatis minima</i>	annual	15-17	R	+	fruiting
<i>Iris longiscapa</i>	Perennial	15-17	R	+	flowering
<i>Koelpinia linearis</i>	annual	10-12	R	+	fruiting
<i>Krascheninnikovia ceratoides</i>	semishrub	40-50	R-O	+	vegetation
<i>Lactuca orientalis</i>	semishrub	35-40	R-O	+ -1	vegetation
<i>Lallemantia royleana</i>	annual	7-8	R	+	flowering
<i>Leptaleum filifolium</i>	annual	4-5	R	+	fruiting
<i>Lomelosia olivieri</i> (<i>Scabiosa olivieri</i>)	annual	15-17	R	+	fruiting
<i>Lycium ruthenicum</i>	shrub	40-50	R-O	+ -1	vegetation
<i>Nanophyton erinaceum</i>	semishrub	7-10	R-O	+	vegetation
<i>Oreosalsola arbusculiformis</i> (<i>Salsola arbusculiformis</i>)	dwarf shrub	30-35	O-A	1-2	vegetation
<i>Peganum garmala</i>	Perennial	20-25	R	+	vegetation
<i>Poa bulbosa</i>	Perennial	15-17	O-A	+ - +1	vegetation
<i>Rheum turkestanicum</i>	Perennial	20-40	R-O	+ -1	vegetation
<i>Scrophularia leucoclada</i>	semishrub	40-50	R-O	+	vegetation
<i>Scorzonera gageoides</i>	Perennial	12-15	R	+	vegetation
<i>Takhtajaniantha pusilla</i> (<i>Scorzonera pusilla</i>)	Perennial	15-17	R	+	vegetation
<i>Tortula desertorum</i>	moss	0.3-0.5	R	+	vegetation
<i>Tulipa sogdiana</i>	Perennial	7-10	R	+	Vegetation, fruiting
<i>Ziziphora tenuior</i>	annual	7-8	R	+	flowering
<i>Zygophyllum macrophyllum</i>	Perennial	12-15	R	+	Vegetation, flowering
<i>Zygophyllum miniatum</i>	Perennial	10-15	R	+	Vegetation, flowering



Photo 108. D106. Southern slopes of Kuldzhuktau mountains with saltwort-sagebrush vegetation (April)



Photo 109. D100. Southern slopes of Kuldzhuktau mountains with saltwort-sagebrush vegetation (April)



Photo 110. D099. Southern slopes of Kuldzhuktau mountains with saltwort-sagebrush vegetation (April)



Photo 111. D099. Southern slopes of Kuldzhuktau mountains with saltwort-sagebrush vegetation (June)



Photo 112. D098. Stony slopes of Kuldzhuktau mountains with very sparse vegetation (April)



Photo 113. D092. Stony slopes of Kuldzhuktau mountains with sparse sagebrush-saltwort vegetation (June)



Photo 114. D123. Slopes of western part of Kuldzhuktau mountains with saltwort-sagebrush vegetation (June)



Photo 115. D121. Southern slopes of the relic ridge Kuldzhuktau with saltwort-sagebrush vegetation (June)



Photo 116. *Ferula kyzylkumica*, nationally red-listed endemic species, surroundings of D102, 40.9178° N, 63.2387° E

4.2.5. Anthropogenic habitats

Several small villages (the largest are Dzhankeldy and Kalata) and farmsteads are situated within the project site, on the piedmont plain and foothills of the relic ridge Kuldzhuktau (Photo 117–118). In addition, the impact of mining operations is more expressed in “Dzhankeldy” site than in “Bash”; there are numerous active and abandoned mines and quarries, geological exploration is underway at the present (Photo 119). Dense thickets of *Peganum harmala* typical for degraded rangelands of arid zone of Uzbekistan occur around settlements, farmsteads and wells. Halophytic shrubs (*Lycium ruthenicum*, *Halimodendron halodendron*, *Tamarix hispida* and *Tamarix laxa*) grows near the springs and wells. In surroundings of quarries and mines, the canopy cover is extremely sparse, or the vegetation is almost completely exterminated. Alien or red-listed plants were not found.



Photo 117. Surroundings of the village Kalata (April)



Photo 118. *Peganum harmala* in surroundings of the village Dzhankeldy (June)



Photo 119. Ruins of an abandoned mining village

4.3. “Bash-Dzhankeldy” power line

Following types of habitats (mapping units) were identified along the “Bash-Dzhankeldy” line:

4.3.1. Sandy and sandy-loamy desert plain

This habitat type occupies the southernmost part of planned power line, at the northern edge of the “Bash” project site, as well as along the railway, between the “Bash” project site and the rail crossing.

Sandy and sandy-loamy desert plain with flat or flat-wavy terrain is covered with native ephemeroid-sagebrush (*Artemisia diffusa*, *Poa bulbosa*, *Carex physodes*, *Carex subphysodes*) and saltwort-ephemeroid-sagebrush vegetation (*Artemisia diffusa*, *Poa bulbosa*, *Carex physodes*, *Carex subphysodes*, *Caroxylon orientale* (*Salsola orientalis*), *Xylosalsola arbuscula*, (*Salsola arbuscula*), sometimes with small plots of fixed sands with psammophilous shrubs (*Calligonum leucocladum*, *C. microcarpum*), or with saxaul plantations (*Haloxylon ammodendron*) or solitary saxaul trees on sabulous grey-brown desert soil and sandy desert soil (photo 120–121). The elevation is 263–180 m a.s.l. The canopy cover is 20 to 40%, and the density saxaul stands is up to 0.1–0.2. Plant communities are characterized with low species diversity and low to medium level of anthropogenic disturbance. A check-list of 16 plant species and 1 moss recorded for this habitat is presented below (table 48).

Table 48. Check-list of plants recorded for sandy and sandy-loamy desert plain with ephemeroid-sagebrush and saltwort-ephemeroid-sagebrush vegetation, and with saxaul plantations

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
<i>Acanthophyllum elatius</i>	Perennial	40–45	R	+	flowering

<i>Alyssum desertorum</i>	annual	5–6	R–O	+	dried
<i>Artemisia diffusa</i>	semishrub	25–35	A–D	1–2	vegetation
<i>Astragalus villosissimus</i>	dwarf shrub	30–35	O	+	vegetation
<i>Bromus tectorum</i>	annual	12–15	R–O	+	fruiting
<i>Calligonum leucocladum</i>	shrub	50–100	R–O	+	fruiting
<i>Calligonum microcarpum</i>	shrub	50–70	R–O	+	fruiting
<i>Carex physodes</i>	Perennial	12–15	O–A	+–1	dried
<i>Carex subphysodes</i>	Perennial	10–12	A–D	1	dried
<i>Caroxylon orientale (Salsola orientalis)</i>	dwarf shrub	30–35	R–A	+–1	vegetation
<i>Ceratocarpus arenarius</i>	annual	15–20	R–O	+	Dried
<i>Convolvulus hamadae</i>	semishrub	25–30	R–O	+	flowering
<i>Cousinia hamadae</i>	Perennial	15–20	R	+	vegetation
<i>Ferula foetida</i>	Perennial	30–35	R–A	+	Fruiting, dried
<i>Haloxylon ammodendron (Haloxylon aphyllum)</i>	Small tree	150–170	R–A	1–2	vegetation
<i>Heliotropium arguzioides</i>	Perennial	20–25	R	+	vegetation
<i>Iris songarica</i>	Perennial	30–35	R–O	+	vegetation
<i>Peganum garmala</i>	Perennial	30–35	R	+	flowering
<i>Poa bulbosa</i>	Perennial	15–17	O–A	+–1	dried
<i>Stipagrostis pennata</i>	Perennial	30–35	R	+	vegetation
<i>Tortula desertorum</i>	moss	0.3–0.5	O	+	vegetation
<i>Xylosalsola arbuscula (Salsola arbuscula)</i>	shrub	40–50	R–A	+–1	vegetation



Photo 121. Sandy-loamy desert plain with native ephemeroid-sagebrush plant community and sparse black saxaul (remains of plantations), 40.708281° N, 64.573836° E



Photo 122. Sandy plain with native ephemeroid-saltwort-sagebrush vegetation and plantations of black saxaul, 40.76059° N, 64.52554° E

4.3.2. Fixed and semi-fixed sands

Fixed and semi-fixed sands with hilly, ridge-hilly, ridge and wavy terrain are covered with psammophilous shrublands (photo 123). Dominants and subdominants are *Calligonum leucocladum*, *Calligonum microcarpum*, *Haloxylon persicum*, *H. ammodendron*,

Astragalus villosissimus, *Artemisia diffusa*, *Carex physodes*, and on local plots – sand acacia (*Ammodendron conollyi*). The grass cover of the sandy desert is formed by desert sedge (*Carex physodes*) which plays a key role in sands fixation through its densely branched root system. The giant Umbelliferae *Ferula foetida* often is a subdominant. 36 plant species and one moss were recorded for this habitat type (table 49), including one nationally red-listed species, *Tulipa lehmanniana* (solitary fruiting and dried specimens were found on the route between 40.80932° N, 64.48027° E and 40.85202° N, 64.4183° E). This habitat is located in the southern part of the previous variant of the power line (red line), and also along the railway, between the rail crossing and village Chengeldy.

Table 49. Check-list of plants recorded for fixed and semi-fixed sands with psammophilous shrubs and ephemeroïd-sagebrush vegetation

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
<i>Acanthophyllum elatius</i>	Perennial	40–45	R–O	+	flowering
<i>Alhagi pseudalhagi</i>	Perennial	30–35	R–O	+	vegetation
<i>Alyssum desertorum</i>	annual	5–6	R	+	dried
<i>Ammodendron conollyi</i>	Small tree	100–150	R–A	+–1	fruiting
<i>Arnebia decumbens</i>	annual	15–20	R	+	fruiting
<i>Artemisia diffusa</i>	semishrub	35–40	A–D	1–2	vegetation
<i>Astragalus flexus</i>	perennial	15–17	R	+	dried
<i>Astragalus villosissimus</i>	dwarf shrub	35–40	A	1	vegetation
<i>Bromus tectorum</i>	annual	12–15	O–A	+	dried
<i>Calligonum leucocladum</i>	shrub	50–100	D–O	1–2	fruiting
<i>Calligonum microcarpum</i>	shrub	50–100	A–O	1	fruiting
<i>Carex physodes</i>	Perennial	12–15	D	1	flowering
<i>Caroxylon orientale (Salsola orientalis)</i>	dwarf shrub	35–40	R–O	+	vegetation
<i>Ceratocarpus arenarius</i>	annual	15–20	O	+	vegetation
<i>Convolvulus divaricatus</i>	semishrub	30–45	O	+	flowering
<i>Convolvulus hamadae</i>	semishrub	30–40	O	+	flowering
<i>Cousinia hamadae</i>	Perennial	30–35	R–O	+	vegetation
<i>Eremopyrum bonaepartis</i>	annual	10–12	O	+	fruiting
<i>Eremopyrum distans</i>	annual	10–12	O	+	fruiting

<i>Euphorbia turczaninowii</i>	annual	10–12	R	+	Flowering, fruiting
<i>Ferula foetida</i>	Perennial	50–60	O–A	1	Fruiting, dried
<i>Haplophyllum ramosissimum</i>	Perennial	25–30	R	+	vegetation
<i>Haloxylon ammodendron</i> (<i>Haloxylon aphyllum</i>)	Small tree	150–170	R–O	+–1	vegetation
<i>Haloxylon persicum</i>	Small tree	150–170	O–A	1	vegetation
<i>Heliotropium arguzioides</i>	Perennial	25–30	R–O	+	flowering
<i>Iris songarica</i>	Perennial	30–35	R	+	vegetation
<i>Mausolea eriocarpa</i>	semishrub	45–50	O–A	1	flowering
<i>Oreosalsola arbusculiformis</i> (<i>Salsola arbusculiformis</i>)	dwarf shrub	50–60	O	+–1	vegetation
<i>Peganum garmala</i>	Perennial	30–35	R–O	+	flowering
<i>Poa bulbosa</i>	Perennial	15–17	O	+	dried
<i>Salsola paulsenii</i>	annual	30–35	R	+	vegetation
<i>Sophora pachycarpa</i>	Perennial	20–25	R	+	flowering
<i>Smirnowia turkestanica</i>	Perennial	30–35	R–O	+	flowering
<i>Stipagrostis pennata</i>	Perennial	30–35	O	+	vegetation
<i>Tortula desertorum</i>	moss	0.3–0.5	O	+	vegetation
<i>Tulipa lehmanniana</i>	Perennial	10–15	R	+	fruiting
<i>Xylosalsola arbuscula</i> (<i>Salsola arbuscula</i>)	shrub	40–50	R–O	+	vegetation



Photo 123. Fixed hilly sands with Calligonum-sagebrush vegetation with participation of black saxaul, 40.81108° N, 64.47365° E

4.3.3. Complex of fixed and semi-fixed sands, saline depressions and takyr

This habitat is located in surroundings of the village Shengeldy (2–6 km to the south), on the edge of the saline depression Karakata. Sandy areas are covered with psammophytic shrubs and ephemeroïd-sagebrush vegetation (photo 124). Dominants are sand acacia (*Ammodendron conollyi*), *Calligonum leucocladum*, *Artemisia diffusa*, *Carex physodes*, subdominants – *Haloxylon ammodendron*, *Calligonum microcarpum*, *Astragalus villosissimus*, *Oreosalsola arbusculiformis* (*Salsola arbusculiformis*), *Ferula foetida*. Small saline depressions and takyr have very sparse vegetation (canopy cover less than 10%) represented with the same species that on the sands, with participation of *Tamarix sp.* and *Lycium ruthenicum*. 35 plant species and one moss were recorded for this habitat type in total (table 50).

Table 50. Check-list of plants recorded for complex of fixed and semi-fixed hilly and wavy sands, small saline depressions and takyr

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
<i>Acanthophyllum elatius</i>	Perennial	40–45	R	+	flowering
<i>Alhagi pseudalhagi</i>	Perennial	30–35	R–O	+	vegetation
<i>Alyssum desertorum</i>	annual	5–6	R	+	dried
<i>Ammodendron conollyi</i>	Small tree	100–150	O–D	+–12	fruiting
<i>Arnebia decumbens</i>	annual	15–20	R	+	fruiting
<i>Artemisia diffusa</i>	semishrub	35–40	O–A	+–1	vegetation

<i>Astragalus villosissimus</i>	dwarf shrub	35-40	O-A	+—1	vegetation
<i>Bassia eriophora</i>	annual	12–15	O	+	fruiting
<i>Bromus tectorum</i>	annual	12–15	O-A	+	dried
<i>Calligonum leucocladum</i>	shrub	50–100	A-O	1	fruiting
<i>Calligonum microcarpum</i>	shrub	50–100	A-O	1	fruiting
<i>Carex physodes</i>	Perennial	12–15	O-A	+	flowering
<i>Caroxylon orientale</i> (<i>Salsola orientalis</i>)	dwarf shrub	35-40	R-O	+	vegetation
<i>Ceratocarpus arenarius</i>	annual	15-20	O-A	+	vegetation
<i>Convolvulus divaricatus</i>	semishrub	30–45	O-R	+	flowering
<i>Convolvulus hamadae</i>	semishrub	30–40	O-R	+	flowering
<i>Cousinia hamadae</i>	Perennial	30–35	R	+	vegetation
<i>Eremopyrum bonaepartis</i>	annual	10–12	O-R	+	fruiting
<i>Eremopyrum distans</i>	annual	10–12	O-R	+	fruiting
<i>Euphorbia turczaninowii</i>	annual	10–12	R	+	Flowering, fruiting
<i>Ferula foetida</i>	Perennial	50–60	O-R	+—1	Fruiting, dried
<i>Haplophyllum ramosissimum</i>	Perennial	25–30	R	+	vegetation
<i>Haloxylon ammodendron</i> (<i>Haloxylon aphyllum</i>)	Small tree	150–170	R-O	+—1	vegetation
<i>Heliotropium arguzioides</i>	Perennial	25–30	R-O	+	flowering
<i>Lycium ruthenicum</i>	Shrub	50–70	R-O	+—1	flowering
<i>Mausolea eriocarpa</i>	semishrub	45–50	R-O	+—1	flowering
<i>Oreosalsola arbusculiformis</i> (<i>Salsola arbusculiformis</i>)	dwarf shrub	50–60	O-A	+—1	vegetation
<i>Peganum garmala</i>	Perennial	30–35	R-A	+—1	flowering
<i>Poa bulbosa</i>	Perennial	15–17	R-O	+	dried
<i>Salsola paulsenii</i>	annual	30–35	R-O	+	vegetation
<i>Sophora pachycarpa</i>	Perennial	20–25	R-O	+	flowering
<i>Smirnowia turkestanica</i>	Perennial	30–35	R-O	+	flowering

<i>Stipagrostis pennata</i>	Perennial	30–35	R	+	vegetation
<i>Tamarix sp.</i>	Shrub	100–150	R	+–1	vegetation
<i>Tortula desertorum</i>	moss	0.3–0.5	O	+	vegetation
<i>Xylosalsola arbuscula</i> (<i>Salsola arbuscula</i>)	shrub	40–50	R	+	vegetation



Photo 124. Fixed sands with native psammophilous vegetation with domination of sand acacia, 40.94366° N, 64.35031° E

4.3.4. Weakly inclined piedmont plain of relic low mountains

Weakly inclined piedmonts of relic low mountains Kuldzhuktau with flat, wavy or gently sloping terrain are covered with native ephemeroid-sagebrush and saltwort-sagebrush vegetation, sometimes with *Calligonum* and plantations of black saxaul on sabulous grey-brown desert soil (photos 125–127). This habitat type is located along the road P-61, between the village Shengeldy and the eastern edge of “Dzhankeldy” project site. Canopy cover is 20–40%. 31 plant species and one moss were recorded for this habitat type (table 51), including 3 species listed in the Red Data Book of Uzbekistan (2019). They are *Acanthophyllum cyrtostegium* (category 3 – reducing; national endemic) (photo 128), *Calligonum zakirovii* (category 1 – endangered, disappearing species; national endemic) (photo 129), and *Tulipa lehmanniana* (category 3 – reducing). A small population of *Acanthophyllum cyrtostegium* (8 plants) was found near the route P-61 (40.95635° N, 64.3285° E); 11 plants were found near the village Shengeldy (40.9735° N, 64.3617° E). Solitary individuals of *Calligonum zakirovii* (30–40 per 1 hectare) were recorded among *Calligonum leucocladum* and *C. microcarpum* along the route P-61, on the border of saline depression (40.9846° N, 63.9094° E). During the April expedition, it has been noted that *Tulipa lehmanniana* (several dozens of individuals in each population, mostly pre-generative) occur sporadically along the road P-61, between the village Shengeldy and the eastern edge of “Dzhankeldy” project site (photo 130).

Table 51. Check-list of plants recorded for piedmont plains with ephemeroid-sagebrush and saltwort-sagebrush vegetation, with plantations of black saxaul

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
<i>Acanthophyllum cyrtostegium</i>	Perennial	25–30	R	+	flowering
<i>Acanthophyllum elatius</i>	Perennial	40–45	R	+	flowering
<i>Alyssum desertorum</i>	annual	5–6	R	+	dried
<i>Anabasis eriopoda</i>	semishrub	15–20	R	+	vegetation
<i>Arnebia decumbens</i>	annual	15–20	R	+	fruiting
<i>Artemisia diffusa</i>	semishrub	30–35	A–D	1–2	vegetation
<i>Artemisia turanica</i>	semishrub	30–35	O–A	+–1	vegetation
<i>Astragalus villosissimus</i>	dwarf shrub	40–60	O–A	+–1	vegetation
<i>Bassia prostrata</i> (<i>Kochia prostrata</i>)	semishrub	15–20	R	+	vegetation
<i>Bromus tectorum</i>	annual	12–15	R–O	+	fruiting
<i>Calligonum leucocladum</i>	shrub	50–100	R–O	+	fruiting
<i>Calligonum microcarpum</i>	shrub	50–70	R–O	+	fruiting
<i>Calligonum zakirovii</i>	shrub	40–50	R	+	fruiting
<i>Carex physodes</i>	Perennial	12–15	O–A	+	dried
<i>Carex subphysodes</i>	Perennial	10–12	O–A	+	dried
<i>Caroxylon orientale</i> (<i>Salsola orientalis</i>)	dwarf shrub	35–40	O–A	+–1	vegetation
<i>Caroxylon scleranthum</i> (<i>Salsola sclerantha</i>)	annual	15–20	R	+	vegetation
<i>Ceratocarpus arenarius</i>	annual	10–12	R–O	+	vegetation
<i>Convolvulus hamadae</i>	semishrub	25–30	O–A	+–1	flowering
<i>Cousinia hamadae</i>	Perennial	25–30	R	+	vegetation
<i>Eremopyrum bonaepartis</i>	annual	10–12	R–O	+	fruiting
<i>Eremopyrum distans</i>	annual	10–12	R–O	+	fruiting
<i>Ferula foetida</i>	Perennial	100–150	O–A	+–1	Fruiting, dried

<i>Haloxylon ammodendron</i> (<i>Haloxylon aphyllum</i>)	Small tree	100–150	R–O	+–1	vegetation
<i>Heliotropium arguzioides</i>	Perennial	20–25	R	+	vegetation
<i>Oreosalsola arbusculiformis</i> (<i>Salsola arbusculiformis</i>)	dwarf shrub	50–60	O	+–1	vegetation
<i>Peganum garmala</i>	Perennial	30–35	R–O	+	flowering
<i>Poa bulbosa</i>	Perennial	15–17	O–A	+	dried
<i>Salsola paulsenii</i>	annual	30–35	R	+	vegetation
<i>Smirnowia turkestanica</i>	Perennial	30–35	R	+	flowering
<i>Tortula desertorum</i>	moss	0.3–0.5	O	+	vegetation
<i>Tulipa lehmanniana</i>	Perennial	10–20	R–O	+	Vegetation, flowering
<i>Ziziphora tenuior</i>	annual	6–7	R–O	+	dried



Photo 125. Weakly inclined piedmont plain of the relic ridge Kuldzhuktau with saltwort-sagebrush vegetation, 40.9156° N, 63.51822° E



Photo 126. Piedmont plain of the relic ridge Kuldzhuktau with ephemeroïd-sagebrush vegetation and sparse black saxaul (remains of plantation), 40.94507° N, 64.28577° E



Photo 127. Piedmont plain of the relic ridge Kuldzhuktau with ephemeroïd-sagebrush vegetation and plantation of black saxaul, surroundings of the village Chontabay, 40.99858° N, 63.68805° E



Photo 128. *Acanthophyllum cyrtostegium*, nationally red-listed endemic species (category 3 – reducing species).



Photo 129. *Calligonum zakirovii*, nationally red-listed endemic to the south-western Kyzylkum (category 1 – endangered, disappearing species).



Photo 130. *Tulipa lehmanniana*, nationally red-listed species. Roadside of the road P-61, between the villages Shengeldy and Chontabay, April 2021

4.3.5. Foothills of relic low mountains

This habitat type is found on some plots along the previous variant of the power line (red line) running across the foothills of the relic ridge Kuldzhuktau. The terrain is more or less rugged, and the vegetation is represented with native saltwort-sagebrush communities on gypsiferous grey-brown desert soil and outcrops of variegated beds (photo 131), sometimes with tamarisk along dry riverbeds. Canopy cover is 10–30%. 27 plant species and one moss were recorded for this habitat type (table 52).

Table 52. Check-list of plants recorded for eroded foothills with outcrops of variegated beds and saltwort-sagebrush vegetation

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
<i>Anabasis turkestanica</i>	semishrub	15–20	R	+	vegetation
<i>Arnebia decumbens</i>	annual	15–20	R	+	fruiting
<i>Artemisia diffusa</i>	semishrub	30–35	A	1–2	vegetation
<i>Artemisia turanica</i>	semishrub	30–35	O–A	+–1	vegetation
<i>Astragalus villosissimus</i>	dwarf shrub	40–60	O	+	vegetation
<i>Bassia prostrata</i> (<i>Kochia prostrata</i>)	semishrub	15–20	R	+	vegetation
<i>Bromus tectorum</i>	annual	12–15	R	+	fruiting
<i>Caroxylon orientale</i> (<i>Salsola orientalis</i>)	dwarf shrub	35–40	A	1	vegetation

<i>Caroxylon scleranthum</i> (<i>Salsola sclerantha</i>)	annual	15–20	R–O	+	vegetation
<i>Ceratocarpus arenarius</i>	annual	10–12	R–O	+	vegetation
<i>Climacoptera</i> sp.	annual	10–15	R–O	+	vegetation
<i>Convolvulus hamadae</i>	semishrub	25–30	O–A	+–1	flowering
<i>Cousinia hamadae</i>	Perennial	25–30	R–O	+	vegetation
<i>Eremopyrum bonaepartis</i>	annual	10–12	R–O	+	fruiting
<i>Eremopyrum distans</i>	annual	10–12	R–O	+	fruiting
<i>Ferula foetida</i>	Perennial	100–120	R	+	Fruiting, dried
<i>Halimocnemis villosa</i>	annual	10–15	R–O	+	vegetation
<i>Haloxylon ammodendron</i> (<i>Haloxylon aphyllum</i>)	Small tree	100–150	R	+	vegetation
<i>Haplophyllum bungei</i>	perennial	20–25	R	+	flowering
<i>Haplophyllum robustum</i>	perennial	25–30	R	+	flowering
<i>Heliotropium arguzioides</i>	Perennial	20–25	R	+	vegetation
<i>Oreosalsola arbusculiformis</i> (<i>Salsola arbusculiformis</i>)	dwarf shrub	50–60	O–A	+–1	vegetation
<i>Peganum garmala</i>	Perennial	30–35	R–O	+	flowering
<i>Poa bulbosa</i>	Perennial	15–17	O	+	dried
<i>Salsola paulsenii</i>	annual	30–35	R	+	vegetation
<i>Tamarix</i> sp.	shrub	100–120	R	+	vegetation
<i>Tortula desertorum</i>	moss	0.3–0.5	O	+	vegetation
<i>Ziziphora tenuior</i>	annual	6–7	R	+	dried



Photo 131. Eroded foothills of the relic ridge Kuldzhuktau with saltwort-sagebrush vegetation, 40.87604° N, 64.25413° E

4.3.6. Outcrops of variegated beds

This habitat type is found on rather small plots along the previous variant of the power line (red line) running across the northern foothills of the relic ridge Kuldzhuktau. The terrain is more or less rugged; the vegetation is very sparse (canopy cover is 1–10%) and composed by saltworts and gypsophytes. The species composition is the same that is described in 4.2.3.

4.3.7. Saline lands

Several rather small saline depressions with very sparse saltworts or with takyr and without any vegetation are situated along the road P-61, between the village Shengeldy and the eastern edge of “Dzhankeldy” project site, among the weakly inclined northern piedmonts of the relic mountains Kuldzhuktau (photos 132–133). Canopy cover is 0–5%. 22 plant species were recorded for this habitat type (table 53), including one red-listed species, *Tulipa lehmanniana* (4 dried pre-generative specimens, 40.46116° N, 64.21558° E).

Note: “takyr” is a peculiar type of landscape occurring in the deserts of Central Asia, which is formed on periodically inundated depressions with loamy soil, forming a cracked crust at the dry season.

Table 53. Check-list of plants recorded for saline depressions and takyr

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
<i>Alhagi pseudalhagi</i>	Perennial	30–35	R–O	+	vegetation
<i>Anabasis turkestanica</i>	semishrub	15–20	R	+	vegetation
<i>Artemisia turanica</i>	semishrub	30–35	R–O	+	vegetation

<i>Bassia eriophora</i>	annual	12–15	O	+	fruiting
<i>Caroxylon orientale</i> (<i>Salsola orientalis</i>)	dwarf shrub	35–40	R–O	+	vegetation
<i>Caroxylon scleranthum</i> (<i>Salsola sclerantha</i>)	annual	15–20	R–O	+	vegetation
<i>Ceratocarpus arenarius</i>	annual	10–12	R–O	+	vegetation
<i>Climacoptera</i> sp.	annual	10–15	R–O	+	vegetation
<i>Convolvulus hamadae</i>	semishrub	25–30	R–O	+	flowering
<i>Cousinia hamadae</i>	Perennial	25–30	R–O	+	vegetation
<i>Eremopyrum bonaepartis</i>	annual	10–12	R	+	fruiting
<i>Eremopyrum distans</i>	annual	10–12	R	+	fruiting
<i>Ferula foetida</i>	Perennial	70–100	R	+	Fruiting, dried
<i>Halimocnemis villosa</i>	annual	10–15	R–O	+	vegetation
<i>Halimodendron halodendron</i>	Shrub	50–70	R	+	vegetation
<i>Haloxylon ammodendron</i> (<i>Haloxylon aphyllum</i>)	Small tree	100–150	R	+	vegetation
<i>Lycium ruthenicum</i>	Shrub	50–70	R–O	+–1	flowering
<i>Oreosalsola arbusculiformis</i> (<i>Salsola arbusculiformis</i>)	dwarf shrub	50–60	R–O	+1	vegetation
<i>Peganum garmala</i>	Perennial	30–35	R–O	+	flowering
<i>Tamarix</i> sp.	shrub	100–120	R	+	vegetation
<i>Tulipa lehmanniana</i>	Perennial	10–15	R	+	dried
<i>Ziziphora tenuior</i>	annual	6–7	R	+	dried



Photo 132. Saline depression with sparse saltworts, 40.96116° N, 64.21218° E.



Photo 133. Depression with takyr, vegetation is absent, 40.96262° N, 64.08994° E

It has been found that the vegetation along the planned power line “Bash-Dzhankeldy” is represented with native plant communities typical for South-western Kyzylkum, somewhere with saxaul plantations created in the past to prevent erosion of soils. The vegetation of studied area is characterized with sparse canopy cover, low species diversity and low to medium level of anthropogenic disturbance. At the present, the human impact is connected mainly with use of rangelands and a network of ground roads, as well as with littering by household waste near farms and villages and along roads.

A total check-list of vascular plants recorded along the planned power line “Bash-Dzhankeldy” during the field survey in May includes 52 species (Appendix 1); 3 species are nationally red-listed. *Calligonum zakirovii*, an endemic to south-western Kyzylkum and national endemic, is included in the Red Data Book of Uzbekistan (2019) with the status 1 (endangered, disappearing species). *Acanthophyllum cyrtostegium* and *Tulipa lehmanniana* are included in the Red Data Book of Uzbekistan (2019) with the status 3 (reducing).

4.4. “Bash-Karakul” power line

Following types of habitats (mapping units) were identified along the “Bash-Karakul” line:

4.4.1. Sandy and sandy-loamy desert plain

Sandy and sandy-loamy desert plain with flat, flat-wavy or wavy terrain is covered with native ephemeroid-sagebrush (*Artemisia diffusa*, *Poa bulbosa*, *Carex physodes*, *Carex subphysodes*) and ephemeroid-saltwort-sagebrush vegetation (*Artemisia diffusa*, *Poa bulbosa*, *Carex physodes*, *Caroxylon orientale* (*Salsola orientalis*), *Xylosalsola arbuscula*, (*Salsola arbuscula*)), sometimes with psammophilous shrubs (*Calligonum leucocladum*, *C. microcarpum*) and with saxaul plantations (*Haloxylon ammodendron*) on sandy desert soil (photo 134–135). On some areas, subdominants are *Alhagi pseudalhagi*, *Ferula foetida* and *Iris songarica* (photo 136–137). Local thickets of *Peganum garmala* have been found on overgrazed areas around farms and wells (photo 138). The elevation is 265–223 m a.s.l. The canopy cover is 10 to 40%, and the density of saxaul stands is up to 10–20%. A check-list of 29 plant species and 1 moss recorded for this habitat is presented below (table 54). This habitat is situated in the northern part of the power line, between the “Bash” project site and the discharge channel Agytma.

Table 54. Check-list of plants recorded for sandy desert plain with ephemeroid-sagebrush ephemeroid-saltwort-sagebrush vegetation, with psammophilous shrubs and saxaul plantations

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
<i>Acanthophyllum elatius</i>	Perennial	40–45	R	+	flowering
<i>Alhagi pseudalhagi</i>	Perennial	30–35	R–A	+–1	vegetation
<i>Alyssum desertorum</i>	annual	5–6	R	+	dried
<i>Artemisia diffusa</i>	semishrub	20–35	A–D	1–2	vegetation
<i>Astragalus villosissimus</i>	dwarf shrub	35–45	O–A	+	vegetation
<i>Bromus tectorum</i>	annual	12–15	R–O	+	fruiting
<i>Calligonum leucocladum</i>	shrub	50–100	R–O	+	fruiting
<i>Calligonum microcarpum</i>	shrub	50–70	R–O	+	fruiting
<i>Carex physodes</i>	Perennial	12–15	A–D	1	dried
<i>Carex subphysodes</i>	Perennial	10–12	O–D	1	dried
<i>Calligonum leucocladum</i>	shrub	50–100	R–O	+–1	fruiting
<i>Calligonum microcarpum</i>	shrub	50–100	R–O	+–1	fruiting

<i>Caroxylon orientale (Salsola orientalis)</i>	dwarf shrub	35-40	R-A	+—1	vegetation
<i>Ceratocarpus arenarius</i>	annual	10-12	R-A	+—1	vegetation
<i>Convolvulus divaricatus</i>	semishrub	25-35	R-O	+	flowering
<i>Convolvulus hamadae</i>	semishrub	25-30	R-A	+—1	flowering
<i>Cousinia hamadae</i>	Perennial	25-30	R-O	+	vegetation
<i>Ferula foetida</i>	Perennial	50-80	R-A	+—1	Fruiting, dried
<i>Halothamnus subaphyllus</i>	semishrub	50-60	R	+	vegetation
<i>Haloxylon ammodendron (Haloxylon aphyllum)</i>	Small tree	100-150	R-A	+—2	vegetation
<i>Heliotropium arguzioides</i>	Perennial	20-25	R	+	vegetation
<i>Iris songarica</i>	Perennial	30-35	R-A	+—1	vegetation
<i>Peganum garmala</i>	Perennial	30-35	R-A	+—1	flowering
<i>Poa bulbosa</i>	Perennial	15-17	A	+	dried
<i>Salsola paulsenii</i>	annual	30-35	R	+	vegetation
<i>Sophora pachycarpa</i>	Perennial	20-25	R-O	+	flowering
<i>Smirnowia turkestanica</i>	Perennial	30-35	R	+	flowering
<i>Stipagrostis pennata</i>	Perennial	30-35	R	+	vegetation
<i>Tortula desertorum</i>	moss	0.3-0.5	O-A	+—1	vegetation
<i>Xylosalsola arbuscula (Salsola arbuscula)</i>	shrub	40-50	O-A	+—1	vegetation



Photo 134. Sandy plain with native ephemeroid-sagebrush vegetation and remains of plantations of black saxaul, 40.538601° N, 64.69604° E



Photo 135. Sandy plain with native ephemeroid-saltwort-sagebrush vegetation and plantations of black saxaul, 40.42977° N, 64.57947° E



Photo 136. Sandy plain with native ephemeroid-sagebrush vegetation, with abundance of *Ferula foetida* and *Iris songarica*, 40.42856° N, 64.555° E



Photo 137. Wavy sandy plain with native ephemeroid-sagebrush vegetation, with abundance of *Ferula foetida*, 40.46222° N, 64.58032° E



Photo 138. Overgrazed rangelands with abundance of *Peganum garmala* on sandy plain near the sheep farm, 40.48734° N, 64.64465° E

4.4.2. Fixed and semi-fixed sands

Fixed and semi-fixed sands with hilly, ridge-hilly, ridge and wavy terrain are covered with native stands of saxaul, communities of psammophytic shrubs, dwarf shrubs, ephemers and ephemeroids (photo 139–141), and with plots of saxaul plantations. This habitat prevails in the central and southern part of the power line, between the discharge channel Agytma and Karakul. Dominants and subdominants are *Haloxylon persicum*, *H. ammodendron*, *Ammodendron conollyi*, species of *Calligonum* and *Xylosalsola*, *Artemisia diffusa*, *Astragalus villosissimus*, *Carex physodes*, *Ferula foetida*, *Convolvulus divaricatus*. The density of saxaul stands is up to 0.3–0.4. Local plots of unfixed moving sands and communities of pastoral weeds *Peganum garmala* and *Sophora pachycarpa* have been found on overgrazed and other disturbed areas around farms and wells, and along roads (photo 142). 48 plant species and one moss were recorded for this habitat type (table 55), including one nationally red-listed species, *Calligonum zakirovii* (fruiting specimens were found near the southern edge of saline wetland situated along the discharge channel Agytma, 40.80932° N, 64.48027° E) (photo 143).

Table 55. Check-list of plants recorded for fixed and semi-fixed sands with psammophytic shrubs and ephemeroid-sagebrush vegetation

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
<i>Acanthophyllum elatius</i>	Perennial	40–45	R–O	+	flowering
<i>Agriophyllum lateriflorum</i>	annual	20–30	R–O	+	vegetation
<i>Alhagi pseudalhagi</i>	Perennial	30–40	R–A	+–1	vegetation

<i>Alyssum desertorum</i>	annual	5–6	R	+	dried
<i>Ammodendron conollyi</i>	Small tree	100–150	R–A	+–1	fruiting
<i>Arnebia decumbens</i>	annual	15–20	R	+	fruiting
<i>Artemisia diffusa</i>	semishrub	35–40	O–D	+–2	vegetation
<i>Astragalus unifoliolatus</i>	dwarf shrub	35–40	R–O	+	fruiting
<i>Astragalus villosissimus</i>	dwarf shrub	35–40	O–A	+–1	fruiting
<i>Atriplex dimorphostegia</i>	annual	10–15	R	+	fruiting
<i>Bassia eriophora</i>	annual	10–15	R	+	fruiting
<i>Bromus tectorum</i>	annual	12–15	O–A	+	dried
<i>Calligonum caput-medusae</i>	shrub	100–150	R–O	+–1	fruiting
<i>Calligonum eriopodum</i>	shrub	150–170	R–O	+	fruiting
<i>Calligonum leucocladum</i>	shrub	100–150	O–D	1–2	fruiting
<i>Calligonum microcarpum</i>	shrub	50–100	O–A	1	fruiting
<i>Calligonum zakirovii</i>	shrub	40–50	R	+	fruiting
<i>Carex physodes</i>	Perennial	12–15	A–D	+–1	flowering
<i>Caroxylon orientale</i> (<i>Salsola orientalis</i>)	dwarf shrub	35–40	R–O	+	vegetation
<i>Caroxylon scleranthum</i> (<i>Salsola sclerantha</i>)	annual	20–25	R–O	+	vegetation
<i>Ceratocarpus arenarius</i>	annual	15–20	O–A	+	vegetation
<i>Climacoptera sp.</i>	annual	15–20	R–O	+	vegetation
<i>Convolvulus divaricatus</i>	semishrub	30–45	R–A	+–1	flowering
<i>Convolvulus hamadae</i>	semishrub	30–40	R–A	+–1	flowering
<i>Cousinia hamadae</i>	Perennial	30–35	R–O	+	vegetation
<i>Ephedra strobilacea</i>	shrub	50–150	R–O	+	fruiting
<i>Eremopyrum bonaepartis</i>	annual	10–12	R–O	+	fruiting
<i>Eremopyrum distans</i>	annual	10–12	R–O	+	fruiting
<i>Euphorbia cheirolepis</i>	annual	25–30	R	+	Flowering, fruiting

<i>Euphorbia turczaninowii</i>	annual	10–12	R	+	Flowering, fruiting
<i>Ferula foetida</i>	Perennial	50–60	R–A	+–1	Fruiting, dried
<i>Haplophyllum ramosissimum</i>	Perennial	25–30	R	+	vegetation
<i>Haloxylon ammodendron</i> (<i>Haloxylon aphyllum</i>)	Small tree	150–200	R–A	+–1	vegetation
<i>Haloxylon persicum</i>	Small tree	150–200	O–D	1–3	vegetation
<i>Heliotropium arguzioides</i>	Perennial	25–30	R–O	+	flowering
<i>Iris songarica</i>	Perennial	30–35	R	+	vegetation
<i>Mausolea eriocarpa</i>	semishrub	45–50	O–A	1	flowering
<i>Oreosalsola arbusculiformis</i> (<i>Salsola arbusculiformis</i>)	dwarf shrub	50–60	O	+–1	vegetation
<i>Peganum garmala</i>	Perennial	30–35	R–A	+–1	flowering
<i>Poa bulbosa</i>	Perennial	15–17	O	+	dried
<i>Salsola paulsenii</i>	annual	30–35	R	+	vegetation
<i>Sophora pachycarpa</i>	Perennial	20–25	R–A	+–1	flowering
<i>Smirnowia turkestanica</i>	Perennial	30–35	R–O	+	flowering
<i>Stipagrostis karelinii</i>	Perennial	35–45	O	+	vegetation
<i>Stipagrostis pennata</i>	Perennial	30–35	O	+	vegetation
<i>Tortula desertorum</i>	moss	0.3–0.5	O	+	vegetation
<i>Xylosalsola arbuscula</i> (<i>Salsola arbuscula</i>)	shrub	40–50	R–O	+–1	vegetation
<i>Xylosalsola richteri</i> (<i>Salsola richteri</i>)	shrub	100–150	R–O	+–1	vegetation



Photo 139. Semi-fixed hilly sands with native stands of saxaul and psammophytic shrubs, 40.31608° N, 64.3448° E



Photo 140. Fixed hilly sands with native stands of saxaul, 40.01175° N, 64.01932° E



Photo 141. Fixed sands with native community of *Calligonum* in surroundings of Karakul, 39.5784° N, 63.87543° E



Photo 142. An overgrazed area with unfixed sands and community of pastoral weeds *Peganum garmala* and *Sophora pachycarpa*, 40.24304° N, 64.28011° E



Photo 143. *Calligonum zakirovii*, nationally red-listed endemic to the south-western Kyzylkum (category 1 – endangered, disappearing species), 40.48764° N, 64.60557° E.

4.4.3. Saline lands and wetlands

Saline lands and wetlands are situated in the ancient delta of the Zeravshan River, in depressions and along several irrigation and discharge channels and collectors of the irrigation system of Bukhara oasis (Agytma and Echkiliksay discharge channels, Northern and Central Bukhara collectors, Gazli channel, Karakuldarya, etc.). The vegetation is represented by tugay and salt marsh communities with halophilic shrubs (*Tamarix sp.*, *Halimodendron halodendron*, *Halostachys belangeriana*, *Lycium ruthenicum*), reeds (*Phragmites australis*, *Typha latifolia*, *T. minima*), camel thorn (*Alhagi pseudalhagi*), saltworts (*Halocnemum strobilaceum*, *Ceratocarpus arenarius*, *Climacoptera sp.*, *Salicornia europaea*, *Salsola paulsenii*, *Suaeda sp.*), other halophytes, halomesophytes and halohydrophytes, as *Limonium otolepis*, *Karelinia caspia*, and pastoral weeds (*Peganum garmala*, *Sophora pachycarpa*). Canopy cover and species composition are variable in different locations (photos 144–149). In total, 43 plant species were recorded for this habitat type (table 56), red-listed plants are absent.

Note: “tugay” (or “tugai”) is a local name of riparian ecosystems occurring in the river valleys of the desert zone of Central Asia.

Table 56. Check-list of plants recorded for saline lands and wetlands

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
<i>Aeluropus litoralis</i>	Perennial	10–20	O–A	+–1	Vegetation, flowering
<i>Alhagi persarum</i>	Perennial	35–45	O	+	vegetation
<i>Alhagi pseudalhagi</i>	Perennial	35–45	O–D	+–3	vegetation
<i>Artemisia scoparia</i>	Annual, biennial	35–40	R–A	+–1	vegetation

<i>Bassia eriophora</i>	annual	12–15	R–O	+	fruiting
<i>Bromus tectorum</i>	annual	12–15	O–A	+	dried
<i>Caroxylon scleranthum</i> (<i>Salsola sclerantha</i>)	annual	20–25	R–O	+	vegetation
<i>Ceratocarpus arenarius</i>	annual	10–12	R–A	+–1	vegetation
<i>Climacoptera sp.</i>	Annual	10–15	R–O	+	vegetation
<i>Convolvulus hamadae</i>	semishrub	25–30	R–O	+	flowering
<i>Cousinia resinosa</i>	Perennial	25–30	R–O	+	vegetation
<i>Elaeagnus angustifolia</i>	tree	250–350	R	1	vegetation
<i>Eremopyrum bonaepartis</i>	annual	10–12	R–O	+	fruiting
<i>Eremopyrum distans</i>	annual	10–12	R–O	+	fruiting
<i>Erianthus ravennae</i>	perennial	150–250	R	+	vegetation
<i>Euphorbia granulata</i>	annual	5–10	R–O	+	Flowering, fruiting
<i>Ferula foetida</i>	Perennial	70–100	R–O	+	Fruiting, dried
<i>Glycyrrhiza glabra</i>	Perennial	50–100	R–O	+	Vegetation
<i>Halimocnemis villosa</i>	annual	10–15	R–O	+	vegetation
<i>Halimodendron halodendron</i>	Shrub	70–150	R–O	1–2	vegetation
<i>Halocnemum strobilaceum</i>	semishrub	40–100	R–A	+–1	vegetation
<i>Halostachys belangeriana</i>	Shrub	50–100	R–O	+–1	vegetation
<i>Haloxylon ammodendron</i> (<i>Haloxylon aphyllum</i>)	Small tree	100–150	R–O	1–2	vegetation
<i>Heliotropium ellipticum</i>	annual	15–20	R–O	+	flowering
<i>Karelinia caspia</i>	Perennial	40–100	R–A	+–1	vegetation
<i>Limonium otolepis</i>	Perennial	35–50	R–A	+–1	flowering
<i>Limonium suffruticosum</i>	semishrub	25–35	R–O	+	vegetation
<i>Lycium ruthenicum</i>	Shrub	50–70	R–A	+–2	flowering
<i>Peganum garmala</i>	Perennial	30–35	R–A	+–1	flowering
<i>Phragmites australis</i>	Perennial	200–400	O–D	1–4	vegetation
<i>Poa bulbosa</i>	Perennial	15–17	O–A	+	dried
<i>Salicornia europaea</i>	annual	10–20	O	+	vegetation

<i>Salsola paulsenii</i>	annual	30–35	R–O	+	vegetation
<i>Sophora pachycarpa</i>	Perennial	20–25	R–A	+–1	flowering
<i>Sphaerophysa salsula</i>	Perennial	30–35	R–O	+	vegetation
<i>Suaeda altissima</i>	annual	25–35	R–O	+	vegetation
<i>Suaeda sp.</i>	Annual	10–20	R–O	+	vegetation
<i>Tamarix hispida</i>	shrub	70–150	R–A	1–2	vegetation
<i>Tamarix laxa</i>	shrub	70–150	R–A	1–2	vegetation
<i>Tamarix ramosissima</i>	shrub	150–200	R–D	+–4	vegetation
<i>Typha latifolia</i>	Perennial	150–200	R–O	+–1	vegetation
<i>Typha minima</i>	Perennial	100–150	R	+	vegetation
<i>Zygophyllum oxianum</i>	Perennial	20–30	R	+	fruiting



Photo 144. Saline wetland and a seasonal lake with tamarisk, reeds and halophytes in a small depression between the “Bash” site and Agytma discharge channel, 40.4746° N, 64.63179° E.



Photo 145. Reeds along the Echkiliksay discharge channel, 40.412075° N, 64.50982° E.



Photo 146. Saline wetland and a seasonal lake with tamarisk, reeds and halophytes in a small depression between the “Bash” site and Agytma discharge channel, 40.4746° N, 64.63179° E.



Photo 147. Sparse tamarisk in saline depression near the collector Karakyr, 40.12676° N, 64.105211° E.



Photo 148. Saline land with community of *Lycium ruthenicum* and camel thorn near the Echkiliksay discharge channel, 40.42561° N, 64.52462° E.



Photo 149. Camel thorn community on saline sands near the Agytma discharge channel (at the border between saline lands and sandy desert, 40.47556° N, 64.59086° E.

4.4.5. Agricultural lands

This is the anthropogenic agricultural landscape of the ancient Bukhara Oasis situated in the lower course and the ancient delta of Zeravshan River. There are irrigated croplands, saline fallow lands, wastelands, villages, farmsteads, branched irrigation system of numerous channels and collectors, roads, power lines, and other disturbed areas; vegetation is represented by cultural crops (wheat, rice, cotton, vegetables, etc.), weeds (*Cynodon dactylon*, *Descurainia sophia*, *Peganum garmala*, *Sophora pachycarpa*, *Tribulus terrestris*) and small plots of above-mentioned vegetation of saline lands and wetlands (photo 150–151). Canopy cover and species composition are variable in different locations. The check-list of wild growing plant species is almost the same than the previous habitat type (table 57); 42 species were recorded; red-listed plants are absent, and 2 species are alien (*Cynodon dactylon*, *Tribulus terrestris*).

Table 57. Check-list of plants recorded for agricultural lands

Species	Life form	Height, cm	Abundance		Phenol. Stage
			DAFOR	Braun-Blanquet	
<i>Aeluropus litoralis</i>	Perennial	10–20	O–A	+–1	Vegetation, flowering
<i>Alhagi kirghisorum</i>	Perennial	35–45	O–A	+–2	vegetation
<i>Alhagi persarum</i>	Perennial	35–45	O	+	vegetation
<i>Alhagi pseudalhagi</i>	Perennial	35–45	O–D	+–3	vegetation
<i>Artemisia scoparia</i>	Annual, biennial	35–40	R–A	+–1	vegetation
<i>Bromus tectorum</i>	annual	12–15	O–A	+	dried

<i>Ceratocarpus arenarius</i>	annual	10-12	R-A	+–1	vegetation
<i>Climacoptera sp.</i>	Annual	10–15	R-O	+	vegetation
<i>Cousinia resinosa</i>	Perennial	25–30	R-O	+	vegetation
<i>Cynodon dactylon</i>	Perennial	10–15	R-O	+	Vegetation, flowering
<i>Descurainia sophia</i>	annual	20–25	O	+	fruiting
<i>Elaeagnus angustifolia</i>	tree	250–350	R	1	vegetation
<i>Eremopyrum bonaepartis</i>	annual	10–12	R-O	+	fruiting
<i>Eremopyrum distans</i>	annual	10–12	R-O	+	fruiting
<i>Erianthus ravennae</i>	perennial	150–250	R	+	vegetation
<i>Euphorbia granulata</i>	annual	5–10	R-O	+	Flowering, fruiting
<i>Glycyrrhiza glabra</i>	Perennial	50–100	R-O	+	Vegetation
<i>Halimocnemis villosa</i>	annual	10–15	R-O	+	vegetation
<i>Halimodendron halodendron</i>	Shrub	70–150	R-O	1–2	vegetation
<i>Halocnemum strobilaceum</i>	semishrub	40–100	R-A	+–1	vegetation
<i>Halostachys belangeriana</i>	Shrub	50–100	R-O	+–1	vegetation
<i>Haloxylon ammodendron</i> (<i>Haloxylon aphyllum</i>)	Small tree	50–150	R	+–1	vegetation
<i>Heliotropium ellipticum</i>	annual	15–20	R-O	+	flowering
<i>Karelinia caspia</i>	Perennial	40–100	R-A	+–1	vegetation
<i>Limonium otolepis</i>	Perennial	35–50	R-A	+–1	flowering
<i>Lycium ruthenicum</i>	Shrub	50–70	R-A	+–2	flowering
<i>Peganum garmala</i>	Perennial	30–35	R-A	+–1	flowering
<i>Phragmites australis</i>	Perennial	200–400	O-D	1–4	vegetation
<i>Poa bulbosa</i>	Perennial	15–17	O-A	+	dried
<i>Populus pruinosa</i>	tree	400–600	R-O	1–2	Vegetation, fruiting
<i>Salicornia europaea</i>	annual	10–20	O	+	vegetation
<i>Salsola paulsenii</i>	annual	30–35	R-O	+	vegetation
<i>Sophora pachycarpa</i>	Perennial	20–25	R-A	+–1	flowering
<i>Suaeda altissima</i>	annual	25–35	R-O	+	vegetation
<i>Suaeda sp.</i>	Annual	10–20	R-O	+	vegetation
<i>Tamarix hispida</i>	shrub	70–150	R-A	1–2	vegetation

<i>Tamarix laxa</i>	shrub	70–150	R–A	1–2	vegetation
<i>Tamarix ramosissima</i>	shrub	150–200	R–D	+–4	vegetation
<i>Tribulus terrestris</i>	annual	10–20	R–O	+	Vegetation, flowering
<i>Typha latifolia</i>	Perennial	150–200	R–O	+–1	vegetation
<i>Typha minima</i>	Perennial	100–150	R–O	+	vegetation
<i>Zygophyllum oxianum</i>	Perennial	20–30	R–O	+	fruiting



Photo 150. Rice fields, 40.04997° N, 64.63179° E.



Photo 151. Saline fallow lands, 40.4215° N, 64.50701° E.

5. Conclusion

Results of the field surveys conducted in both project sites in springtime (April) and early summer (middle May and middle June) showed that the species composition has been identified almost completely during the first survey. The main difference between data of springtime and summer surveys is that all ephemers and ephemeroïds completed their vegetation and dried, so their abundance and coverage decreased. Some representatives of Amarantaceae family (Climacoptera, Suaeda) were identified only at generic level, because the correct identification of these plants is possible at the flowering or fruiting stage (second half of August to October).

It has been found that the vegetation of the project zone, including “Bash” and “Dzhankeldy” sites, and an area between these sites along the planned power line, is represented with native ephemeroïd-sagebrush, saltwort-sagebrush, saltwort-ephemeroïd-sagebrush and saltwort plant communities on sandy, sandy-loamy and skeleton grey-brown desert soils, with sparse halophilous and gypsophilous vegetation on saline depressions and outcrops of variegated beds, with psammophilous shrubs on fixed and semi-fixed sands, and sometimes with saxaul plantations created in the past for fixation of sands and combat soil deflation. The vegetation of the project zone is typical for South-western Kyzylkum (and for the desert zone of Central Asia). The field survey showed that the draft maps of habitats created on the basis of proxy data are generally correct, and only some adjustments are necessary.

Plant communities of the project zone are characterized with sparse canopy cover, low species diversity and low to medium level of anthropogenic disturbance. The canopy cover is 20–40% on most areas, less than 10% (sometimes almost 0%) on saline depressions, takyrs and outcrops of variegated beds, and up to 40–50% for communities of psammophilous shrubs or saxaul stands.

A total check-list of vascular plants were recorded within the project site “Bash” during the field surveys includes 49 species (Annex 1); 85 species were recorded within the “Dzhankeldy” site (Annex 2), 52 species – along the planned power line “Bash-Dzhankeldy” (Annex 3), and 76 species – along the “Bash-Karakul” line (Annex 4). Among them, 4 species are nationally red-listed. *Calligonum zakirovii*, an endemic to south-western Kyzylkum and national endemic, is included in the Red Data Book of Uzbekistan (2019) with the status 1 (endangered, disappearing species). *Acanthophyllum cyrtostegium*, *Ferula kyzylkumica* and *Tulipa lehmanniana* are included in the Red Data Book of Uzbekistan (2019) with the status 3 (reducing). Among them, 3 species are endemics with restricted range (*Acanthophyllum cyrtostegium*, *Calligonum zakirovii*, *Ferula kyzylkumica*).

Nationally red-listed *Tulipa lehmanniana* occurs sporadically within two project sites and along the planned power line “Bash-Dzhankeldy”; its relative abundance according the DAFOR scale is R (rare) to O (occasional), population density varies from solitary specimens to 900–1000 per 1 hectare. Due to the dry weather conditions of last winter and this spring, mainly pre-generative and non-flowering generative specimens of this tulip were observed; the number of flowering specimens is very low. *Tulipa lehmanniana* included in the Red Data Book of Uzbekistan (2019) with the status 3 (vulnerable, reducing), it is nationally red-listed also in Kazakhstan, Tajikistan and Turkmenistan, and not evaluated in the IUCN Red List. The main threats are overgrazing, habitat loss, collection of flowers and bulbs. This species is quite widely spread in the desert zone of Irano-Turanian region of Tethyan (Ancient Mediterranean) floristic subkingdom of Holarctic (Takhtajan, 1986), and it grows in Uzbekistan, Kazakhstan, Tajikistan, Turkmenistan, Afghanistan, Pakistan, and Iran. Recent field studies (Abduraimov, 2017; Shomurodov & al., 2018) showed that large populations with thousands of specimens grow in the Uzbek part of the Kyzylkum desert. Tojibaev &

Beshko (2015) noted that this species can be assessed as Least Concern (LC) by the IUCN Red List Categories and Criteria (IUCN, 2012).

Another plant listed in the Red Data Book of Uzbekistan (2019) with the category 3 (reducing), *Ferula kyzylkumica*, is endemic to the relic mountains of Kyzylkum with a disjunction in the Nuratau Mountains, and national endemic. This species also is widely spread in the Kuldzhuktau Mountains; solitary specimens and populations of 50–100 individuals occur sporadically on stony slopes and foothills within and between survey plots in “Dzhankeldy” project site.

Nationally red-listed endemic to south-western Kyzylkum and Zirabulak-Ziadin Mountains, *Acanthophyllum cyrtostegium*, occurs sporadically in the piedmont plains and foothills of Kuldzhuktau, solitary or in small groups, the population density is up to 40–50 individuals per 1 hectare.

As for *Calligonum zakirovii*, only several small populations were found in “Dzhankeldy” project site and along the “Bash-Dzhankeldy” power line during the field studies.

Three species (*Cousinia sogdiana*, *Eremurus korolkowii* and *Tulipa sogdiana*) are endemic to Central Asian deserts, which previously were included in the Red Data Book of Uzbekistan, but on the basis of field surveys performed during the last 20 years they have been removed from the national Red Data Book. Among them, endemic to relic mountains of Kyzylkum *Eremurus korolkowii* has most restricted range and habitat.

None of these nationally red-listed or endemic plants were evaluated in the IUCN Red List.

Other threatened or endemic species known for the study area from literature (see Chapter 2.2 above) were not recorded during our field surveys in 2021, but can potentially be found with more detailed studies in the future. Taking into account the published and field data, the insular mountains Kuldzhuktau (and “Dzhankeldy” project site in particular) meets the critical habitat criteria 1 and 2 as a habitat of several nationally red-listed and restricted range endemic plant species (Annex 5).

Within the whole project area, anthropogenically transformed ecosystems are mainly concentrated along the “Bash-Karakul” power line; there are irrigated croplands, fallow lands, wastelands, villages, farmsteads, irrigation systems, roads, power lines, and other infrastructure; vegetation is represented by cultural crops, weeds and small plots of vegetation of saline lands and wetlands.

At the present, the human impact within the “Bash” and “Dzhankeldy” sites and along the “Bash-Dzhankeldy” power line is connected mainly with economical activities of local people inhabiting several small villages and farmsteads (use of rangelands and ground roads). *Peganum harmala*, a plant species which is an indicator of overgrazing and degradation of pastures, has been found in all natural habitats and majority of survey plots, but its abundance is low. Within the “Navoi-Bah” site, we did not observe dense thickets of *Peganum harmala* typical for degraded rangelands of arid zone of Uzbekistan, but in “Dzhankeldy” site and along the power lines these thickets occur around settlements, farmsteads and wells. As for invasive alien plants, these were not recorded during our field surveys in “Bash” and “Dzhankeldy” sites and along “Bash-Dzhankeldy” power line, and 2 alien weeds (*Cynodon dactylon* and *Tribulus terrestris*) were found along the “Bash-Karakul” power line, in anthropogenic landscapes.

Technologically disturbed areas occupy very small part of the “Bash” project site in a narrow strip along the railway and underground gas pipeline. Small disturbed areas (construction sites or quarries about 250x150 and 350x250 m in size) with almost completely exterminated vegetation are located also in the south-eastern part of this project site. In “Dzhankeldy” site, the impact of mining operations is more expressed (there are numerous active and abandoned mines and quarries, geological exploration is underway at the present). Such technogenically disturbed areas in the Kyzylkum desert,

as well as overgrazed territories around farms, wells and villages, usually become centers of erosion which can lead to the formation of moving sands.

Table 58. Summary table

SPECIES	ABUNDANCE ON SITE (RARE/OCCASIONAL/FREQUENT/DOMINANT)	RANGE (ENDEMIC / REGIONAL / TRANSCONTINENTAL)	IUCN /RDB STATUS
“Bash WF” site			
Tulipa lehmanniana Merckl.	Occasional to Rare	Regional	Not Evaluated (NE) / UzbRDB 3 (vulnerable, declining species)
“Dzhankeldy WF” site			
Acanthophyllum cyrtostegium Vved.	Rare	Endemic	Not Evaluated (NE) / UzbRDB 3 (vulnerable, declining species)
Calligonum zakirovii (Khalk.) Czerep.	Rare	Endemic	Not Evaluated (NE) / UzbRDB 1 (endangered species)
Eremurus korolkowii Regel (see note below)	Occasional to Rare	Endemic	Not Evaluated (NE) / UzbRDB 2 (rare species) in former editions, currently excluded
Ferula kyzylkumica Korovin	Occasional to Rare	Endemic	Not Evaluated (NE) / UzbRDB 3 (vulnerable, declining species)
Tulipa lehmanniana Merckl.	Occasional to Rare	Regional	Not Evaluated (NE) / UzbRDB 3 (vulnerable, declining species)
OHTL segment 1 (“Bash WF – Dzhankeldy WF”)			
Acanthophyllum cyrtostegium Vved.	Rare	Endemic	Not Evaluated (NE) / UzbRDB 3 (vulnerable, declining species)
Calligonum zakirovii (Khalk.) Czerep.	Rare	Endemic	Not Evaluated (NE) / UzbRDB 1 (endangered species)
Tulipa lehmanniana Merckl.	Occasional to Rare	Regional	Not Evaluated (NE) / UzbRDB 3 (vulnerable, declining species)
OHTL segment 2 (“Bash WF – Karakul sub-station”)			
Calligonum zakirovii (Khalk.) Czerep.	Rare	Endemic	Not Evaluated (NE) / UzbRDB 1 (endangered species)

Note: In the international taxonomic databases, Eremurus korolkowii currently treated as a synonym of Eremurus anisopterus (assessed as LC by IUCN). But experts in Central Asian flora do not support this point of view and consider these plants as two separated species, which morphologically and ecologically well differ from each other. Additional molecular-genetic studies are needed.

	NAME OF SPECIES		IUCN /RDB STATUS	ABUNDANCE/ DENSITY
	LATIN	ENGLISH		
1	<i>Acanthophyllum cyrtostegium</i> Vved.	-	Not Evaluated (NE) / UzbRDB 3 (vulnerable, declining species)	Rare / up to 40–50 individuals per 1 hectare
2	<i>Calligonum zakirovii</i> (Khalk.) Czerep.	Zakirov's calligonum	Not Evaluated (NE) / UzbRDB 1 (endangered species)	Rare / density varies from solitary plants to 30–40 per 1 hectare
3	<i>Eremurus korolkowii</i> Regel	Korolkow's desert-candle	Not Evaluated (NE) / UzbRDB 2 (rare species) in former editions, currently excluded	Occasional to Rare / density varies from solitary plants to 100–150 per 1 hectare
4	<i>Ferula kyzylkumica</i> Korovin	Kyzylkum's ferula	Not Evaluated (NE) / UzbRDB 3 (vulnerable, declining species)	Occasional to Rare / density varies from solitary plants to 50–100 per 1 hectare
5	<i>Tulipa lehmanniana</i> Merckl.	Lehmann's tulip	Not Evaluated (NE) / UzbRDB 3 (vulnerable, declining species)	Occasional to Rare / density varies from solitary plants to 900–1000 per 1 hectare

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Annex 1. A check-list of plants recorded in “Bash” site

Plant species	Life form	Family	Abundance	Habitat
1. <i>Acanthophyllum elatius</i>	Perennial	Caryophyllaceae	O–R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands, relic hills
2. <i>Alhagi pseudalhagi</i>	Perennial	Fabaceae	O–R	Fixed and semi-fixed sands
3. <i>Alyssum desertorum</i>	annual	Brassicaceae	O–R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands, relic hills
4. <i>Artemisia diffusa</i>	semishrub	Asteraceae	D–A	All natural habitats and all survey plots
5. <i>Atraphaxis spinosa</i>	shrub	Polygonaceae	R	Cliffs and eroded slopes of saline depression
6. <i>Astragalus ammotrophus</i>	perennial	Fabaceae	R	Cliffs and eroded slopes of saline depression
7. <i>Astragalus chiwensis</i>	perennial	Fabaceae	R	Fixed and semi-fixed sands (B067, B068)
8. <i>Astragalus flexus</i>	perennial	Fabaceae	R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
9. <i>Astragalus rubromarginatus</i>	perennial	Fabaceae	R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
10. <i>Astragalus villosissimus</i>	dwarf shrub	Fabaceae	A–R	All natural habitats and majority of survey plots
11. <i>Bassia prostrata</i> (<i>Kochia prostrata</i>)	semishrub	Amaranthaceae	R	Sandy and sandy-loamy desert plain, cliffs and eroded slopes of saline depression
12. <i>Bromus tectorum</i>	annual	Poaceae	O	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
13. <i>Calligonum leucocladum</i>	shrub	Polygonaceae	A–R	Fixed and semi-fixed sands
14. <i>Calligonum microcarpum</i>	shrub	Polygonaceae	A–R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
15. <i>Carex physodes</i>	Perennial	Cyperaceae	D–A	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
16. <i>Carex subphysodes</i>	Perennial	Cyperaceae	A–O	Sandy and sandy-loamy desert plain, cliffs and eroded

				slopes of saline depression, relic hills
17. <i>Caroxylon orientale</i> (<i>Salsola orientalis</i>)	dwarf shrub	Amaranthaceae	D-R	All natural habitats and all survey plots
18. <i>Caroxylon scleranthum</i> (<i>Salsola sclerantha</i>)	annual	Amaranthaceae	R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
19. <i>Ceratocarpus arenarius</i>	annual	Amaranthaceae	R	All natural habitats and majority of survey plots
20. <i>Ceratocephala falcata</i>	annual	Ranunculaceae	O-R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
21. <i>Climacoptera</i> sp.	Annual	Amaranthaceae	R	Sandy and sandy-loamy desert plain, cliffs and eroded slopes of saline depression
22. <i>Convolvulus divaricatus</i>	semishrub	Convolvulaceae	O-R	fixed and semi-fixed sands, relic hills
23. <i>Convolvulus hamadae</i>	semishrub	Convolvulaceae	A-R	All natural habitats and majority of survey plots
24. <i>Cousinia hamadae</i>	perennial	Asteraceae	R	All natural habitats and majority of survey plots
25. <i>Cousinia sogdiana</i>	biennial	Asteraceae	R	fixed and semi-fixed sands
26. <i>Cousinia resinosa</i>	perennial	Asteraceae	R	Sandy and sandy-loamy desert plain (B036, B037)
27. <i>Ferula foetida</i>	Perennial, ephemeroid	Apiaceae	D-R	All natural habitats and majority of survey plots
28. <i>Halothamnus subaphyllus</i>	semishrub	Amaranthaceae	R	Sandy and sandy-loamy desert plain, relic hills
29. <i>Haloxylon persicum</i>	Small tree	Amaranthaceae	A-D	fixed and semi-fixed sands
30. <i>Heliotropium arguzioides</i>	Perennial	Boraginaceae	R	fixed and semi-fixed sands
31. <i>Holosteum umbellatum</i>	annual	Caryophyllaceae	O-R	Sandy and sandy-loamy desert plain, cliffs and eroded slopes of saline depression, relic hills
32. <i>Hypecoum pendulum</i>	annual	Papaveraceae	O-R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
33. <i>Iris falcifolia</i>	Perennial	Iridaceae	R	cliffs and eroded slopes of saline depression

34. <i>Iris longiscapa</i>	Perennial	Iridaceae	R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
35. <i>Iris songarica</i>	Perennial	Iridaceae	A-R	All natural habitats and majority of survey plots
36. <i>Ixiolirion tataricum</i>	Perennial, ephemeroid	Ixioliriaceae	R	Sandy and sandy-loamy desert plain, relic hills
37. <i>Mausolea eriocarpa</i>	semishrub	Asteraceae	O	fixed and semi-fixed sands
38. <i>Oreosalsola arbusculiformis</i> (<i>Salsola arbusculiformis</i>)	dwarf shrub	Amaranthaceae	A-R	Sandy and sandy-loamy desert plain, cliffs and eroded slopes of saline depression, relic hills
39. <i>Peganum harmala</i> Indicator of overgrazing	Perennial	Nitrariaceae	R	All natural habitats and majority of survey plots
40. <i>Phlomis desertorum</i>	Perennial	Lamiaceae	R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands, relic hills
41. <i>Poa bulbosa</i>	Perennial	Poaceae	A-O	All natural habitats and all survey plots
42. <i>Salsola paulsenii</i>	annual	Amaranthaceae	R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
43. <i>Sophora pachycarpa</i>	Perennial	Fabaceae	R	fixed and semi-fixed sands (B005, B006)
44. <i>Stipagrostis pennata</i>	Perennial	Poaceae	O-R	fixed and semi-fixed sands
45. <i>Streptoloma desertorum</i>	annual	Brassicaceae	R	Sandy and sandy-loamy desert plain
46. <i>Tulipa lehmanniana</i> Nationally red-listed (status 3 – reducing species)	Perennial	Liliaceae	O-R	All natural habitats and majority of survey plots
47. <i>Tulipa sogdiana</i>	Perennial	Liliaceae	R	Sandy and sandy-loamy desert plain, cliffs and eroded slopes of saline depression, relic hills
48. <i>Xylosalsola arbuscula</i> (<i>Salsola arbuscula</i> .)	Shrub	Amaranthaceae	A-R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
49. <i>Zygophyllum macrophyllum</i>	Perennial	Zygophyllaceae	R	Sandy and sandy-loamy desert plain, cliffs and eroded slopes of saline depression

Annex 2. A check-list of plants recorded in the “Dzhankeldy” site during the field survey in 2021

Plant species	Life form	Family	Abundance	Habitat
1. <i>Acanthophyllum cyrtostegium</i> Nationally red-listed (status 3 – reducing species), national endemic	Perennial	Caryophyllaceae	R	Weakly inclined piedmont plain and foothills
2. <i>Acanthophyllum elatius</i>	Perennial	Caryophyllaceae	R	weakly inclined piedmont plain
3. <i>Alhagi pseudalhagi</i>	Perennial	Fabaceae	R–O	Anthropogenic disturbed areas
4. <i>Allium griffithianum</i>	perennial	Amaryllidaceae	R	Foothills, stony slopes
5. <i>Allium karakense</i>	perennial	Amaryllidaceae	R	Stony slopes
6. <i>Allium protensum</i>	perennial	Amaryllidaceae	R	All habitats, except for anthropogenic
7. <i>Allium sabulosum</i>	perennial	Amaryllidaceae	R	Foothills, stony slopes
8. <i>Alyssum desertorum</i>	annual	Brassicaceae	R–O	All habitats
9. <i>Alyssum linifolium</i> (<i>Meniocus linifolius</i>)	annual	Brassicaceae	R–O	Foothills, stony slopes
10. <i>Ammodendron conollyi</i>	Small tree	Fabaceae	R	weakly inclined piedmont plain, foothills
11. <i>Anabasis eriopoda</i>	semishrub	Amaranthaceae	R	All habitats, except for anthropogenic
12. <i>Anabasis turkestanica</i>	semishrub	Amaranthaceae	R	weakly inclined piedmont plain, foothills, outcrops of variegated beds
13. <i>Arnebia decumbens</i>	annual	Boraginaceae	R	All habitats, except for anthropogenic
14. <i>Artemisia diffusa</i>	semishrub	Asteraceae	A–D	All habitats, except for anthropogenic and outcrops of variegated beds
15. <i>Artemisia juncea</i>	semishrub	Asteraceae	R–O	Foothills, stony slopes
16. <i>Artemisia scoparia</i>	Annual, biennial	Asteraceae	A–D	All habitats
17. <i>Artemisia turanica</i>	semishrub	Asteraceae	O–D	All habitats
18. <i>Astragalus ammotrophus</i>	perennial	Fabaceae	R	All habitats, except for anthropogenic
19. <i>Astragalus villosissimus</i>	dwarf shrub	Fabaceae	A–R	All habitats, except for anthropogenic
20. <i>Atraphaxis spinosa</i>	shrub	Polygonaceae	R	All habitats, except for anthropogenic

21. <i>Bassia eriophora</i>	annual	Amaranthaceae	O	outcrops of variegated beds
22. <i>Bassia prostrata</i> (<i>Kochia prostrata</i>)	semishrub	Amaranthaceae	R	Foothills, outcrops of variegated beds
23. <i>Bromus tectorum</i>	annual	Poaceae	R–O	All habitats
24. <i>Calligonum leucocladum</i>	shrub	Polygonaceae	A–R	weakly inclined piedmont plain
25. <i>Calligonum microcarpum</i>	shrub	Polygonaceae	A–R	weakly inclined piedmont plain
26. <i>Calligonum zakirovii</i> Nationally red-listed (status 1 – endangered species), national endemic	shrub	Polygonaceae	R	weakly inclined piedmont plain, outcrops of variegated beds
27. <i>Carex pachystylis</i>	Perennial	Cyperaceae	D–A	All habitats, except for anthropogenic
28. <i>Carex subphysodes</i>	Perennial	Cyperaceae	D–O	weakly inclined piedmont plain
29. <i>Carex physodes</i>	Perennial	Cyperaceae	O	weakly inclined piedmont plain
30. <i>Caroxylon gemmascens</i> (<i>Salsola gemmascens</i>)	dwarf shrub	Amaranthaceae	O–R	All habitats, except for anthropogenic
31. <i>Caroxylon orientale</i> (<i>Salsola orientalis</i>)	dwarf shrub	Amaranthaceae	A–R	All habitats, except for anthropogenic
32. <i>Caroxylon scleranthum</i> (<i>Salsola sclerantha</i>)	annual	Amaranthaceae	R–O	All habitats, except for anthropogenic
33. <i>Ceratocarpus arenarius</i>	annual	Amaranthaceae	R	All habitats
34. <i>Ceratocephala falcata</i>	annual	Ranunculaceae	O–R	All habitats
35. <i>Climacoptera</i> sp.	Annual	Amaranthaceae	R	All habitats, except for anthropogenic
36. <i>Convolvulus divaricatus</i>	semishrub	Convolvulaceae	O–R	weakly inclined piedmont plain
37. <i>Convolvulus hamadae</i>	semishrub	Convolvulaceae	A–R	All habitats, except for anthropogenic
38. <i>Cousinia hamadae</i>	perennial	Asteraceae	R–O	All habitats, except for anthropogenic
39. <i>Eminium lehmannii</i>	perennial	Araceae	R	Foothills, stony slopes
40. <i>Ephedra intermedia</i>	shrub	Ephedraceae	R–O	Foothills, stony slopes
41. <i>Eremopyrum bonaepartis</i>	annual	Poaceae	R–O	All habitats
42. <i>Eremopyrum distans</i>	annual	Poaceae	R–O	All habitats
43. <i>Ferula foetida</i>	Perennial, ephemeroi d	Apiaceae	A–R	All habitats
44. <i>Ferula kyzylkumica</i>	perennial	Apiaceae	A–R	Stony slopes

Nationally red-listed (status 3 – reducing species), national endemic				
45. <i>Fritillaria karelinii</i>	Perennial	Liliaceae	R	Foothills, stony slopes
46. <i>Gagea afghanica</i>	Perennial	Liliaceae	R	Foothills, stony slopes
47. <i>Gagea bergii</i>	Perennial	Liliaceae	R	Foothills, stony slopes
48. <i>Halimocnemis gamocarpa</i>	annual	Amaranthaceae	R	Foothills, stony slopes, outcrops of variegated beds
49. <i>Halimocnemis latifolia</i>	annual	Amaranthaceae	R	Foothills, stony slopes, outcrops of variegated beds
50. <i>Halimocnemis villosa</i>	annual	Amaranthaceae	R–O	Foothills, outcrops of variegated beds
51. <i>Halimodendron halodendron</i>	Shrub	Fabaceae	R	Foothills, outcrops of variegated beds, anthropogenic habitats
52. <i>Haloxylon ammodendron</i> (<i>Haloxylon aphyllum</i>)	Small tree	Amaranthaceae	R–A	All habitats
53. <i>Haplophyllum bungei</i>	perennial	Rutaceae	R	Foothills, outcrops of variegated beds
54. <i>Haplophyllum robustum</i>	perennial	Rutaceae	R	All habitats, except for anthropogenic
55. <i>Heliotropium arguzioides</i>	Perennial	Boraginaceae	R	weakly inclined piedmont plain
56. <i>Holosteum umbellatum</i>	annual	Caryophyllaceae	R	Foothills, stony slopes
57. <i>Hypecoum pendulum</i>	annual	Papaveraceae	R	foothills, stony slopes
58. <i>Iris longiscapa</i>	Perennial	Iridaceae	R	Foothills, stony slopes, outcrops of variegated beds
59. <i>Iris songarica</i>	Perennial	Iridaceae	R–O	weakly inclined piedmont plain, foothills
60. <i>Isatis minima</i>	annual	Brassicaceae	R	stony slopes
61. <i>Koelpinia linearis</i>	annual	Asteraceae	R	All habitats
62. <i>Krascheninnikovia ceratoides</i>	semishrub	Amaranthaceae	R–O	stony slopes
63. <i>Lactuca orientalis</i>	semishrub	Asteraceae	R	All habitats, except for anthropogenic
64. <i>Leontice inserta</i>	perennial	Berberidaceae	R	Stony slopes, outcrops of variegated beds

65. <i>Leptaleum filifolium</i>	annual	Brassicaceae	R–O	foothills, stony slopes
66. <i>Lycium ruthenicum</i>	Shrub	Solanaceae	R–O	All habitats, except for anthropogenic
67. <i>Nanophyton erinaceum</i>	semishrub	Amaranthaceae	R–O	All habitats, except for anthropogenic
68. <i>Oreosalsola arbusculiformis</i> (<i>Salsola arbusculiformis</i>)	dwarf shrub	Amaranthaceae	D–O	All habitats, except for anthropogenic
69. <i>Peganum harmala</i> Indicator of overgrazing	Perennial	Nitrariaceae	R–A	All habitats
70. <i>Poa bulbosa</i>	Perennial	Poaceae	A–O	All habitats
71. <i>Rheum turkestanicum</i>	Perennial	Polygonaceae	R–O	Stony slopes
72. <i>Salsola paulsenii</i>	annual	Amaranthaceae	R	All habitats
73. <i>Scorzonera gageoides</i>	perennial	Asteraceae	R	foothills, stony slopes
74. <i>Scrophularia leucoclada</i>	semishrub		R–O	All habitats, except for anthropogenic
75. <i>Smirnowia turkestanica</i>	Perennial	Fabaceae	R–O	weakly inclined piedmont plain
76. <i>Stipa hohenackeriana</i>	Perennial	Poaceae	R	foothills, stony slopes
77. <i>Takhtajaniantha pusilla</i> (<i>Scorzonera pusilla</i>)	Perennial	Asteraceae	R	All habitats, except for anthropogenic
78. <i>Tamarix hispida</i>	shrub	Tamaricaceae	R–O	Anthropogenic habitats
79. <i>Tamarix laxa</i>	shrub	Tamaricaceae	R–O	All habitats
80. <i>Tulipa lehmanniana</i> Nationally red-listed (status 3 – reducing species)	Perennial	Liliaceae	R–O	All habitats, except for anthropogenic
81. <i>Tulipa sogdiana</i>	Perennial	Liliaceae	R	All habitats, except for anthropogenic
82. <i>Xylosalsola arbuscula</i> (<i>Salsola arbuscula</i> .)	Shrub	Amaranthaceae	O–R	weakly inclined piedmont plain
83. <i>Ziziphora tenuior</i>	annual	Lamiaceae	R	All habitats, except for anthropogenic
84. <i>Zygophyllum macrophyllum</i>	Perennial	Zygophyllaceae	R	All habitats, except for anthropogenic
85. <i>Zygophyllum miniatum</i>	Perennial	Zygophyllaceae	R	All habitats, except for anthropogenic

Annex 3. A check-list of plants recorded along the planned power line “Bash-Dzhankeldy” during the field survey in 2021

Plant species	Life form	Family	Abundance	Habitat
1. <i>Acanthophyllum cyrtostegium</i> Nationally red-listed (status 3 – reducing species), national endemic	Perennial	Caryophyllaceae	R	Weakly inclined piedmont plain and foothills of relic low mountains
2. <i>Acanthophyllum elatius</i>	Perennial	Caryophyllaceae	R–O	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands, weakly inclined piedmont plain
3. <i>Alhagi pseudalhagi</i>	Perennial	Fabaceae	R–O	Fixed and semi-fixed sands, saline depressions and takyr
4. <i>Alyssum desertorum</i>	annual	Brassicaceae	R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands, weakly inclined piedmont plain
5. <i>Ammodendron conollyi</i>	Small tree	Fabaceae	R–A	fixed and semi-fixed sands
6. <i>Anabasis eriopoda</i>	semishrub	Amaranthaceae	R	eroded foothills with outcrops of variegated beds, saline depressions and takyr
7. <i>Anabasis turkestanica</i>	semishrub	Amaranthaceae	R	eroded foothills with outcrops of variegated beds, saline depressions and takyr
8. <i>Arnebia decumbens</i>	annual	Boraginaceae	R	fixed and semi-fixed sands, weakly inclined piedmont plain, eroded foothills with outcrops of variegated beds
9. <i>Artemisia diffusa</i>	semishrub	Asteraceae	A–D	All habitats, except for saline depressions and takyr
10. <i>Artemisia turanica</i>	semishrub	Asteraceae	O–A	weakly inclined piedmont plain,

				eroded foothills with outcrops of variegated beds, saline depressions
11. <i>Astragalus flexus</i>	perennial	Fabaceae	R	fixed and semi-fixed sands
12. <i>Astragalus villosissimus</i>	dwarf shrub	Fabaceae	A–R	All habitats, except for saline depressions and takyr
13. <i>Bassia eriophora</i>	annual	Amaranthaceae	O	Fixed and semi-fixed sands, saline depressions and takyr
14. <i>Bassia prostrata</i> (<i>Kochia prostrata</i>)	semishrub	Amaranthaceae	R	eroded foothills with outcrops of variegated beds
15. <i>Bromus tectorum</i>	annual	Poaceae	R–O	All habitats, except for saline depressions and takyr
16. <i>Calligonum leucocladum</i>	shrub	Polygonaceae	A–R	Sandy desert plain, fixed and semi-fixed sands, weakly inclined piedmont plain
17. <i>Calligonum microcarpum</i>	shrub	Polygonaceae	A–R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands, weakly inclined piedmont plain
18. <i>Calligonum zakirovii</i> Nationally red-listed (status 1 – endangered species), national endemic	shrub	Polygonaceae	R	weakly inclined piedmont plain
19. <i>Carex physodes</i>	Perennial	Cyperaceae	D–A	Sandy desert plain, fixed and semi-fixed sands
20. <i>Carex subphysodes</i>	Perennial	Cyperaceae	D–O	Sandy and sandy-loamy desert plain, weakly inclined piedmont plain
21. <i>Caroxylon orientale</i> (<i>Salsola orientalis</i>)	dwarf shrub	Amaranthaceae	A–R	All habitats
22. <i>Caroxylon scleranthum</i> (<i>Salsola sclerantha</i>)	annual	Amaranthaceae	R	weakly inclined piedmont plain, eroded foothills with outcrops of variegated beds,

				saline depressions and takyrs
23. <i>Ceratocarpus arenarius</i>	annual	Amaranthaceae	R	All habitats
24. <i>Climacoptera sp.</i>	annual	Amaranthaceae	R	eroded foothills with outcrops of variegated beds, saline depressions and takyrs
25. <i>Convolvulus divaricatus</i>	semishrub	Convolvulaceae	O-R	fixed and semi-fixed sands
26. <i>Convolvulus hamadae</i>	semishrub	Convolvulaceae	A-R	All habitats
27. <i>Cousinia hamadae</i>	perennial	Asteraceae	R-O	All habitats
28. <i>Eremopyrum bonaepartis</i>	annual	Poaceae	R-O	fixed and semi-fixed sands, weakly inclined piedmont plain, eroded foothills with outcrops of variegated beds, saline depressions and takyrs
29. <i>Eremopyrum distans</i>	annual	Poaceae	R-O	fixed and semi-fixed sands, weakly inclined piedmont plain, eroded foothills with outcrops of variegated beds, saline depressions and takyrs
30. <i>Euphorbia turczaninowii</i>	annual	Euphorbiaceae	R	fixed and semi-fixed sands
31. <i>Ferula foetida</i>	Perennial, ephemeroi d	Apiaceae	A-R	All habitats
32. <i>Halimocnemis villosa</i>	annual	Amaranthaceae	R-O	eroded foothills with outcrops of variegated beds, saline depressions and takyrs
33. <i>Halimodendron halodendron</i>	Shrub	Fabaceae	R	saline depressions and takyrs
34. <i>Haloxylon ammodendron (Haloxylon aphyllum)</i>	Small tree	Amaranthaceae	R-A	All habitats
35. <i>Haloxylon persicum</i>	Small tree	Amaranthaceae	A-D	fixed and semi-fixed sands
36. <i>Haplophyllum bungei</i>	perennial	Rutaceae	R	eroded foothills with outcrops of variegated beds

37. <i>Haplophyllum ramosissimum</i>	Perennial	Rutaceae	R	fixed and semi-fixed sands
38. <i>Haplophyllum robustum</i>	perennial	Rutaceae	R	eroded foothills with outcrops of variegated beds
39. <i>Heliotropium arguzioides</i>	Perennial	Boraginaceae	R–O	fixed and semi-fixed sands
40. <i>Iris songarica</i>	Perennial	Iridaceae	A–R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
41. <i>Lycium ruthenicum</i>	Shrub	Solanaceae	R–O	saline depressions and takyr
42. <i>Mausolea eriocarpa</i>	semishrub	Asteraceae	O–A	fixed and semi-fixed sands
43. <i>Oreosalsola arbusculiformis</i> (<i>Salsola arbusculiformis</i>)	dwarf shrub	Amaranthaceae	A–R	fixed and semi-fixed sands, weakly inclined piedmont plain, eroded foothills with outcrops of variegated beds, saline depressions and takyr
44. <i>Peganum harmala</i> Indicator of overgrazing	Perennial	Nitrariaceae	R–O	All habitats
45. <i>Poa bulbosa</i>	Perennial	Poaceae	A–O	All habitats, except for saline depressions and takyr
46. <i>Salsola paulsenii</i>	annual	Amaranthaceae	R	fixed and semi-fixed sands, weakly inclined piedmont plain, eroded foothills with outcrops of variegated beds, saline depressions and takyr
47. <i>Sophora pachycarpa</i>	Perennial	Fabaceae	R–O	fixed and semi-fixed sands
48. <i>Smirnowia turkestanica</i>	Perennial	Fabaceae	R–O	fixed and semi-fixed sands, weakly inclined piedmont plain
49. <i>Stipagrostis pennata</i>	Perennial	Poaceae	R–O	fixed and semi-fixed sands
50. <i>Tamarix</i> sp.	Shrub	Tamaricaceae	R	saline depressions and takyr
51. <i>Tulipa lehmanniana</i> Nationally red-listed	Perennial	Liliaceae	R	fixed and semi-fixed sands, saline

(status 3 – reducing species)				depressions and takyr
52. <i>Xylosalsola arbuscula</i> (<i>Salsola arbuscula</i> .)	Shrub	Amaranthaceae	A–R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
53. <i>Ziziphora tenuior</i>	annual	Lamiaceae	R	weakly inclined piedmont plain, eroded foothills with outcrops of variegated beds, saline depressions and takyr

Annex 4. A check-list of plants recorded along the planned power line “Bash-Karakul” during the field survey in 2021

Plant species	Life form	Family	Abundance	Habitat
1. <i>Acanthophyllum elatius</i>	Perennial	Caryophyllaceae	R–O	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
2. <i>Agriophyllum lateriflorum</i>	annual	Amaranthaceae	R–O	Fixed and semi-fixed sands
3. <i>Alhagi pseudalhagi</i>	Perennial	Fabaceae	R–O	All habitats
4. <i>Alyssum desertorum</i>	annual	Brassicaceae	R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
5. <i>Ammodendron conollyi</i>	Small tree	Fabaceae	R–A	fixed and semi-fixed sands
6. <i>Arnebia decumbens</i>	annual	Boraginaceae	R	fixed and semi-fixed sands
7. <i>Artemisia diffusa</i>	semishrub	Asteraceae	A–D	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
8. <i>Artemisia turanica</i>	semishrub	Asteraceae	O–A	Sandy and sandy-loamy desert plain
9. <i>Astragalus flexus</i>	perennial	Fabaceae	R	fixed and semi-fixed sands
10. <i>Astragalus unifoliolatus</i>	dwarf shrub	Fabaceae	O–R	fixed and semi-fixed sands
11. <i>Astragalus villosissimus</i>	dwarf shrub	Fabaceae	A–R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
12. <i>Atriplex dimorphostegia</i>	annual	Amaranthaceae	R	fixed and semi-fixed sands
13. <i>Bassia eriophora</i>	annual	Amaranthaceae	O	Fixed and semi-fixed sands, saline lands
14. <i>Bromus tectorum</i>	annual	Poaceae	R–O	All habitats
15. <i>Calligonum leucocladum</i>	shrub	Polygonaceae	A–R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
16. <i>Calligonum microcarpum</i>	shrub	Polygonaceae	A–R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
17. <i>Calligonum zakirovii</i> Nationally red-listed (status 1 – endangered species), national endemic	shrub	Polygonaceae	R	fixed and semi-fixed sands

18. <i>Carex physodes</i>	Perennial	Cyperaceae	D–A	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
19. <i>Carex subphysodes</i>	Perennial	Cyperaceae	D–O	Sandy and sandy-loamy desert plain
20. <i>Caroxylon orientale</i> (<i>Salsola orientalis</i>)	dwarf shrub	Amaranthaceae	A–R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
21. <i>Caroxylon scleranthum</i> (<i>Salsola sclerantha</i>)	annual	Amaranthaceae	R	fixed and semi-fixed sands, saline lands
22. <i>Ceratocarpus arenarius</i>	annual	Amaranthaceae	R	All habitats
23. <i>Climacoptera</i> sp.	annual	Amaranthaceae	R	fixed and semi-fixed sands, saline lands
24. <i>Convolvulus divaricatus</i>	semishrub	Convolvulaceae	O–R	fixed and semi-fixed sands
25. <i>Convolvulus hamadae</i>	semishrub	Convolvulaceae	A–R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
26. <i>Cousinia hamadae</i>	perennial	Asteraceae	R–O	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
27. <i>Cousinia resinosa</i>	perennial	Asteraceae	R–O	All habitats
28. <i>Cousinia sogdiana</i>	biennial	Asteraceae	R	fixed and semi-fixed sands
29. <i>Cynodon dactylon</i> Alien weed	Perennial	Poaceae	R–O	agricultural lands
30. <i>Descurainia sophia</i>	annual	Brassicaceae	O	agricultural lands
31. <i>Elaeagnus angustifolia</i>	tree	Elaeagnaceae	R–O	Saline and agricultural lands
32. <i>Eremopyrum bonaepartis</i>	annual	Poaceae	R–O	All habitats
33. <i>Eremopyrum distans</i>	annual	Poaceae	R–O	All habitats
34. <i>Erianthus ravennae</i>	perennial	Poaceae	R–O	Saline and agricultural lands
35. <i>Euphorbia cheirolepis</i>	annual	Euphorbiaceae	R	fixed and semi-fixed sands
36. <i>Euphorbia granulata</i>	annual	Euphorbiaceae	R–O	Saline and agricultural lands
37. <i>Euphorbia turczaninowii</i>	annual	Euphorbiaceae	R	fixed and semi-fixed sands
38. <i>Ferula foetida</i>	Perennial, ephemeroi d	Apiaceae	A–R	All habitats, except for agricultural

39. <i>Glycyrrhiza glabra</i>	Perennial	Fabaceae	R–O	Saline and agricultural lands
40. <i>Halimocnemis villosa</i>	annual	Amaranthaceae	R–O	eroded foothills with outcrops of variegated beds, saline depressions and takyr
41. <i>Halimodendron halodendron</i>	Shrub	Fabaceae	R	Saline and agricultural lands
42. <i>Halocnemum strobilaceum</i>	semishrub	Amaranthaceae	R–A	Saline and agricultural lands
43. <i>Halostachys belangeriana</i>	Shrub	Amaranthaceae	R–O	Saline and agricultural lands
44. <i>Halothamnus subaphyllus</i>	semishrub	Amaranthaceae	R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
45. <i>Haloxylon ammodendron</i> (<i>Haloxylon aphyllum</i>)	Small tree	Amaranthaceae	R–A	All habitats
46. <i>Haloxylon persicum</i>	Small tree	Amaranthaceae	A–D	fixed and semi-fixed sands
47. <i>Haplophyllum ramosissimum</i>	Perennial	Rutaceae	R	fixed and semi-fixed sands
48. <i>Heliotropium arguzioides</i>	Perennial	Boraginaceae	R–O	fixed and semi-fixed sands
49. <i>Heliotropium ellipticum</i>	annual			
50. <i>Iris songarica</i>	Perennial	Iridaceae	A–R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
51. <i>Karelinia caspia</i>	Perennial	Asteraceae	R–A	Saline and agricultural lands
52. <i>Limonium otolepis</i>	Perennial	Plumbaginaceae	R–A	Saline and agricultural lands
53. <i>Limonium suffruticosum</i>	semishrub	Plumbaginaceae	R–O	Saline lands
54. <i>Lycium ruthenicum</i>	Shrub	Solanaceae	R–O	Saline and agricultural lands
55. <i>Mausolea eriocarpa</i>	semishrub	Asteraceae	O–A	fixed and semi-fixed sands
56. <i>Oreosalsola arbusculiformis</i> (<i>Salsola arbusculiformis</i>)	dwarf shrub	Amaranthaceae	A–R	fixed and semi-fixed sands, weakly inclined piedmont plain, eroded foothills with outcrops of variegated beds, saline depressions and takyr

57. <i>Peganum harmala</i> Indicator of overgrazing	Perennial	Nitrariaceae	R–O	All habitats
58. <i>Phragmites australis</i>	Perennial	Poaceae	O–D	Saline and agricultural lands
59. <i>Poa bulbosa</i>	Perennial	Poaceae	A–O	All habitats, except for saline depressions and takys
60. <i>Populus pruinosa</i>	tree	Salicaceae	R–O	agricultural lands
61. <i>Salicornia europaea</i>	annual	Amaranthaceae	O	Saline and agricultural lands
62. <i>Salsola paulsenii</i>	annual	Amaranthaceae	R	fixed and semi-fixed sands, weakly inclined piedmont plain, eroded foothills with outcrops of variegated beds, saline depressions and takys
63. <i>Sophora pachycarpa</i>	Perennial	Fabaceae	R–O	fixed and semi-fixed sands
64. <i>Smirnowia turkestanica</i>	Perennial	Fabaceae	R–O	fixed and semi-fixed sands, weakly inclined piedmont plain
65. <i>Stipagrostis pennata</i>	Perennial	Poaceae	R–O	fixed and semi-fixed sands
66. <i>Suaeda altissima</i>	annual	Amaranthaceae	R–O	Saline and agricultural lands
67. <i>Suaeda sp.</i>	Annual	Amaranthaceae	R–O	Saline and agricultural lands
68. <i>Tamarix hispida</i>	Shrub	Tamaricaceae	A–R	Saline and agricultural lands
69. <i>Tamarix laxa</i>	Shrub	Tamaricaceae	A–R	Saline and agricultural lands
70. <i>Tamarix ramosissima</i>	Shrub	Tamaricaceae	A–R	Saline and agricultural lands
71. <i>Tribulus terrestris</i> Alien weed	annual	Zygophyllaceae	R–O	agricultural lands
72. <i>Typha latifolia</i>	Perennial	Typhaceae	R–O	Saline and agricultural lands
73. <i>Typha minima</i>	Perennial	Typhaceae	R–O	Saline and agricultural lands
74. <i>Xylosalsola arbuscula</i> (<i>Salsola arbuscula</i>)	Shrub	Amaranthaceae	A–R	Sandy and sandy-loamy desert plain, fixed and semi-fixed sands
75. <i>Xylosalsola richteri</i> (<i>Salsola richteri</i>)	Shrub	Amaranthaceae	R–O	fixed and semi-fixed sands

76. <i>Zygophyllum oxianum</i>	Perennial	Zygophyllaceae	R-O	Saline and agricultural lands
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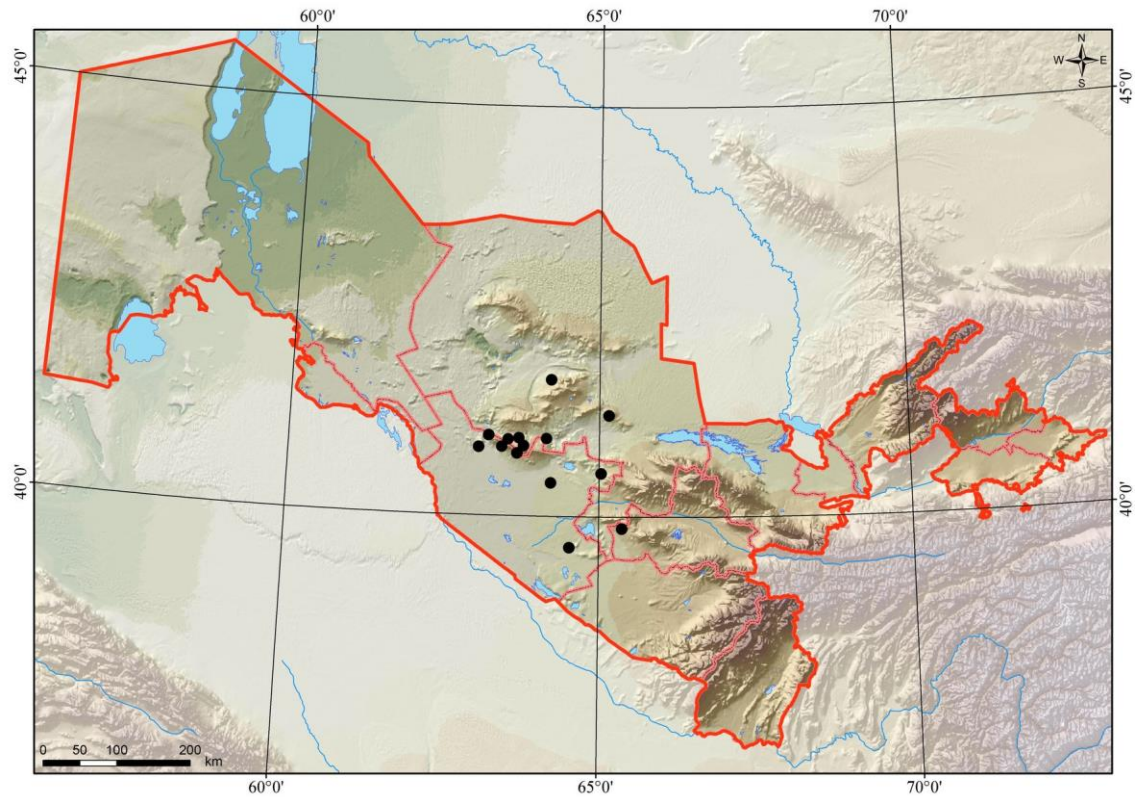
Annex 5. Trigger plant species for critical habitat assessment (recorded during the field survey)

Species	IUCN RL status	National status	Population	Distribution	Data sources	Threats	Criteria	Assessment
Acanthophyllum cyrtostegium Vved.	Not Evaluated (NE)	UzbrDB 2009 – 2 (rare) UzbrDB 2019 – 3 (vulnerable, declining)	Estimated population – about 500–600 individuals	National endemic, endemic to south-western Kyzylkum and Zirabulak-Ziadin Mountains, estimated AOO – about 50 hectares. Within the “Dzhankeldy” project site occurs sporadically, solitary or in small groups	Field survey - 2021 Red Data Book of the Republic of Uzbekistan (2009) Vol. 1. Plants and Fungi. Chinor ENK, Tashkent. 360 p. Red Data Book of the Republic of Uzbekistan (2019) Vol. 1. Plants. Tasvir, Tashkent. 356 p. Tojibaev K.Sh., Beshko N.Yu., Shomurodov Kh.F. & al. (2019) Inventory of the flora of Uzbekistan: Navoi Province. Fan Publishers, Tashkent. 216 p. Tojibaev K.Sh., Beshko N.Yu., Shomurodov Kh.F. & al. (2020) Inventory of the flora of Uzbekistan: Bukhara Province. O'kituvchi Publishers, Tashkent. 128 p.	Overgrazing, mining, road and infrastructure construction	Critical habitat Criterion 2. Habitat of significant importance to endemic and/or restricted-range species. KBA Criterion B1	Due to the restricted geographic range and population of the species, project area likely to support $\geq 10\%$ of the global habitat and population. Triggering Critical Habitat Criterion 2

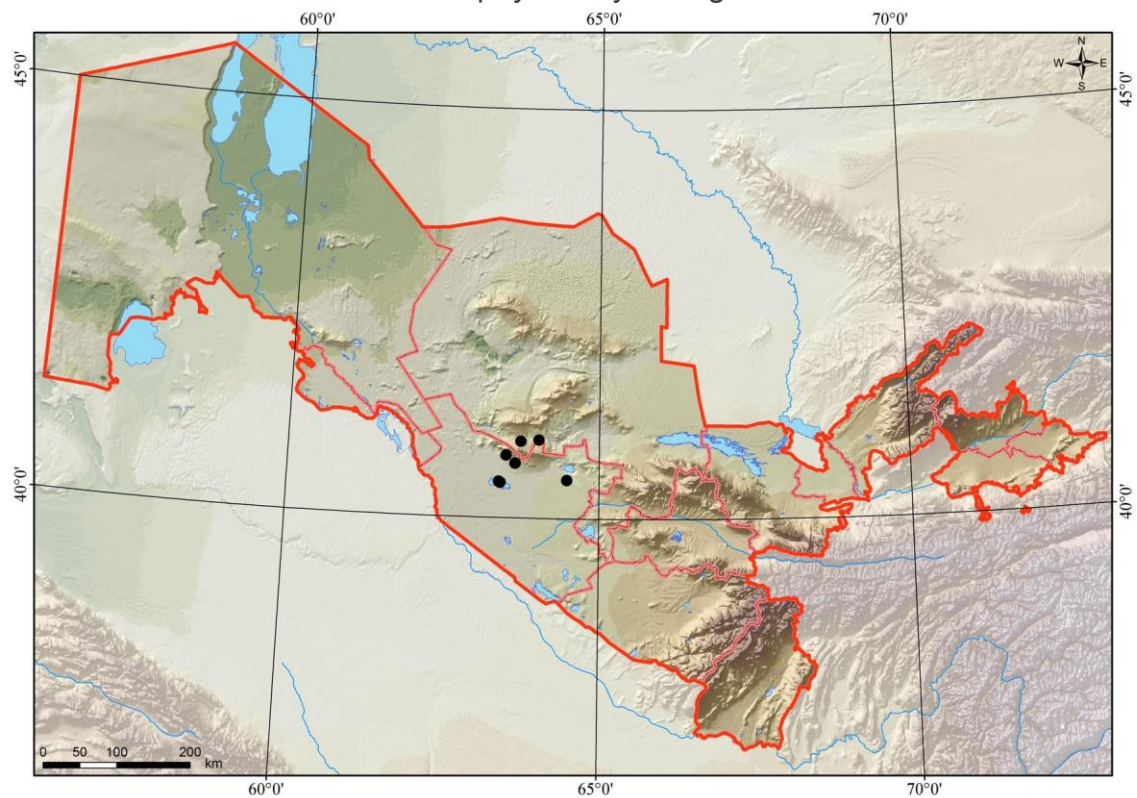
Calligonum zakirovii (Khalk.) Czerep.	Not Evaluated (NE)	UzbrDB 2019 – 1 (endangered)	Estimated population – about 500 individuals	National endemic, endemic to relic mountains of Kyzylkum, estimated AOO – about 50 hectares. Within the “Dzhankeldy” project site occurs sporadically, solitary or in small groups	Field survey - 2021 Red Data Book of the Republic of Uzbekistan (2009) Vol. 1. Plants and Fungi. Chinor ENK, Tashkent. 360 p. Red Data Book of the Republic of Uzbekistan (2019) Vol. 1. Plants. Tasvir, Tashkent. 356 p. Tojibaev K.Sh., Beshko N.Yu., Shomurodov Kh.F. & al. (2019) Inventory of the flora of Uzbekistan: Navoi Province. Fan Publishers, Tashkent. 216 p. Tojibaev K.Sh., Beshko N.Yu., Shomurodov Kh.F. & al. (2020) Inventory of the flora of Uzbekistan: Bukhara Province. O'kituvchi Publishers, Tashkent. 128 p.	Overgrazing, mining, road and infrastructure construction	Critical habitat Criterion 1. (i) Habitat of significant importance to species listed as CR or EN on the IUCN Red List, and nationally/regionally listed species assessed using similar criteria. Criterion 2. Habitat of significant importance to endemic and/or restricted-range species. KBA Criterion B1	Due to the national status, restricted geographic range and population of the species, project area likely to support ≥ 10% of the global habitat and population. Triggering Critical Habitat Criterion 1 and 2
Ferula kyzylkumica Korovin	Not Evaluated (NE)	UzbrDB 2009 – 2 (rare) UzbrDB 2019 – 3 (vulnerable, declining)	Estimated population – about 4000–4500 individuals in Navoi Province and 400–500 in Bukhara Province	National endemic, endemic to relic mountains of Kyzylkum with disjunction in Nuratau Mountains, estimated AOO in Bukhara Province – about 10	Field survey - 2021 Red Data Book of the Republic of Uzbekistan (2009) Vol. 1. Plants and Fungi. Chinor ENK, Tashkent. 360 p. Red Data Book of the Republic of Uzbekistan (2019) Vol. 1. Plants. Tasvir, Tashkent. 356 p. Tojibaev K.Sh., Beshko N.Yu., Shomurodov Kh.F. & al. (2019) Inventory of the flora of	Overgrazing, mining	Critical habitat Criterion 2. Habitat of significant importance to endemic and/or restricted-range species. KBA Criterion B1	Due to the restricted geographic range and population of the species, project area likely to support ≥ 10% of the global habitat and population. Triggering Critical Habitat Criterion 2

				hectares. Within the “Dzhankeldy” project site occurs sporadically, solitary or in groups	Uzbekistan: Navoi Province. Fan Publishers, Tashkent. 216 p. Tojibaev K.Sh., Beshko N.Yu., Shomurodov Kh.F. & al. (2020) Inventory of the flora of Uzbekistan: Bukhara Province. O'kituvchi Publishers, Tashkent. 128 p.			

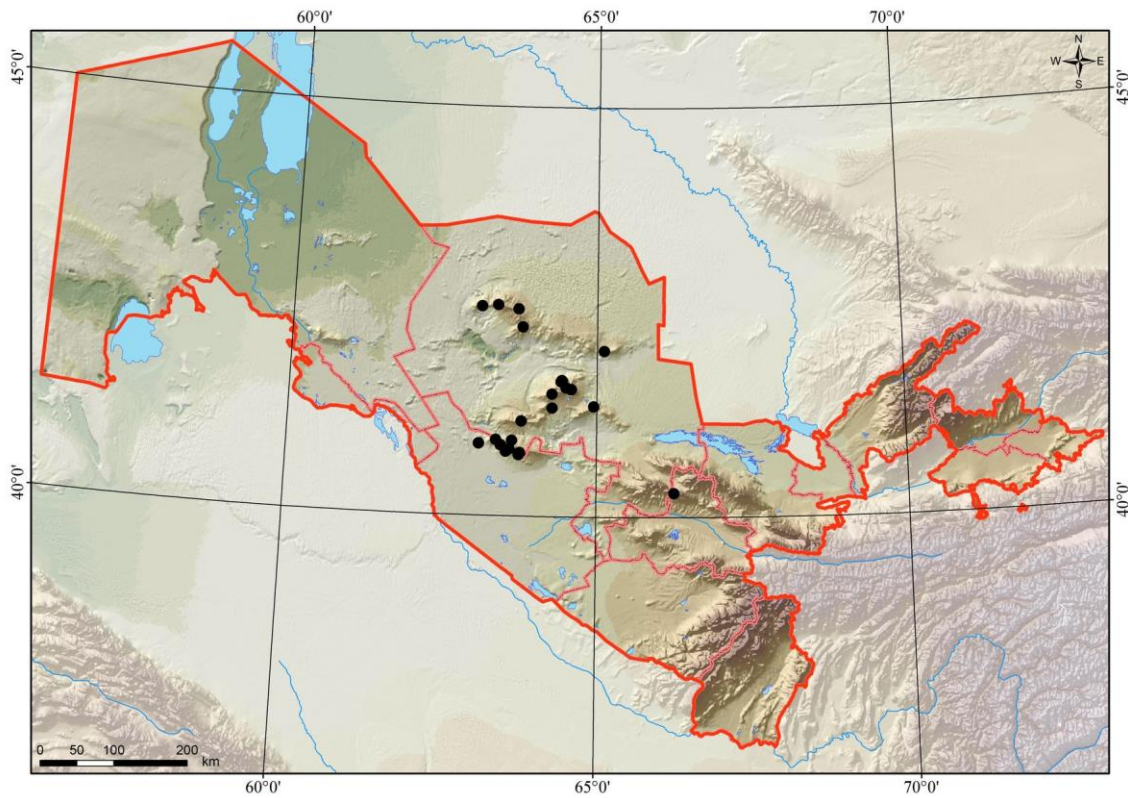
Annex 6. Distribution maps of trigger plant species (based on the field survey, herbarium and published data)



Acanthophyllum cyrtostegium



Calligonum zakirovii



Ferula kzylykumica

Interim report of the bird VP monitoring

Report Title	Interim report (May-June) of the bird VP monitoring along planned Dzhankeldy-Bash OHTL
Scope	BIRDS VP
Areas Covered	DZHANKELDY TO BASH OHTL
Seasons Covered	SPRING 2021 / SUMMER 2021
Notes	

**Interim report
(May-June)
of the bird VP monitoring
along planned
Dzhankeldy-Bash OHTL**

DZHANKELDY WIND FARM PROJECT:

CLIENT: 5 CAPITALS

DATE: JULY 2021

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INTRODUCTION

The project facilities are located in the central part of the Kyzylkum desert between the north-eastern shore of Lake Ayakagitma and Dzhankeldy settlement (Figure 1) and represent two substations connected by an overhead transmission line (OHTL).

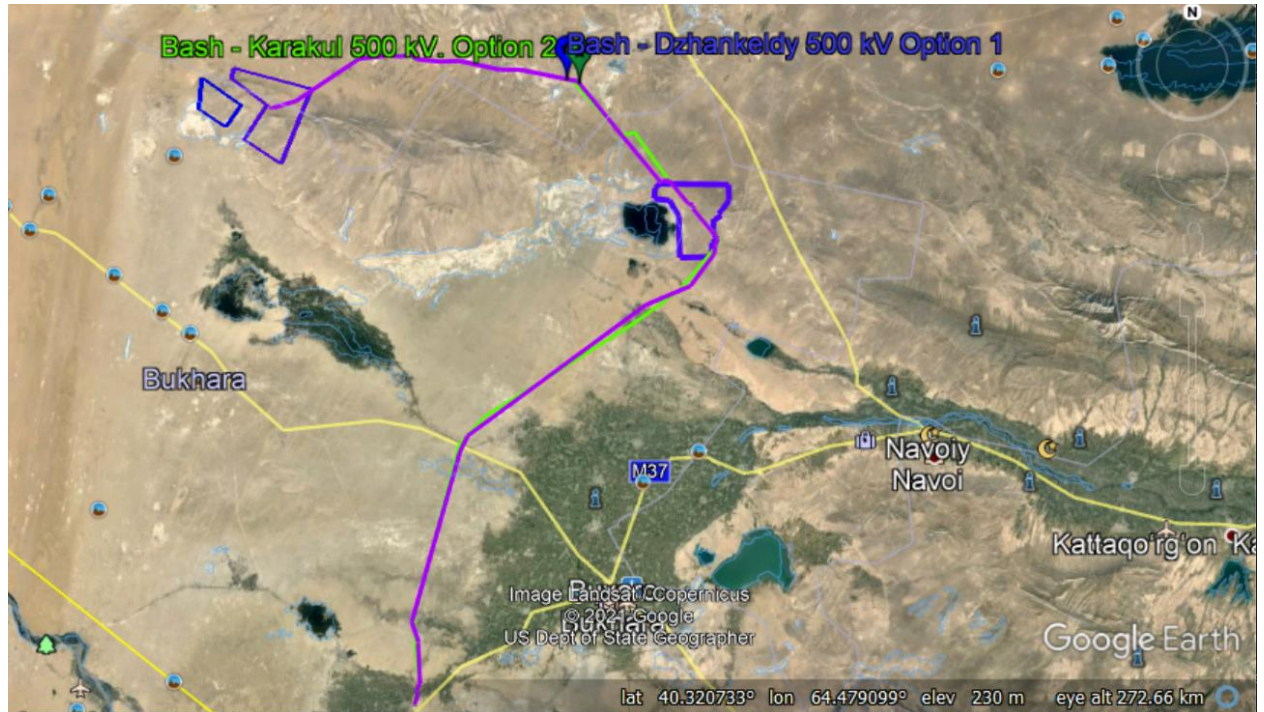


Figure 1. Location of project facilities

Review of background information and potential impacts

This review provides general information on bird mortality from OHTL as per the existing literature data, as well as lists the species that may be encountered in the project area, and considers potential threats and mitigation measures.

The proposed OHTL route mainly runs in fixed sands along the northern slopes of the Kuldjuktai massif, the length of which is about 128 km, width is about 15 km, and maximum height is 785 m. The southern slopes are gentle cut by dry canyons; the northern slopes are steep, with rock outcrops. The Kuldjuktai mountains are composed mainly of schists and limestone, with Jurassic, Cretaceous and Paleogene sedimentary strata on the outskirts, with overblown sands on the surface here and there.

The “Gijduvan” substation is located on the eastern shore of Lake Ayakagitma, so wetland bird species are also included in this overview.

In addition, there is the Karakata Depression in the immediate vicinity (35 km north of Lake Ayakagitma), which fills with water in the springtime and attracts wetland birds. Birds possibly move between the above-mentioned water bodies.

The Lake Ayakagitma is located at the bottom of the like-named depression in the Gijduvan district of Bukhara region. The bottom is a desert landscape with extensive alkaline soil. The sides are flat and steep. The water body was formed in the early 1970s by discharge waters. Most of the shoreline is bare, not covered with reeds. Only in the western part of the lake there are small reeds and jingle shore thickets at the place of discharge canal inflow. Maximum depth in the middle of the lake is 25-30 m. The water surface area is about 10 ha (Google Earth 2021, surveying in 2018).

Lake Ayakagitma and the adjacent desert are included into the network of the most important ornithological territories of Uzbekistan (IBA Uz051). The IBA area is 32854 ha.

Alkaline lands are mainly located near the shallows of the lake's southern part. The alkaline land is one of the poorest habitats for animals and birds. Herbaceous plants are represented by some species of saltwort. There are thickets of tamarisk around the lake, which grows in the saline soil. Generally, animals do not live in alkaline lands, but they visit them from time to time, especially in spring, when salt lands fill with water and turn into shallow salt lakes. Each spring, such wetlands attract many migrating birds, mostly waders, gulls, and common terns. The tamarisk undergrowth serves as a perfect refuge for some animals. When alkaline lands dry up, even halophytes die.

Table 1 presents general information about birds using the project area based on the available publications and departmental data from the Institute of Zoology of the Academy of Sciences of the Republic of Uzbekistan and State Biological Control of the State Committee on Ecology and Environmental Protection) for the period from 2000 to 2011.

Table 1. List of birds using the project area according to the literature data

№	Species	Number	Nature of stay	Conservation status	Habitats			
					Desert	Water-bodies	Mountains, cliffs	Developed zone
1.	Little Grebe <i>Tachibaptus ruficollis</i>	low	B, M			+		
2.	Black-naked Grebe <i>Podiceps nigricollis</i>	low	M			+		
3.	Red-necked Grebe <i>Podiceps grisegena</i>	rare	M			+		
4.	Slavonian Grebe <i>Podiceps auritus</i>	rare	M			+		
5.	Great Crested Grebe <i>Podiceps cristatus</i>	common	M			+		
6.	Great white Pelican <i>Pelecanus onocrotalus</i>	low	M, W	UzRDB-VU		+		
7.	Dalmatian Pelican <i>Pelecanus crispus</i>	low	M, W	UzRDB-EN, IUCN - VU		+		
8.	Great cormorant <i>Phalacrocorax carbo</i>	common	M, W			+		
9.	Pygmy cormorant <i>Phalacrocorax pygmaeus</i>	common	M, W	UzRDB-NT		+		
10.	Night heron <i>Nycticorax nycticorax</i>	low	M			+		
11.	Great Egret <i>Egretta alba</i>	common	M, W			+		
12.	Little Egret <i>Egretta garzetta</i>	low	M, W	UzRDB-VU		+		
13.	Grey Heron <i>Ardea cinerea</i>	common	M, W			+		
14.	Purple Heron <i>Ardea purpurea</i>	rare	M			+		
15.	Spoonbill <i>Platalea leucorodia</i>	rare	M	UzRDB-VU		+		
16.	Glossy Ibis <i>Plegadis falcinellus</i>	rare	M	UzRDB-VU		+		
17.	Greylag Goose <i>Anser anser</i>	low	M, W			+		
18.	Greater Flamingo <i>Phoenicopterus roseus</i>	rare	M	UzRDB-VU		+		
19.	Mute swan <i>Cygnus olor</i>	low	M, W	UzRDB-NT		+		

20.	Whooper swan <i>Cygnus cygnus</i>	rare	M, W	UzRDB-VU		+		
21.	Ruddy shelduck <i>Tadorna ferruginea</i>	low	M, W			+		
22.	Common Shelduck <i>Tadorna tadorna</i>	low	M, B, W			+		
23.	Mallard <i>Anas platyrhynchos</i>	common	B, W			+		
24.	Gadwall <i>Anas strepera</i>	low	B, W			+		
25.	Eurasian Wigeon <i>Anas penelope</i>	low	M, W			+		
26.	Common Teal <i>Anas crecca</i>	common	M, W			+		
27.	Garganey <i>Anas querquedula</i>	low	M			+		
28.	Northern Shoveler <i>Anas clypeata</i>	low	M, B, W			+		
29.	Marbled Teal <i>Anas angustirostris</i>	rare	M	UzRDB-EN IUCN-VU		+		
30.	Red-crested Pochard <i>Netta rufina</i>	common	M, W			+		
31.	Common Pochard <i>Aythya ferina</i>	common	M, W	IUCN-VU		+		
32.	Ferruginous Duck <i>Aythya nyroca</i>	low	M, W	UzRDB-VU IUCN - VU				
33.	Smew <i>Mergus albellus</i>	low	M, W			+		
34.	Osprey <i>Pandion haliaetus</i>	low	M	UzRDB-VU		+	+	+
35.	Black Kite <i>Milvus migrans</i>	low	M		+	+	+	+
36.	Hen Harrier <i>Circus cyaneus</i>	low	M, W		+		+	+
37.	Pallid Harrier <i>Circus macrourus</i>	rare	M	UzRDB-NT IUCN-NT	+		+	+
38.	Montagu's Harrier <i>Circus pygargus</i>	low	M		+		+	+
39.	Marsh Harrier <i>Circus aeruginosus</i>	common	R		+	+		+
40.	Long-legged Buzzard <i>Buteo rufinus</i>	common	M, B, W		+		+	+
41.	Common Buzzard <i>Buteo buteo</i>	rare	M		+		+	+
42.	Short-toed Eagle <i>Circaetus gallicus</i>	rare	M	UzRDB -VU	+		+	+
43.	Steppe Eagle <i>Aquila nipalensis</i>	rare	M, W	UzRDB-VU, IUCN - EN	+		+	+
44.	Golden Eagle <i>Aquila chrysaetos</i>	rare	R	UzRDB-VU,	+		+	+
45.	Greater spotted Eagle <i>Aquila clanga</i>	rare	M	UzRDB-VU, IUCN-VU	+		+	+
46.	Imperial Eagle <i>Aquila heliaca</i>	rare	M	UzRDB-VU, IUCN-VU	+		+	+
47.	Bonelly's Eagle <i>Hieraaetus pennatus</i>	rare	M	UzRDB-CR			+	
48.	White-tailed Sea Eagle <i>Haliaeetus albicilla</i>	low	M, W	UzRDB-VU		+		
49.	Cinireous Vulture <i>Aegypius monachus</i>	rare	B, M, W	UzRDB-NT, IUCN-NT			+	
50.	Eurasian Griffon <i>Gyps fulvus</i>	low	B, M, W	UzRDB-VU			+	

51.	Egyptian Vulture <i>Neophron percnopterus</i>	rare	M	IUCN-EN, UzRDB-VU	+		+	+
52.	Bearded Vulture <i>Gypaetus barbatus</i>	rare	R	UzRDB-VU			+	
53.	Saker Falcon <i>Falco cherrug</i>	rare	M, B, W	UzRDB-EN, IUCN - EN	+		+	
54.	Peregrine Falcon <i>Falco Peregrinus</i>	rare	M	UzRDB-VU	+		+	
55.	Red-capped Falcon <i>Falco pelegrinoides</i>	rare	M, B	UzRDB-VU	+		+	
56.	Eurasian Hobby <i>Falco subbuteo</i>	rare	M		+		+	
57.	Lesser Kestrel <i>Falco naumanni</i>	rare	M	UzRDB-NT	+		+	
58.	Common Kestrel <i>Falco tinnunculus</i>	low	M, B,W		+		+	
59.	Merlin <i>Falco colubarius</i>	rare	M, W		+		+	+
60.	Eurasian Sparrowhawk <i>Accipiter nisus</i>	rare	M		+		+	+
61.	Common Quail <i>Coturnix coturnix</i>	common	M		+		+	+
62.	Chukar <i>Alectoris chukar</i>	common	R		+		+	
63.	Common crane <i>Grus grus</i>	common	M		+	+	+	+
64.	Demoiselle Crane <i>Anthropoides virgo</i>	common	M		+	+	+	+
65.	Common Moorhen <i>Gallinula chloropus</i>	rare	R			+		
66.	Common Coot <i>Fulica atra</i>	common	M, B, W			+		
67.	Great Bustard <i>Otis tarda</i>	rare	M	UzRDB-CR IUCN - VU	+			
68.	Little Bustard <i>Tetrax tetrax</i>	rare	M	UzRDB-VU, IUCN - NT	+			
69.	Houbara Bustard <i>Chlamydotis undulata</i>	rare	M, B	UzRDB-VU, IUCN - VU	+			
70.	Grey Plover <i>Pluvialis squatarola</i>	common	M			+		
71.	Common Ringed Plover <i>Charadrius hiaticula</i>	low	M			+		
72.	Great Sand Plover <i>Charadrius leschenaultii</i>	common	B, M			+		
73.	Little Ringed Plover <i>Charadrius dubius</i>	common	M			+		
74.	Kentish Plover <i>Charadrius alexandrinus</i>	low	M, B			+		
75.	White-tailed Lapwing <i>Vanellus leucurus</i>	common	M, B			+		+
76.	Sociable Lapwing <i>Vanellus gregaria</i>	rare	M	IUCN- CR, UzRDB-VU		+		+
77.	Black-winged Stilt <i>Himantopus himantopus</i>	common	M, B			+		
78.	Pied Avocet <i>Recurvirostra avosetta</i>	common	M, B			+		
79.	Common Oystercatcher <i>Haematopus ostralegus</i>	common	M			+		
80.	Green Sandpiper <i>Tringa ochropus</i>	low	M			+		
81.	Common Sandpiper <i>Actitis Hypoleucos</i>	common	M			+		

82.	Wood Sandpiper <i>Tringa glareola</i>	rare	M			+		
83.	Common Greenshunk <i>Tringa nebularia</i>	rare	M			+		
84.	Common Redshunk <i>Tringa totanus</i>	low	M			+		
85.	Marsh Sandpiper <i>Tringa stagnatilis</i>	rare	M			+		
86.	Spotted Redshunk <i>Tringa erythropus</i>	low	M			+		
87.	Red-necked Phalarope <i>Phalaropus lobatus</i>	low	M			+		
88.	Ruff <i>Phylomachus pugnax</i>	low	M			+		
89.	Temminck's Stint <i>Calidris temminckii</i>	low	M			+		
90.	Culew Sandpiper <i>Calidris ferruginea</i>	low	M			+		
91.	Little Stint <i>Calidris minuta</i>	low	M			+		
92.	Dunlin <i>Calidris alpina</i>	low	M, W			+		
93.	Common Snipe <i>Gallinago gallinago</i>	low	M			+		
94.	Black-tailed Godwit <i>Limosa limosa</i>	rare	M	IUCN-NT, UzRDB-VU		+		
95.	Bar-tailed Godwit <i>Limosa lapponica</i>	rare	M			+		
96.	Eurasian Curlew <i>Numenius arquata</i>	rare	M	IUCN - NT, UzRDB- VU		+		
97.	Whimbrel <i>Numenius phaeopus</i>	rare	M			+		
98.	Slender-billed Culew <i>Numenius tenuirostris</i>	rare	M	IUCN -CR, UzRDB-CR		+		
99.	Collared Pratincole <i>Glareola pratincola</i>	common	M			+		+
100.	Black-winged Pratincole <i>Glareola nordmanni</i>	rare	M	UzRDB-VU, IUCN-NT		+		
101.	Yellow-legged Gull <i>Larus cachinnans</i>	common	M, B, W			+		
102.	Black-headed Gull <i>Larus ridibundus</i>	common	M, B, W			+		
103.	Slender-billed Gull <i>Larus genei</i>	low	M, B, W			+		
104.	Gull-billed Tern <i>Gelochelidon nilotica</i>	low	M, B			+		
105.	Caspian Tern <i>Hydroprogne caspia</i>	common	M, B			+		
106.	Common Tern <i>Sterna hirundo</i>	common	M, B			+		
107.	Little Tern <i>Sterna albifrons</i>	common	M, B			+		
108.	Black-bellied Sandgrouse <i>Pterocles orientalis</i>	common	R		+	+		
109.	Rock Dove <i>Columba livia</i>	common	R		+	+	+	+
110.	Collared Dove <i>Streptopelia decaocto</i>	common	R		+			+
111.	Turtle Dove <i>Streptopelia turtur</i>	low	B	IUCN -VU, UzRDB-VU	+			+

112.	Oriental Turtle Dove <i>Streptopelia orientalis</i>	low	M		+			+
113.	Laughing Dove <i>Streptopelia senegalensis</i>	low	R		+			+
114.	Common Cuckoo <i>Cuculus canorus</i>	low	M, B			+		
115.	Eagle Owl <i>Bubo bubo</i>	rare	R		+		+	
116.	Little Owl <i>Athene noctua</i>	common	R		+		+	
117.	European Nightjar <i>Caprimulgus europaeus</i>	low	M		+			
118.	Egyptian Nightjar <i>Caprimulgus aegyptius</i>	low	M		+			
119.	Common Swift <i>Apus apus</i>	common	M		+		+	+
120.	European Roller <i>Coracias garrulus</i>	common	M, B	IUCN - NT	+	+	+	+
121.	European Bee-eater <i>Merops apiaster</i>	common	M		+	+	+	+
122.	Blue-cheeked Bee-eater <i>Merops persicus</i>	common	M, B		+	+	+	+
123.	Eurasia Hoopoe <i>Upupa epops</i>	common	R		+	+	+	+
124.	Sand Martin <i>Riparia riparia</i>	common	M		+	+		+
125.	Barn Swallow <i>Hirundo rustica</i>	common	M, B		+	+		+
126.	Red-rumped Swallow <i>Hirundo daurica</i>	low	M		+	+		+
127.	Crested Lark <i>Galerida cristata</i>	common	R		+			
128.	Lesser Short-toed Lark <i>Calandrella rufescens</i>	common	M, B		+			+
129.	Red-capped Lark <i>Calandrella cinerea</i>	low	M, B		+		+	
130.	Calandra Lark <i>Melanocorypha calandra</i>	common	M		+			
131.	Tawny pipit <i>Anthus campestris</i>	common	M		+	+	+	+
132.	Tree pipit <i>Anthus trivialis</i>	common	M		+	+	+	+
133.	Yellow wagtail <i>Motacilla flava</i>	common	M		+	+	+	+
134.	Citrine Wagtail <i>Motacilla citreola</i>	common	M		+	+	+	+
135.	White Wagtail <i>Motacilla alba</i>	common	M, W		+	+		+
136.	Pied Wagtail <i>Motacilla personata</i>	common	M, B		+	+		+
137.	Isabelline shrike <i>Lanius isabellinus</i>	low	M		+			+
138.	Long-tailed Shrike <i>Lanius schach</i>	rlow	M		+			+
139.	Great grey shrike <i>Lanius excubitor</i>	low	M		+			+
140.	Asian Grey Shrike <i>Lanius pallidirostris</i>	common	B, M		+			+
141.	Red-backed Srike <i>Lanius collurio</i>	common	M		+			+
142.	Turkestan Shrike	common	M		+			+

	<i>Lanius phoenicuroides</i>							
143.	Common Starling <i>Sturnus vulgaris</i>	common	M, W		+	+		+
144.	Rose Starling <i>Pastor roseus</i>	common	M					+
145.	Indian Myna <i>Acridotheres tristis</i>	common	R		+			+
146.	Magpie <i>Pica pica</i>	common	R		+			+
147.	Eurasian Jackdaw <i>Corvus monedula</i>	common	M		+	+		
148.	Rook <i>Corvus frugilegus</i>	common	M, W		+	+		
149.	Carrion Crow <i>Corvus corone</i>	low	R		+	+		
150.	Hooded Crow <i>Corvus cornix</i>	low	M, W		+			
151.	Brown-nacked Raven <i>Corvus ruficollis</i>	low	R		+		+	
152.	Eastern Rock Nuthatch <i>Sitta terphonota</i>	low	R				+	
153.	Pddyfied Warbler <i>Acrocephalus agricola</i>	common	M, B		+	+		+
154.	Clamorous Reed Warbler <i>Acrocephalus stentoreus</i>	common	M, B		+	+		+
155.	Greear Reed Warbler <i>Acrocephalus arundinaceus</i>	common	M		+	+		+
156.	Booted Warbler <i>Hippolais caligata</i>	common	M		+	+		+
157.	Syke's Warbler <i>Hippolais rama</i>	low	M, B		+			+
158.	Common Whitethroat <i>Sylvia communis</i>	low	M		+			+
159.	Lesser Whitethroat <i>Sylvia curruca</i>	low	M		+			+
160.	Desert Warbler <i>Sylvia nana</i>	rare	B		+			
161.	Ciffchaff <i>Phylloscopus collybita</i>	common	M		+			
162.	Scrub Warbler <i>Scotocerca inquieta</i>	low	R		+			
163.	Spotted Flycather <i>Muscicapa striata</i>	low	M		+			
164.	Common Stonechat <i>Saxicola torquata</i>	low	M		+			+
165.	Pied bushchat <i>Saxicola caprata</i>	low	M, B		+			+
166.	Bluethroat <i>Luscinia svecica</i>	common	M		+			+
167.	Black Redstat <i>Phoenicurus ochruros</i>	common	M		+			+
168.	Nothern Wheater <i>Oenanthe oenanthe</i>	rare	M		+		+	
169.	Pied Wheater <i>Oenanthe pleschanka</i>	common	M, B		+		+	
170.	Variable wheater <i>Oenanthe picata</i>	low	M, B				+	
171.	Finschs Wheater <i>Oenanthe finschii</i>	low	M, B				+	

172.	Black-eared Wheater <i>Oenanthe hispanica</i>	low	M, B				+	
173.	Deser Wheater <i>Oenanthe deserti</i>	low	M,B		+			
174.	Isabelline Wheater <i>Oenanthe isabellina</i>	low	M, B		+			
175.	Rufous Scrub Robin <i>Cercotrichas galactotes</i>	low	M,B		+			
176.	Common Nightingale <i>Luscinia megarhynchos</i>	low	M		+		+	+
177.	Thrush Nightingale <i>Luscinia luscinia</i>	low	M		+			
178.	Bearded Reedling <i>Panurus biarmicus</i>	common	R			+		
179.	Turkestan Tit <i>Parus bokharensis</i>	low	R		+			+
180.	House sparrow <i>Passer domesticus</i>	low	M					+
181.	Indian sparrow <i>Passer indicus</i>	common	M, B		+			+
182.	Eurasian tree sparrow <i>Passer montanus</i>	common	R		+			+
183.	Desert Finch <i>Rhodospiza obsoleta</i>	common	R		+			
184.	Reed bunting <i>Emberiza schoeniclus</i>	common	M, B		+	+		+
185.	Желчная овсянка <i>Emberiza bruniceps</i>	rare	M, B		+	+		+
186.	Corn Bunting <i>Emberiza calandra</i>	common	M					+

Note

Nature of stay: M - migration, B - breeding, W - wintering, R - resident

Conservation status:

UzRDB - Red Book of the Republic of Uzbekistan, IUCN - IUCN Red List.

Analysis of existing data showed that ornithological fauna of the project area is represented by 186 bird species, 23 of which are resident birds (Table 1). About 50 species are nesting. Many birds inhabit the territory during seasonal migrations or post-nesting nomadic migrations. According to the literature data 22 globally endangered species are found here. 37 species are registered in the National Red Book.

The typical inhabitants of the desert are larks, bramblings, pterocles, and small birds of prey.

Uzbekistan is located on the historical Central Asian migration route of birds from Western Siberia and Kazakhstan to Indo-Pakistan, Iran-Caspian and African flyways (Figure 2). The main flyways covering the territory of Uzbekistan are presented in the following scheme. Familiarity with this scheme shows that there are 3 flyways passing through the territory of Uzbekistan: Black Sea-Mediterranean, East African-West Asian and Central Asian.

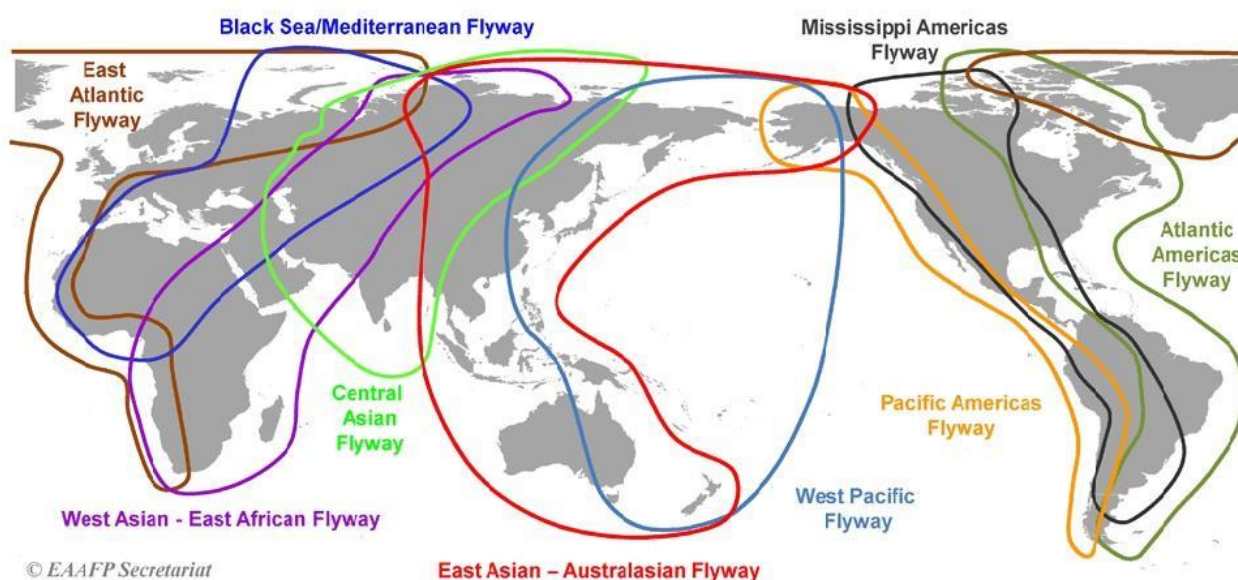


Figure 2. Main flyways (East Asian–Australasian Flyway Partnership Secretariat)

Of the 434 bird species inhabiting Uzbekistan, only 10-15% of the species is settled in different areas. The remaining birds are migratory.

Several major ecological groups can be distinguished among migratory birds according to their nature of stay:

- Species arriving to Uzbekistan for nesting from India, Pakistan, Afghanistan, Iran, North and West Africa.
- Species arriving to Uzbekistan for wintering from Western Siberia, Kazakhstan, Kyrgyzstan, Aral Sea region (outside Uzbekistan), Northern Caspian Sea region.
- Transit migrating birds crossing the territory of Uzbekistan during seasonal migrations and stopping here only for resting and feeding in order to replenish energy resources required to continue their flyway.

The main wintering grounds of birds are located mainly to the south of the average winter isotherm 0°C. In Uzbekistan, it passes approximately along the Zarafshan River. Consequently, all species arriving in Uzbekistan for wintering spend it in the southern regions of the republic, i.e. practically they cross the country in the southern direction.

In Uzbekistan the spring migration period starts from the end of February (in the south) to early March. So-called early migrants fly first and include geese, ducks, crow family species and others. The main flyway of many species through Uzbekistan takes place in March and April. There are also so-called late migrants, represented mainly by insectivore species. These are the birds such as swallows, orioles, Eurasian rollers, typical bee-eaters, nightjars, streptopelias and sparrows. In general, spring migration ends by the end of May. During the summer months, waders continue to migrate and, after reaching the tundra begin their return migration almost immediately.

Autumn migration starts in the second half of August and lasts almost until December. The main wintering grounds of various bird species in Uzbekistan are formed from October to December.

Thus, most of the year (nearly 9 months) in Uzbekistan there is a change in the species composition of birds and their territorial distribution.

Special studies of migration in the Central Asian region under the program "Asia" in the 1980s showed that the night migration of all groups of birds over the mountains and deserts of Central Asia and Kazakhstan passes everywhere from the eastern shore of the Caspian Sea to the eastern border of the Tian Shan. Moreover, up to 90% of all migrating birds fly over Central Asia at night and at considerable altitudes, while the rest fly during

daylight time. According to Dolnik V.R. and Bolshakov K.V. (1985), the spring night flight over deserts passes everywhere in a wide formation without forming densities along ecological waterways.

There are two general directions of night migration over Central Asia. One (northwest) is formed by birds that wintered in South Asia. The other (northeastern) is formed by both migrating birds that wintered from Africa to Iran and by birds that wintered in South Asia, but which go around the mountains and high mountain deserts of Central Asia. The overlapping of these three streams of different origin in the band from the western edge of the Himalayas to the central part of the Kopetdag leads to a sharply increased density of night flight in the area between the southwestern Tian Shan and the Kopetdag, persisting northward as far as the latitude of the Aral Sea. Thus, globally, migratory birds do not fly around the arid and mountainous areas of Central Asia in spring, which increases the likelihood of collisions between birds and OHTL.

In recent years, the world community has paid increasing attention to the conservation of cranes, one of the oldest systematic groups of birds. In Uzbekistan, mainly two species of cranes migrate: Demoiselle Crane *Anthropoides virgo* and Common Crane *Grus grus* (Lanovenko, Kreitzberg, 2002, Gavrilov, Van Der Ven. 2004). They are found during migration in many areas of the republic.

It has been determined that migrating birds cross the territory of the republic in spring mainly from southwest to northeast, and in autumn in the opposite direction. On their way they encounter various threats, including collisions with power lines. If OHTL is located perpendicular to the direction of bird movements, it poses a greater danger to birds than OHTL located parallel. The future OHTL Dzhanakeldy-Bash is located along the Kuldjuktai mountain massif, i.e. perpendicular to the prevailing direction of migrating birds, which means that it poses a certain danger.

Collisions with OHTL

The use of electricity is one of the achievements of technological progress of mankind. Various capacity OHTL (up to 500 kV) are used to transmit it from source to consumer, which pose a certain danger to migratory birds.

On the one hand, OHTL towers serve as roost sites for some species of birds, especially birds of prey, and especially in open landscapes, which attracts them to OHTL. On the other hand, when birds land on towers or fly between the wires, they are at risk of being electrocuted as a result of the resulting short circuit or simply from physical injury from striking wires. An increased risk of electrocution exists if birds have wet or damp feathers. Smaller birds landing on towers or wires are generally not at risk. However, bad weather conditions such as fog, rain or snow, as well as darkness, can make power lines invisible and therefore dangerous for any type of bird to collide with OHTL wires. As a result of the collision, birds can be physically injured, electrocuted, or burned in the resulting electrical arc. Falling burning birds can cause fires, both in natural habitats and in man-made landscapes. An international estimate is that 5 to 15% of all power lines can cause birds to collide with wires (IMBD Information, April 2005).

In Uzbekistan, there are known facts that during spring and autumn migrations medium and large size birds die on power lines, among them prevail mostly rare and endangered species - Steppe eagle, Golden eagle, Eastern imperial eagle, Osprey, Short-toed eagle, Saker falcon, White stork, Dalmatian pelican, Eurasian eagle-owl and others (Abdunazarov, 1987; Shernazarov, Lanovenko, 1994; Lanovenko, 2007, Lanovenko, 2017).

Surveys were conducted in Tashkent, Djizak, Surkhandarya, Kashkadarya, Bukhara, Namangan and Ferghana regions of the republic to establish the scale of bird mortality on OHTL (without specifying OHTL capacity). The length of surveyed lines was more than

2000 km in open landscapes (Abdunazarov, 1987). The estimated number of birds mortality on OHTL is up to 50 birds of prey in the Ferghana Valley, Samarkand and Surkhandarya regions (mainly Buzzards and Common kestrels); from 50 to 100 birds in the Tashkent, Syrdarya and Kashkadarya regions (mainly Buzzards and Common kestrels); from 300 to 500 birds in the Jizzak region (Eagles, Buzzards, Ospreys, Kestrels); from 200 to 500 birds in the Navoi and Bukhara regions (Eagles, Buzzards, large Falcons, Kestrels). Moreover, among them, many species have a high conservation status, as they are listed in the national Red Book, the international list of globally threatened species, as well as in the annexes of international conventions on migratory species (Bonn) and CITES. Birds of prey tend to die by using OHTL towers as roost sites. To expand the geography and specify the species composition of birds of prey that die from electrocution, we will provide some materials of the same author (Abdunazarov, 1990) on birds of prey dying on 6-10 kV OHTL: during 1981-1984 in the Farish steppe (Jizzak region) on a 30 km section 3 Ospreys *Pandion haliaetus*, 16 Steppe Eagles *Aquila nipalensis*, 1 Eastern imperial eagle *Aquila heliaca*, 1 Golden Eagle *Aquila chrysaetos* and 3 Short-toed eagles *Circaetus gallicus* were found dead. On 26/04/89, 64 birds of prey of 12 species were recorded dead in the same area. Among them were 1 Osprey, 2 White-tailed Eagle *Haliaeetus albicilla*, 2 Short-toed eagles, 11 Steppe Eagles, 1 Golden Eagle, 1 Eastern imperial eagle and 2 Saker Falcons *Falco cherrug*. In both cases, all the mentioned species are listed in the Red Book of Uzbekistan (2019).

Birds of prey are generally more often die from electrocution when using OHTL towers as roost sites. In the central part of the Kyzylkum desert in September 2007, a Golden eagle, Steppe eagle, Griffon vulture and Houbara bustard were found dead from electrocution under the OHTL connected to the Navoi Mining and Metallurgical Plant (Kashkarov, 2007; IBA project newsletter in Uzbekistan, 2007). These species are also listed in the Red Book of Uzbekistan.

However, different species of birds often die as a result of direct collision with wires as well. Such species include small passerines (Larks, Warblers), Waders, Rails (Corn crane), Pterocles (black-bellied sandgrouse), quail and others. According to Nazarov A.P. and Zagrebin S.V. (1987), quail regularly collide with OHTL during spring and autumn migrations.

Constant monitoring to analyse the impact of OHTLs on birds was not conducted in Uzbekistan. In the Central part of the Kyzylkum desert in the period from 1997 to 2007, M.G. Mitropolsky (2009) collected remains of birds of prey that died on OHTL in order to collect shoulder bones. In total, he collected 71 specimens of 14 species of birds of prey in this area: *Accipiter gentilis* (1 specimen), *Buteo buteo* (1), *Buteo rufinus* (22), *Circus cyaneus* (2), *Circus aeruginosus* (1), *Aquila chrysaetos* (19), *A. heliaca* (2), *A. nipalensis* (7), *A. clanga* (5), *Aegypius monachus* (2), *Gyps fulvus* (2), *Neophron percnopterus* (1), *Circaetus gallicus* (3), *Falco tinnunculus* (2).

OHTLs located near water bodies, which are places of waterfowl concentration, pose a particular danger. According to the Institute of Zoology of the Academy of Sciences of Uzbekistan, Dalmatian Pelicans *Pelicanus crispus* regularly die on the 220 kV OHTL that runs from Kyzyltepa substation along the western shore of Tudakul Lake (Navoi region). During the 2002-2005 winter surveys, up to three dead birds were regularly found here. During the visit to the lake in January 2004, 7 dead burnt birds were found under wires at once (Lanovenko, 2007).

Birds have also been known to cause short-circuits in the electric power industry, causing outage of high voltage lines, resulting in economic losses due to power outages at enterprises, but not leading to bird deaths (Shernazarov & Lanovenko, 1994).

Some birds are killed by mechanical collisions with wires during flight, more often during poor visibility at night or unfavorable weather conditions. It is especially difficult to avoid collision with wires for large birds that do not have good maneuverability or fly with

high speed. In Uzbekistan, there are known cases of cranes, black-bellied grouse, kestrel, quail, corncrake and many other species dying from collision with wires.

Some birds are killed by mechanical collisions with wires during flight, more often during poor visibility at night or unfavorable weather conditions. It is especially difficult to avoid collision with wires for large birds that do not have good manoeuvrability or fly with high speed. In Uzbekistan, there are known cases of Demoiselle cranes, Black-bellied sandgrouse, Kestrel, Quail, Corn crake and many other species dying from collision with wires.

One of the features of modern bird ecology is their adaptation to nesting on OHTL towers. In Central Kyzylkum, we have repeatedly found Kestrel *Falco tinnunculus* nests on the OHTL. Researches of O. Mitropolsky, E. Fotteler and G. Tretiakov (1987) established nesting of Golden eagle and Saker falcon on OHTL in Kyzylkum, which allowed these species to expand their breeding ground deep into the desert. According to Zinoviev S. estimate (1990), up to 40% of nests of the Golden Eagle and 33% of nests of the Saker Falcon were located in the Kyzylkum Desert on OHTLs.

Specific data on peculiarities of daily bird migration along the route of the future overhead line are missing. There is no direct evidence that there is any narrow migration route for migrating birds in the Project area. However, analysis of information on existing global bird migration routes and evidence of the existence of wide-frontage migration in the whole territory of Uzbekistan suggests it is passing along the Project route as well. Thus, it is possible to talk about bird migration in the area of the OHTL route and in the adjacent areas in a broader sense (at region level).

Calculation of bird mortality on OHTLs in the Kyzylkum desert.

There are no real statistics on bird deaths on OHTLs in Uzbekistan. There are data on bird mortality on the 220 kV OHTL running through the central part of the Kyzylkum desert from Yangigazgan to Uchkuduk and further to the north-east.

Like the project area, the Kyzylkum desert is an arid zone characterized by an open landscape and small desert lowlands. Bird migration through Kyzylkum is most active in spring. To determine the approximate level of bird mortality, available information on this OHTL was used. The surveyed 220 kV OHTL runs a short distance along a road, the total length of which is about 320 km. In the third decade of October, which is usually the time of late migrants' flyway in Uzbekistan, eight sections of 220 kV OHTLs with a total length of 140 km were surveyed in 2007 (Table 2).

Table 2. Data on birds collected dead under OHTLs in the central part of the Kyzylkum Desert based on the result of the October 2007 survey (Navoi region, Uzbekistan)

Survey date	Section name	OHTL length	Types and number of died birds	OHTL capacity, kV	Comments
18.10.2007	Karakata - Ayakkuduk	20 km	Calandrella rufescens – 4 Galerida cristata – 1 Philloscopus collibita – 1 Sylvia communis 1	220 кВ	(150-130 km)
18.10.2007	Route to Chimbay	15 km	Gyps fulvus – 1 Aquila chrysaetos – 1 A.nipalensis – 1 Falco tonnunculus – 1 Galerida cristata – 1 Buteo rufinus - 1	220 kV	(85-70 km)
19.10.2007	Route to Kyzylkuduk settlement	10 km	Coturnix coturnix – 1 Calandrella rufescens – 2	220 kV	From west to east (460-470 km)
19.10.2007		5 km	Aquila chrysaetos – 2 Calandrella rufescens – 1	220 kV	Under OHTL from north to south
19.10.2007		5 km	Calandrella rufescens – 2	220 kV	Along OHTL parallel to the railway
19.10.2007	Zeravshan - Uchkuduk	10 km	Calandrella rufescens – 1	220 kV	In Kuntay farm area (229-239 km)
19.10.2007	Zeravshan - Uchkuduk	10 km	Calandrella rufescens – 1 Emberiza shoeniclus - 1	220 kV	10 km NW Kuntay (241-251 km)
21.10.2007	Route to Akbaytal	30 км km	Alauda arvensis – 1 Calandrella rufescens – 3	220 kV	In Saginbay coll. area (75-105 km)
22.10.2007	Route to Kulkuduk settlement	10 km	No dead birds	220 kV	(15-25 km)
23.10.2007	Uchkuduk - Navoi	5 km under each, 15 total	No dead birds	220 kV	3 parallel OHTL (telegraph and 2 OHTL). Distance between them is 100-150 m (169-164 km)
24.10.2007	Kenimekh-Yangigazan	10 km	Chlamydotis undulate – 1 Calandrella chelensis – 1 Calandrella rufescens – 1 Philloscopus collibita – 1	220 kV	(40-45 km) from both sides of the road

Bird mortality rate calculated by us on this OHTL was 12.2 birds per 100 km. The dead birds were represented by 9 species. The dominant species is the Mediterranean short-toed lark *Calandrella rufescens*. The mortality rate of this species was 7.77 individuals per 100 km. This figure can be useful in comparative assessment of mortality along the OHTL in the Project area.

Identification of bird concentrations along the Project OHTL route and development of measures to reduce potential bird mortality during the Project implementation will reduce the current level of bird mortality.

MATERIALS AND METHODS

Field studies on the route were carried out to identify details of the landscape characteristic picture, as well as possible places of migratory birds' concentration. Introductory surveys were conducted in May and June 2021.

We were moving along the route between "Vantage Points" directly along the route line or near it depending on the availability of access roads. The distance from the route in some places was generally not more than 1-2 km. However, given the landscape homogeneity of the surveyed section, we deem it acceptable to draw analogies between the surveyed area adjacent to the route and the route itself.

Visual observations of birds were made during the route survey. Bird sighting points were also marked using GPS. Bird species membership was determined visually using field binoculars with 8x magnification and Nikon and Fujifilm XT-20 digital cameras as well as audio recordings of bird voices (Xeno-canto Asia) and field bird identifiers (Mullarney, Svensson, Zetterstrom, Grant, 1999; Aye, Schweizer, Roth 2012).

Field surveys were conducted from 3 to 4 May and 19-20 June according to the methodology agreed by the client.

Surveys were conducted at 11 selected points, in 1 km radius sections. Duration of observations was not less than 40 minutes at each vantage point.

The territorial location of vantage points is shown in Figure 3 and 4.



Figure 3. Vantage points when surveying the route of the planned OHTL in May 2021

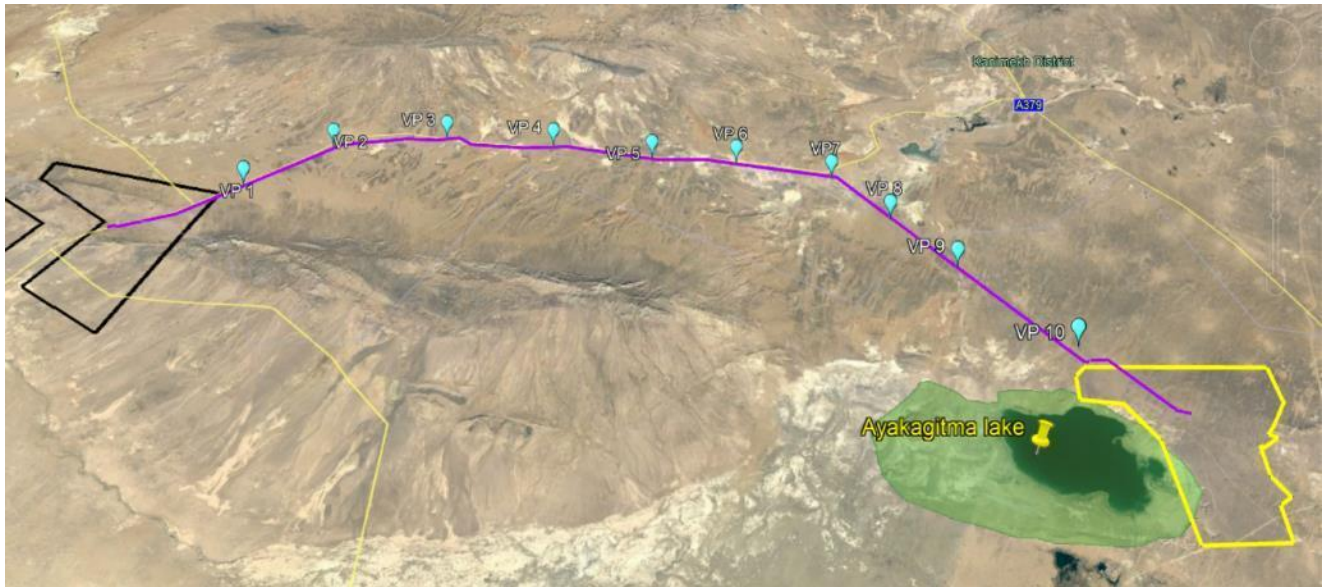


Figure 4. Vantage points when surveying the route of the planned OHTL in June 2021

Due to the route change in June, the number of vantage points was reduced to 10.

SURVEY RESULTS

According to the literature data, the prevailing directions of night and daytime bird migrations in Uzbekistan are northeastern in spring and southwestern in autumn (Dolnik, 1985). In accordance with the above-mentioned features of bird migrations in the region and the geographical direction of the route, it can be assumed that the greatest potential danger for migratory birds pose the section passing through the foothills of the northern slopes of Kuldjuktai mountains, where local streams of low-flying birds can occur. The line section from Dzhanakendy SS to Ayakagitma Lake goes in the eastern direction, i.e., practically perpendicular to the prevailing migration direction.

The Kyzylkum desert is a place of active migration and wintering of some species of large birds of prey, including buzzards, harriers, eagles and large falcons characterized by trophic type of migration. These birds do not migrate far, but constantly move in the right direction, simultaneously making foraging movements. This biological peculiarity of these birds determines the necessity of regular use of roost sites, so in steppe landscape and absence of tree vegetation, OHTL towers are very attractive for birds of prey, which creates a potentially dangerous situation.

Familiarization with the route of Project OHTL showed that the area of the line is represented by open habitats. Due to the fact that the survey of the route took place at the very end of the spring migration, the data presented below are preliminary. However, they indicate the possible impact of OHTL on nesting birds and the need for monitoring surveys during the migration period to identify places of migrating birds' concentration. During the survey along the Project route, we found nests of Common Kestrel on the existing and running parallel to OHTL-220. Nesting of the common myne *Acridotheres tristis* and house sparrow *Passer domesticus* were observed in non-residential nests of this species. None of these species has a high conservation status.

In the course of familiarization with the line route, no potential high-risk areas were identified. Details of the results of the ornithological survey of the route are given in APPENDIX 1 and 2.

Table 3. The summary list of the observed bird species

	NAME OF SPECIES		IUCN /RDB STATUS	TOTAL No. OBSERVED (MAY)	TOTAL No. OBSERVED (JUNE)
	LATIN	ENGLISH			
1	<i>Neophron percnopterus</i>	Egyptian Vulture	IUCN-EN, UzRDB-VU	2	2
2	<i>Circaetus gallicus</i>	Short-toed Eagle	UzRDB -VU	1	-
3	<i>Chlamidotis undulata</i>	Houbara bustard	UzRDB-VU, IUCN - VU	3	1
4	<i>Coracias garrulus</i>	Eurasian Roller	IUCN - NT	-	2

Survey results show that distribution of species across the surveyed sections is quite uniform. 23 bird species were observed in both May and June. Representative species for the entire line route were Crested Lark, Isabelline Wheatear, Black-necked Wheatear, Streaked Scrub Warbler, Desert Finch, and Barn Swallow.

The number of observed birds was much higher in June, which could be explained by the end of the nesting period in small passerines, appearance of juveniles and less hidden way of life. Desert finches and typical bee-eaters had already started migrating after breeding.

From rare species Egyptian vulture, Short-toed eagle, Houbara bustard and Eurasian roller were observed during the survey.

Among the mentioned species, Houbara Bustard is the most vulnerable, as there are nesting sites for this species in the immediate vicinity of the proposed OHTL. Details on Houbara Bustard nesting, potential impacts and mitigation measures are presented in HB survey report.

Short-toed eagle is a trophic migrating species and is not directly associated with the area.

Eurasian roller and Egyptian vulture usually nest on cliffs, no nesting sites of these species were identified in the project area. Egyptian vultures observed in May and June can be both nesting individuals in the Kuldjuktai massif and flying (migrating) individuals.

The locations where the endangered bird species were observed are presented in Figure 5.



Figure 5. Locations of Egyptian Vulture (NP), Houbara Bustard (ChU), Short-toed Eagle (CG) and Eurasian Roller (CG) in May and June 2021.

Other species are common inhabitants of the Kyzylkum desert and widely distributed throughout the adjacent territory. No critical habitats (of special importance for nesting or feeding of rare and other bird species) were identified.

Collection of dead birds under operating OHTL

At the same time with visual observations of birds in selected locations along the project route, route surveys were conducted along existing and already operating OHTL located near the route. The aim was to collect dead birds and their remains under OHTL wires and towers to assess bird mortality on operating OHTL.

Sections of existing OHTL located in the immediate vicinity of the project line route were surveyed to find remains of dead birds under them (Table 4, Figure 5). The total length of the routes under OHTLs was 99 km.

Table 4. Schedule for surveying sections of existing OHTLs in the project area.

Date	Route length (km)	Section and length of the route	Coordinates of route beginning	Coordinates of route end	Dead birds found*
28.03.2021	26	D1-D3	40°47'10.22"N 63°27'7.51"E	40°50'41.02"N 63°19'54.91"E	2
18.04.2021	26	D1-D3	40°47'10.22"N 63°27'7.51"E	40°53'39.54"N 63°10'39.49"E	none
04.05.2021	7	D1-D2	40°47'10.22"N 63°27'7.51"E	40°53'39.54"N 63°10'39.49"E	none
14.05.2021	14	D1-D2	40°47'10.22"N 63°27'7.51"E	40°53'39.54"N 63°10'39.49"E	1
21.05.2021	14	D1-D2	40°47'10.22"N 63°27'7.51"E	40°53'39.54"N 63°10'39.49"E	1
20.06.2021	12	D1-D2	40°47'10.22"N 63°27'7.51"E	40°53'39.54"N 63°10'39.49"E	none

*- see Table 5

During the survey in spring 2021 the remains of 5 dead birds belonging to 4 species were found.

Table 5. List of dead birds found under operating OHTLs

№	Latin name	English name	Number of birds	Coordinates	Date
1.	<i>Upupa epops</i>	Hoopoe	1	N 40°53'36.11", E 63°10'57.38"	28.03.2021
2.	<i>Galerida cristata</i>	Crested lark	1	N 40°52'48.69", E 63°13'29.85"	21.05.2021
3.	<i>Galerida cristata</i>	Crested lark	1	N 40°52'12.47", E 63°16'4.17"	28.03.2021
4.	<i>Sylvia curruca</i>	Lesser Whitethroat	1	N 40°52'24.79", E 63°15'13.56"	14.05.2021
5.	<i>Sturnus vulgaris</i>	Common Starling	1	N 40°51'49.03", E 63°17'53.28"	28.03.2021

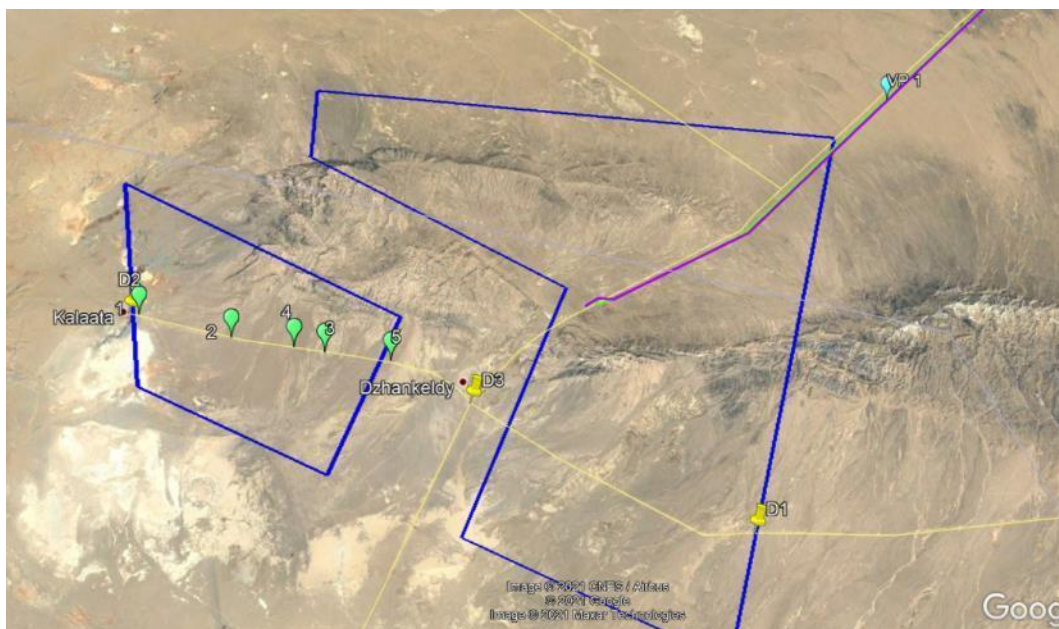


Figure 6. Locations of dead birds.

The species found dead are widespread in the Kyzylkum desert and do not have any conservation status. The presumed cause of death was collision with OHTL wire. Preliminary bird mortality rate was 3.65 birds per 100 km.

ANALYSIS OF IMPACTS AND MITIGATION MEASURES

Power lines are a threat to migrating, nesting and wintering birds during their migration from feeding to resting places. During migration, this threat is greatly increased due to the accumulation of different bird species.

For some species (Falconiformes), the death from collision with OHTL or electrocution is higher than for others.

The impact of these threats can be mitigated through the development of appropriate measures.

Figure 7. Analysis of impacts on ornithological fauna and mitigation measures for construction and operation of the Project OHTL

	Impacts:	Mitigation measures:
1	Loss of habitat as a result of construction works.	Strict compliance with the boundaries of land allotted for construction. Minimization of noise impact. Using only existing/constructed roads, control over vehicle traffic. Performing construction works during the non-breeding period. Carrying out land reclamation upon completion of works.
2	Pollution of the territory by construction and household waste. Spreading of Myna over the territory. Reduction of species and quantitative composition of desert species.	Organization and control over the timely collection and disposal of construction and household waste.
3	Disturbance of animals caused by the presence of people, moving vehicles, machinery work.	Strict compliance with the boundaries of land allotted for construction. Minimization of noise impact. Using only existing/constructed roads, control over vehicle traffic and people movements. Performing construction works

		during the non-breeding period. Limiting visits to bird habitats by construction and operating staff; Informing personnel about the need to preserve biodiversity.
4	Electrocution when birds use OHTL towers for nests and as roost sites (resting places).	Installation of protection boxes that exclude electrocution of birds sitting on OHTL towers. Control the integrity of the insulation and installed boxes.
5	Injury and death due to physical collision of birds with OHTL wires.	Equipping OHTLs with markers to ensure their visibility to birds. Control the integrity of the installed markers.

RECOMMENDED MEASURES FOR CONSERVATION OF ORNITHOLOGICAL FAUNA

- Obligatory ecological expertise of all project decisions;
- Establishment of a protection zone of at least 1 km around Lake Ayakagitma during the design and construction of all facilities in order to reduce disturbance of waterfowl inhabiting the water-body and preservation of their nesting and feeding places.
- Installation of protection boxes on OHTL towers to prevent accidental electrocution of birds on power lines.
- Installing signal markers on OHTLs in order to reduce bird mortality due to collisions with OHTL wires (markers warn birds of the danger and serve as a signal to change the altitude or direction of flight, thereby preventing collisions of birds with wires).
- Awareness of contractor personnel of vulnerable species of flora and fauna encountered in the project area and in need of protection;
- Regularly monitoring of ornithological fauna to identify and minimize potential adverse impacts during construction and operation of OHTLs and develop mitigation measures in a timely manner.
- Annual analysis of operational activities in the project area in order to identify potential negative impacts on biodiversity and implement appropriate corrective actions.

In general, the expected environmental impacts resulting from Project activities in the Dzhankeldy-Bash OHTL area will be of local nature, not exceeding the boundaries of the allotted areas. It is expected that the anthropogenic impact will not exceed the regenerative potential of the ecosystem.

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APPENDIX 1

Table 6. Results of the ornithological survey of the projected route of the overhead line 500 kV Dzhankeldy – Bash (3 - 4.05.2021).

		VP 1	VP 2	VP 3	VP 4	VP 5	VP 6	VP 7	VP 8	VP 9	VP 10	VP 11	
	Coordinates	40°54.986' 63°31.118'	40°57.741' 63°37.354'	40°59.946' 63°44.225'	40°59.199' 63°50.746'	40°59.013' 63°58.217'	40°57.700' 64°8.819'	40°52.889' 64°13.854'	40°50.756' 64°20.469'	40°50.273' 64°26.390'	40°50.682' 64°35.763'	40°42.334' 64°37.219'	
	Habitats	Sandy desert	Sandy desert	Sandy desert	Sandy desert	Sandy desert	Takyr	Clay plain and cliffs	Sandy desert	Sandy desert	Sandy desert	Sandy desert	
	Species	Number of species											Total
1.	Egyptian Vulture <i>Neophron percnopterus</i>							1					1
1.	Common Kestrel <i>Falco tinnunculus</i>										2	2	4
2.	Sand Plover <i>Charadrius leschenaultii</i>						18						18
3.	Kentish Plover <i>Charadrius alexandrinus</i>						80						80
4.	Little Owl <i>Athene noctua</i>							1					1
5.	European Bee-eater <i>Merops apiaster</i>									16			16
6.	Hoopoe <i>Upupa epops</i>									2			2
7.	Barn Swallow <i>Hirundo rustica</i>					2				1	4	7	14
8.	Crested Lark <i>Galerida cristata</i>	5	2	7		4	11	6	7	3	2	4	51
9.	Short-toed Lark <i>Calandrella rufescens</i>										8		8
10.	Great Grey Shrike <i>Lanius excubitor</i>											1	1
11.	Isabelline Shrike									1			1

	Lanius isabellinus												
12.	Rook <i>Corvus frugilegus</i>									1			1
13.	Streaked Scrub Warbler <i>Scotocerca inquieta</i>						4		4				8
14.	Isabelline Wheatear <i>Oenanthe isabellina</i>	6	2	2	1							1	12
15.	Desert Wheatear <i>Oenanthe deserti</i>				1								1
16.	Finch"s Wheater <i>Oenanthe Finchii</i>			1				1	1			1	4
17.	Common whitethroat <i>Sylvia communis</i>			1									1
18.	Chiffchaff <i>Phylloscopus collybita</i>		1								1		2
19.	Common Stonechat <i>Saxicola maurus</i>											4	4
20.	Indian House Sparrow <i>Passer indicus</i>	3	18										21
21.	Desert Finch <i>Rhodospiza obsoleta</i>	4							4				8
22.	Common Rosefinch <i>Carpodacus erythrinus</i>		5										5
	Total species	4	5	4	2	2	4	4	4	6	5	7	23
	Total birds number	18	28	11	2	6	113	9	16	24	17	20	264

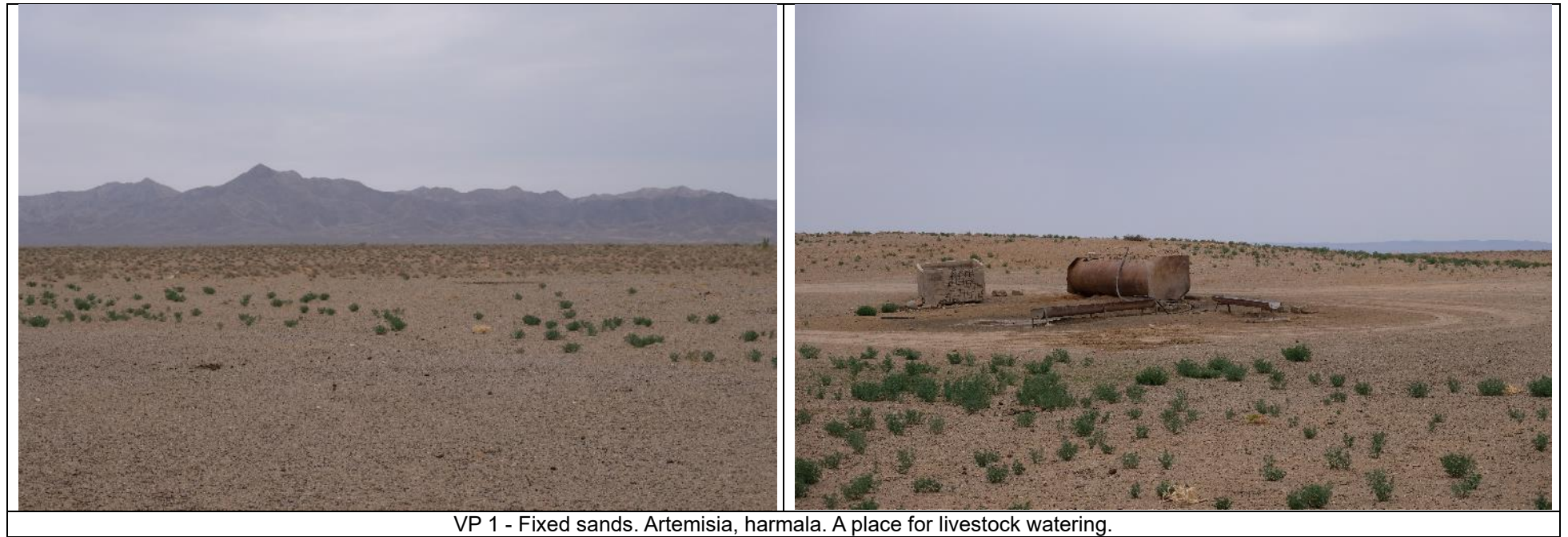
On the way to Ayakagitma Lake, an old nest of a large raptor was found on an anchor post, judging by scattered tortoise shells and urchin skins it was a nest of a golden eagle. At the time of the survey, Indian Sparrows were nesting in the remains of the nest.

Table 7. List of species observed along planned OHTL, outside the VPs.

Species	Number	Notes
Short-toed Eagle <i>Circaetus gallicus</i>	1	Near the Ayakagitma lake

Houbara bustard <i>Chlamidotis undulata</i>	3	Near the Ayakagitma lake
Common Kestrel <i>Falco tinnunculus</i>	3	Between VP 10 и VP 11
Long-legged Buzzard <i>Buteo rufinus</i>	1	2.5 km from VP 10 to VP9
Rufous-tailed Rock Thrush <i>Monticola saxatilis</i>	1	2.5 km from VP 10 to VP9
Spotted Flycatcher <i>Muscicapa striata</i>	1	2.5 km from VP 10 to VP9
Streaked Scrub Warbler <i>Scotocerca inquieta</i>	4	2 км from VP 6 to VP 5
Isabelline Wheatear <i>Oenanthe isabellina</i>	4	2.5 km from VP 10 to VP9
Finch's Wheater <i>Oenanthe Finchii</i>	2	2.5 km from VP 10 to VP9
Cresed Lark <i>Galerida cristata</i>	11	2 km from VP 6 to VP 5

Table 8. Habitat's description.



VP 1 - Fixed sands. Artemisia, harmala. A place for livestock watering.



VP 2 - Fixed sands. Artemisia. Individual saxaul bushes.



VP 3. Sandy desert. Artemisia, saxaul.



VP 4 - Fixed sands, the dominant vegetation is Artemisia terrata. Two small takyr and between them an area of unfixed sands with several small barchans (sandhills). Sheep cote





VP 5 - Fixed sands. Artemisia



VP 6 - Fixed sands. Takyr on both sides of the asphalt road.



VP 7 - Clay desert, hills. Small cliffs.



VP 8 - Sandy desert with well-developed vegetation. Saxaul, Callinonum, Ferula, etc. The Karakata Depression is visible.



VP 9 - Sandy desert with clay areas. Two active power lines, railway.



VP 10 - Sandy desert with clay areas. Two active power lines, presumably 220 kV. Concrete and anchor poles. The Common Kestrel nests on concrete poles. The poles are also used as sitting point by other large predators. Under one of the poles were found pellets containing hair and bones of rodents, as well as fish scales.



VP 11 - Fixed sands. In the immediate vicinity of the point, there are two operating power lines, with a capacity of presumably 220 kV. Concrete and anchor poles. On a concrete support, the nest of a Common Kestrel.

There is an old nest of a large predator on an anchor pole close to Ayakagitma Lake. Judging by scattered tortoise shells and hedgehog skins, it was a nest of a Golden Eagle. At the time of the survey, Indian sparrows were nesting in the remains of the nest.

APPENDIX 2

Table 9. List of species recorded during the VP survey along planned Dzhankeldy-Bash OHTL in June

№	Species	Number of individuals per VP										Total number of individuals
		VP 1	VP 2	VP 3	VP 4	VP 5	VP 6	VP 7	VP 8	VP 9	VP 10	
1.	Egyptian Vulture <i>Neophron percnopterus</i>	1 ad										1
1.	Common Kestrel <i>Falco tinnunculus</i>	2	1							3	3	9
2.	Long-legged Buzzard <i>Buteo rufinus</i>		1					1				2
3.	Sand Plover <i>Charadrius leschenaultii</i>									2	3	5
4.	Little Owl <i>Athene noctua</i>	1		2				1	1	2	1	8
5.	Rock Dove <i>Columba livia</i>	6						12	2			20
6.	Black-bellied Sandgrouse <i>Pterocles orientalis</i>				4		2					6
7.	Laughing Turtle Dove <i>Streptopelia senegalensis</i>			2								2
8.	European Bee-eater <i>Merops apiaster</i>									3	4	7
9.	Blue-cheeked Bee-eater <i>Merops persicus</i>	7	3	15				9		11	35	80
10.	Eurasian Roller <i>Coracias garrulus</i>										2	2
11.	Hoopoe <i>Upupa epops</i>			1								1
12.	Barn Swallow <i>Hirundo rustica</i>	6	2	4				6	5	4	12	39
13.	Crested Lark <i>Galerida cristata</i>	6	3	4	3	5	6	4	7	9	6	53
14.	Short-toed Lark <i>Calandrella rufescens</i>	2	2	4						2	1	11

15.	Streaked Scrub Warbler <i>Scotocerca inquieta</i>		2	2			1		1	1		7
16.	Northern Wheatear <i>Oenanthe oenanthe</i>	2		1						1		2
17.	Isabelline Wheatear <i>Oenanthe isabellina</i>	3	4	2	3	2	4		1	2	1	2
18.	Desert Wheatear <i>Oenanthe deserti</i>		2		1					1		4
19.	Black-necked Wheatear <i>Oenanthe finschii</i>	2	2		2	1	1		1	2		11
20.	Indian House Sparrow <i>Passer indicus</i>		14	34					8			56
21.	Desert Finch <i>Rhodospiza obsoleta</i>			5	7		26					38
22.	Pander's Ground-Jay <i>Podoces panderi</i>			1								1
23.	Desert Warbler <i>Sylvia nana</i>		1							2	3	6
	Total species	11	12	13	6	3	6	6	8	14	11	23
	Total birds number	37	37	77	26	8	40	33	26	45	71	400

Table 10. Species recorded in the project area outside the VPs

No	Species	Number	Notes
1.	Egyptian Vulture - <i>Neophron percnopterus</i>	1	Near the village of Kalaata
2.	Houbara bustard - <i>Chlamidotis undulata</i>	1	On the project territory of Dzhankeldy
3.	Long-legged Buzzard - <i>Buteo rufinus</i>	1	2 km from VP 7
4.	Greater Hoopoe-lark - <i>Alaemon alaudipes</i>	4	1 adult and 3 chicks flew among saxaul bushes near Dzhankeldy village
5.	Chukar Partridge - <i>Alectoris chukar</i>	5	In the village of Dzhankeldy

Among the target species, the following species were recorded: 1 individual of Houbara bustard and 2 individuals of Egyptian Vulture. The Greater Hoopoe-lark (*Alaemon alaudipes*) was registered for the first time in Uzbekistan.

Final report of the bird VP monitoring

Report Title	Final report (May-November) of the bird VP monitoring along planned Dzhankeldy-Bash OHTL
Scope	BIRDS VP
Areas Covered	DZHANKELDY TO BASH OHTL
Seasons Covered	SPRING 2021 / SUMMER 2021 / AUTUMN 2021
Notes	

Final report (May-November) of the bird VP monitoring along planned Dzhankeldy-Bash OHTL

DZHANKELDY WIND FARM PROJECT:

CLIENT: 5 CAPITALS

DATE: DECEMBER 2021

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INTRODUCTION

The project facilities are located in the central part of the Kyzylkum desert between the north-eastern shore of Lake Ayakagitma and Dzhankeldy settlement (Figure 1) and represent two substations connected by an overhead transmission line (OHTL).

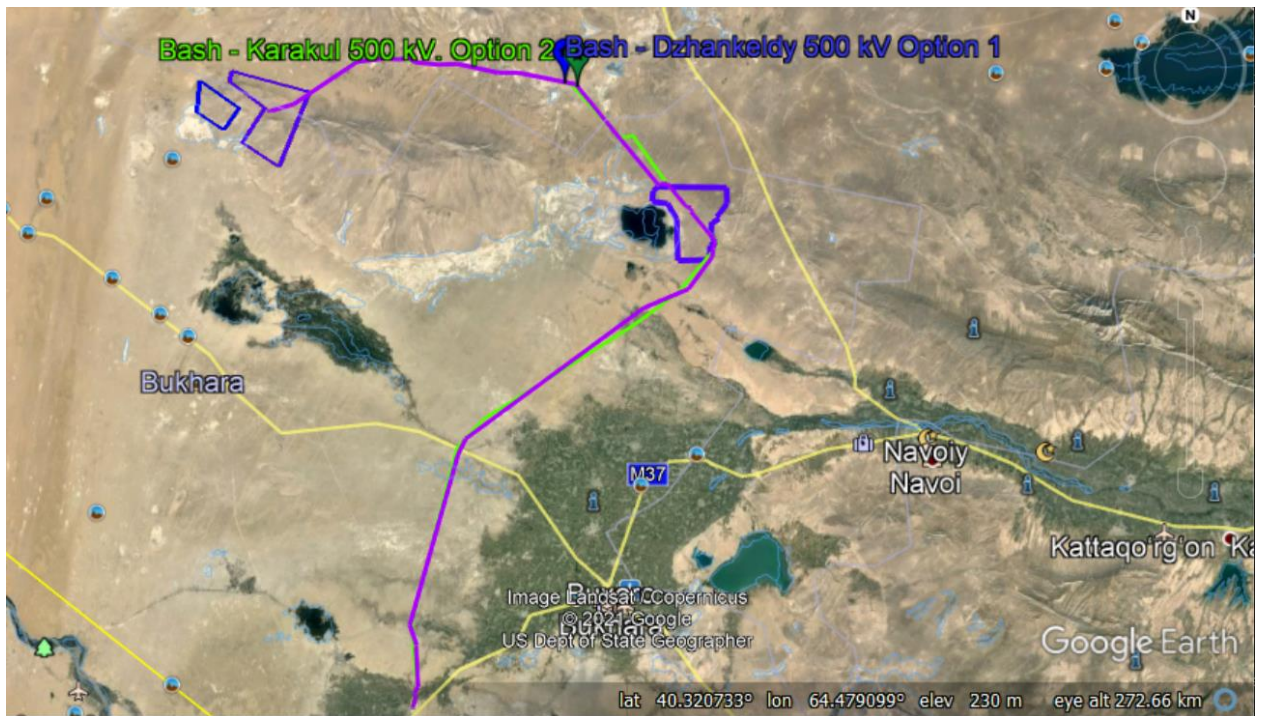


Figure 1. Location of project facilities

Review of background information and potential impacts

This review provides general information on bird mortality from OHTL as per the existing literature data, as well as lists the species that may be encountered in the project area, and considers potential threats and mitigation measures.

The proposed OHTL route mainly runs in fixed sands along the northern slopes of the Kuldjuktai massif, the length of which is about 128 km, width is about 15 km, and maximum height is 785 m. The southern slopes are gentle cut by dry canyons; the northern slopes are steep, with rock outcrops. The Kuldjuktai mountains are composed mainly of schists and limestone, with Jurassic, Cretaceous and Paleogene sedimentary strata on the outskirts, with overblown sands on the surface here and there.

The “Gijduvan” substation is located on the eastern shore of Lake Ayakagitma, so wetland bird species are also included in this overview.

In addition, there is the Karakata Depression in the immediate vicinity (35 km north of Lake Ayakagitma), which fills with water in the springtime and attracts wetland birds. Birds possibly move between the above-mentioned water bodies.

The Lake Ayakagitma is located at the bottom of the like-named depression in the Gijduvan district of Bukhara region. The bottom is a desert landscape with extensive alkaline soil. The sides are flat and steep. The water body was formed in the early 1970s by discharge waters. Most of the shoreline is bare, not covered with reeds. Only in the western part of the lake there are small reeds and jingle shore thickets at the place of discharge canal inflow. Maximum depth in the middle of the lake is 25-30 m. The water surface area is about 10 ha (Google Earth 2021, surveying in 2018).

Lake Ayakagitma and the adjacent desert are included into the network of the most important ornithological territories of Uzbekistan (IBA Uz051). The IBA area is 32854 ha.

Alkaline lands are mainly located near the shallows of the lake's southern part. The alkaline land is one of the poorest habitats for animals and birds. Herbaceous plants are represented by some species of saltwort. There are thickets of tamarisk around the lake, which grows in the saline soil. Generally, animals do not live on alkaline lands, but they visit them from time to time, especially in spring, when salt lands fill with water and turn into shallow salt lakes. Each spring, such wetlands attract many migrating birds, mostly waders, gulls, and terns. The tamarisk undergrowth serves as a perfect refuge for some animals. When alkaline lands dry up, even halophyte plants die.

Table 1 presents general information about birds using the project area based on the available publications and departmental data from the Institute of Zoology of the Academy of Sciences of the Republic of Uzbekistan and State Biological Control of the State Committee on Ecology and Environmental Protection) for the period from 2000 to 2011.

Table 1. List of birds using the project area according to the literature data

№	Species	Number	Nature of stay	Conservation status	Habitats			
					Desert	Water-bodies	Mountains, cliffs	Developed zone
1.	Little Grebe <i>Tachibaptus ruficollis</i>	low	B, M			+		
2.	Black-naked Grebe <i>Podiceps nigricollis</i>	low	M			+		
3.	Red-necked Grebe <i>Podiceps grisegena</i>	rare	M			+		
4	Slavonian Grebe <i>Podiceps auritus</i>	rare	M			+		
5	Great Crested Grebe <i>Podiceps cristatus</i>	common	M			+		
6	Great white Pelican <i>Pelecanus onocrotalus</i>	low	M, W	UzRDB-VU		+		
7	Dalmatian Pelican <i>Pelecanus crispus</i>	low	M, W	UzRDB-EN, IUCN - VU		+		
8	Great cormorant <i>Phalacrocorax carbo</i>	common	M, W			+		
9.	Pygmy cormorant <i>Phalacrocorax pygmaeus</i>	common	M, W	UzRDB-NT		+		
10.	Night heron <i>Nycticorax nycticorax</i>	low	M			+		
11.	Great Egret <i>Egretta alba</i>	common	M, W			+		
12.	Little Egret <i>Egretta garzetta</i>	low	M, W	UzRDB-VU		+		
13.	Grey Heron <i>Ardea cinerea</i>	common	M, W			+		
14.	Purple Heron <i>Ardea purpurea</i>	rare	M			+		
15.	Spoonbill <i>Platalea leucorodia</i>	rare	M	UzRDB-VU		+		
16.	Glossy Ibis <i>Plegadis falcinellus</i>	rare	M	UzRDB-VU		+		
17.	Greylag Goose <i>Anser anser</i>	low	M, W			+		
18.	Greater Flamingo <i>Phoenicopterus roseus</i>	rare	M	UzRDB-VU		+		
19.	Mute swan <i>Cygnus olor</i>	low	M, W	UzRDB-NT		+		
20.	Whooper swan <i>Cygnus cygnus</i>	rare	M, W	UzRDB-VU		+		
21.	Ruddy shelduck <i>Tadorna ferruginea</i>	low	M, W			+		

№	Species	Number	Nature of stay	Conservation status	Habitats			
					Desert	Water-bodies	Mountains, cliffs	Developed zone
22.	Common Shelduck <i>Tadorna tadorna</i>	low	M, B, W			+		
23.	Mallard <i>Anas platyrhynchos</i>	common	B, W			+		
24.	Gadwall <i>Anas strepera</i>	low	B, W			+		
25.	Eurasian Wigeon <i>Anas penelope</i>	low	M, W			+		
26.	Common Teal <i>Anas crecca</i>	common	M, W			+		
27.	Garganey <i>Anas querquedula</i>	low	M			+		
28.	Northern Shoveler <i>Anas clypeata</i>	low	M, B, W			+		
29.	Marbled Teal <i>Anas angustirostris</i>	rare	M	UzRDB-EN IUCN-VU		+		
30.	Red-crested Pochard <i>Netta rufina</i>	common	M, W			+		
31.	Common Pochard <i>Aythya ferina</i>	common	M, W	IUCN-VU		+		
32.	Ferruginous Duck <i>Aythya nyroca</i>	low	M, W	UzRDB-VU IUCN - VU				
33.	Smew <i>Mergus albellus</i>	low	M, W			+		
34.	Osprey <i>Pandion haliaetus</i>	low	M	UzRDB-VU		+	+	+
35.	Black Kite <i>Milvus migrans</i>	low	M		+	+	+	+
36.	Hen Harrier <i>Circus cyaneus</i>	low	M, W		+		+	+
37.	Pallid Harrier <i>Circus macrourus</i>	rare	M	UzRDB-NT IUCN-NT	+		+	+
38.	Montagu's Harrier <i>Circus pygargus</i>	low	M		+		+	+
39.	Marsh Harrier <i>Circus aeruginosus</i>	common	R		+	+		+
40.	Long-legged Buzzard <i>Buteo rufinus</i>	common	M, B, W		+		+	+
41.	Common Buzzard <i>Buteo buteo</i>	rare	M		+		+	+
42.	Short-toed Eagle <i>Circaetus gallicus</i>	rare	M	UzRDB -VU	+		+	+
43.	Steppe Eagle <i>Aquila nipalensis</i>	rare	M, W	UzRDB-VU, IUCN - EN	+		+	+
44.	Golden Eagle <i>Aquila chrysaetos</i>	rare	R	UzRDB-VU,	+		+	+
45.	Greater spotted Eagle <i>Aquila clanga</i>	rare	M	UzRDB-VU, IUCN-VU	+		+	+
46.	Imperial Eagle <i>Aquila heliaca</i>	rare	M	UzRDB-VU, IUCN-VU	+		+	+
47.	Bonelly's Eagle <i>Hieraaetus pennatus</i>	rare	M	UzRDB-CR			+	
48.	White-tailed Sea Eagle <i>Haliaeetus albicilla</i>	low	M, W	UzRDB-VU		+		
49.	Cinereous Vulture <i>Aegypius monachus</i>	rare	B, M, W	UzRDB-NT, IUCN-NT			+	
50.	Eurasian Griffon <i>Gyps fulvus</i>	low	B, M, W	UzRDB-VU			+	
51.	Egyptian Vulture <i>Neophron percnopterus</i>	rare	M	IUCN-EN, UzRDB-VU	+		+	+

№	Species	Number	Nature of stay	Conservation status	Habitats			
					Desert	Water-bodies	Mountains, cliffs	Developed zone
52.	Bearded Vulture <i>Gyphaetus barbatus</i>	rare	R	UzRDB-VU			+	
53.	Saker Falcon <i>Falco cherrug</i>	rare	M, B, W	UzRDB-EN, IUCN - EN	+		+	
54.	Peregrine Falcon <i>Falco Peregrinus</i>	rare	M	UzRDB-VU	+		+	
55.	Red-capped Falcon <i>Falco pelegrinoides</i>	rare	M, B	UzRDB-VU	+		+	
56.	Eurasian Hobby <i>Falco subbuteo</i>	rare	M		+		+	
57.	Lesser Kestrel <i>Falco naumanni</i>	rare	M	UzRDB-NT	+		+	
58.	Common Kestrel <i>Falco tinnunculus</i>	low	M, B, W		+		+	
59.	Merlin <i>Falco colubarius</i>	rare	M, W		+		+	+
60.	Eurasian Sparrowhawk <i>Accipiter nisus</i>	rare	M		+		+	+
61.	Common Quail <i>Coturnix coturnix</i>	common	M		+		+	+
62.	Chukar <i>Alectoris chukar</i>	common	R		+		+	
63.	Common crane <i>Grus grus</i>	common	M		+	+	+	+
64.	Demoiselle Crane <i>Anthropoides virgo</i>	common	M		+	+	+	+
65.	Common Moorhen <i>Gallinula chloropus</i>	rare	R			+		
66.	Common Coot <i>Fulica atra</i>	common	M, B, W			+		
67.	Great Bustard <i>Otis tarda</i>	rare	M	UzRDB-CR IUCN - VU	+			
68.	Little Bustard <i>Tetrax tetrax</i>	rare	M	UzRDB-VU, IUCN - NT	+			
69.	Houbara Bustard <i>Chlamydotis undulata</i>	rare	M, B	UzRDB-VU, IUCN - VU	+			
70.	Grey Plover <i>Pluvialis squatarola</i>	common	M			+		
71.	Common Ringed Plover <i>Charadrius hiaticula</i>	low	M			+		
72.	Great Sand Plover <i>Charadrius leschenaultii</i>	common	B, M			+		
73.	Little Ringed Plover <i>Charadrius dubius</i>	common	M			+		
74.	Kentish Plover <i>Charadrius alexandrinus</i>	low	M, B			+		
75.	White-tailed Lapwing <i>Vanellus leucurus</i>	common	M, B			+		+
76.	Sociable Lapwing <i>Vanellus gregaria</i>	rare	M	IUCN- CR, UzRDB-VU		+		+
77.	Black-winged Stilt <i>Himantopus himantopus</i>	common	M, B			+		
78.	Pied Avocet <i>Recurvirostra avosetta</i>	common	M, B			+		
79.	Common Oystercatcher <i>Haematopus ostralegus</i>	common	M			+		
80.	Green Sandpiper <i>Tringa ochropus</i>	low	M			+		
81.	Common Sandpiper <i>Actitis Hypoleucos</i>	common	M			+		

№	Species	Number	Nature of stay	Conservation status	Habitats			
					Desert	Water-bodies	Mountains, cliffs	Developed zone
82.	Wood Sandpiper <i>Tringa glareola</i>	rare	M			+		
83.	Common Greenshunk <i>Tringa nebularia</i>	rare	M			+		
84.	Common Redshunk <i>Tringa totanus</i>	low	M			+		
85.	Marsh Sandpiper <i>Tringa stagnatilis</i>	rare	M			+		
86.	Spotted Redshunk <i>Tringa erythropus</i>	low	M			+		
87.	Red-necked Phalarope <i>Phalaropus lobatus</i>	low	M			+		
88.	Ruff <i>Phylomachus pugnax</i>	low	M			+		
89.	Temminck's Stint <i>Calidris temminckii</i>	low	M			+		
90.	Culew Sandpiper <i>Calidris ferruginea</i>	low	M			+		
91.	Little Stint <i>Calidris minuta</i>	low	M			+		
92.	Dunlin <i>Calidris alpina</i>	low	M, W			+		
93.	Common Snipe <i>Gallinago gallinago</i>	low	M			+		
94.	Black-tailed Godwit <i>Limosa limosa</i>	rare	M	IUCN-NT, UzRDB-VU		+		
95.	Bar-tailed Godwit <i>Limosa lapponica</i>	rare	M			+		
96.	Eurasian Curlew <i>Numenius arquata</i>	rare	M	IUCN - NT, UzRDB- VU		+		
97.	Whimbrel <i>Numenius phaeopus</i>	rare	M			+		
98.	Slender-billed Culew <i>Numenius tenuirostris</i>	rare	M	IUCN -CR, UzRDB-CR		+		
99.	Collared Pratincole <i>Glareola pratincola</i>	common	M			+		+
100.	Black-winged Pratincole <i>Glareola nordmanni</i>	rare	M	UzRDB-VU, IUCN-NT		+		
101.	Yellow-legged Gull <i>Larus cachinnans</i>	common	M, B, W			+		
102.	Black-headed Gull <i>Larus ridibundus</i>	common	M, B, W			+		
103.	Slender-billed Gull <i>Larus genei</i>	low	M, B, W			+		
104.	Gull-billed Tern <i>Gelochelidon nilotica</i>	low	M, B			+		
105.	Caspian Tern <i>Hydroprogne caspia</i>	common	M, B			+		
106.	Common Tern <i>Sterna hirundo</i>	common	M, B			+		
107.	Little Tern <i>Sterna albifrons</i>	common	M, B			+		
108.	Black-bellied Sandgrouse <i>Pterocles orientalis</i>	common	R		+	+		
109.	Rock Dove <i>Columba livia</i>	common	R		+	+	+	+
110.	Collared Dove <i>Streptopelia decaocto</i>	common	R		+			+

№	Species	Number	Nature of stay	Conservation status	Habitats			
					Desert	Water-bodies	Mountains, cliffs	Developed zone
111.	Turtle Dove <i>Streptopelia turtur</i>	low	B	IUCN -VU, UzRDB-VU	+			+
112.	Oriental Turtle Dove <i>Streptopelia orientalis</i>	low	M		+			+
113.	Laughing Dove <i>Streptopelia senegalensis</i>	low	R		+			+
114.	Common Cuckoo <i>Cuculus canorus</i>	low	M, B			+		
115.	Eagle Owl <i>Bubo bubo</i>	rare	R		+		+	
116.	Little Owl <i>Athene noctua</i>	common	R		+		+	
117.	European Nightjar <i>Caprimulgus europaeus</i>	low	M		+			
118.	Egyptian Nightjar <i>Caprimulgus aegyptius</i>	low	M		+			
119.	Common Swift <i>Apus apus</i>	common	M		+		+	+
120.	European Roller <i>Coracias garrulus</i>	common	M, B	IUCN - NT	+	+	+	+
121.	European Bee-eater <i>Merops apiaster</i>	common	M		+	+	+	+
122.	Blue-cheeked Bee-eater <i>Merops persicus</i>	common	M, B		+	+	+	+
123.	Eurasia Hoopoe <i>Upupa epops</i>	common	R		+	+	+	+
124.	Sand Martin <i>Riparia riparia</i>	common	M		+	+		+
125.	Barn Swallow <i>Hirundo rustica</i>	common	M, B		+	+		+
126.	Red-rumped Swallow <i>Hirundo daurica</i>	low	M		+	+		+
127.	Crested Lark <i>Galerida cristata</i>	common	R		+			
128.	Lesser Short-toed Lark <i>Calandrella rufescens</i>	common	M, B		+			+
129.	Red-capped Lark <i>Calandrella cinerea</i>	low	M, B		+		+	
130.	Calandra Lark <i>Melanocorypha calandra</i>	common	M		+			
131.	Tawny pipit <i>Anthus campestris</i>	common	M		+	+	+	+
132.	Tree pipit <i>Anthus trivialis</i>	common	M		+	+	+	+
133.	Yellow wagtail <i>Motacilla flava</i>	common	M		+	+	+	+
134.	Citrine Wagtail <i>Motacilla citreola</i>	common	M		+	+	+	+
135.	White Wagtail <i>Motacilla alba</i>	common	M, W		+	+		+
136.	Pied Wagtail <i>Motacilla personata</i>	common	M, B		+	+		+
137.	Isabelline shrike <i>Lanius isabellinus</i>	low	M		+			+
138.	Long-tailed Shrike <i>Lanius schach</i>	rlow	M		+			+
139.	Great grey shrike <i>Lanius excubitor</i>	low	M		+			+

№	Species	Number	Nature of stay	Conservation status	Habitats			
					Desert	Water-bodies	Mountains, cliffs	Developed zone
140.	Asian Grey Shrike <i>Lanius pallidirostris</i>	common	B, M		+			+
141.	Red-backed Shrike <i>Lanius collurio</i>	common	M		+			+
142.	Turkestan Shrike <i>Lanius phoenicuroides</i>	common	M		+			+
143.	Common Starling <i>Sturnus vulgaris</i>	common	M, W		+	+		+
144.	Rose Starling <i>Pastor roseus</i>	common	M					+
145.	Indian Myna <i>Acridotheres tristis</i>	common	R		+			+
146.	Magpie <i>Pica pica</i>	common	R		+			+
147.	Eurasian Jackdaw <i>Corvus monedula</i>	common	M		+	+		
148.	Rook <i>Corvus frugilegus</i>	common	M, W		+	+		
149.	Carrion Crow <i>Corvus corone</i>	low	R		+	+		
150.	Hooded Crow <i>Corvus cornix</i>	low	M, W		+			
151.	Brown-necked Raven <i>Corvus ruficollis</i>	low	R		+		+	
152.	Eastern Rock Nuthatch <i>Sitta terphonota</i>	low	R				+	
153.	Paddyfield Warbler <i>Acrocephalus agricola</i>	common	M, B		+	+		+
154.	Clamorous Reed Warbler <i>Acrocephalus stentoreus</i>	common	M, B		+	+		+
155.	Great Reed Warbler <i>Acrocephalus arundinaceus</i>	common	M		+	+		+
156.	Booted Warbler <i>Hippolais caligata</i>	common	M		+	+		+
157.	Syke's Warbler <i>Hippolais rama</i>	low	M, B		+			+
158.	Common Whitethroat <i>Sylvia communis</i>	low	M		+			+
159.	Lesser Whitethroat <i>Sylvia curruca</i>	low	M		+			+
160.	Desert Warbler <i>Sylvia nana</i>	rare	B		+			
161.	Ciffchaff <i>Phylloscopus collybita</i>	common	M		+			
162.	Scrub Warbler <i>Scotocerca inquieta</i>	low	R		+			
163.	Spotted Flycatcher <i>Muscicapa striata</i>	low	M		+			
164.	Common Stonechat <i>Saxicola torquata</i>	low	M		+			+
165.	Pied bushchat <i>Saxicola caprata</i>	low	M, B		+			+
166.	Bluethroat <i>Luscinia svecica</i>	common	M		+			+
167.	Black Redstart <i>Phoenicurus ochruros</i>	common	M		+			+
168.	Northern Wheatear <i>Oenanthe oenanthe</i>	rare	M		+		+	

№	Species	Number	Nature of stay	Conservation status	Habitats			
					Desert	Water-bodies	Mountains, cliffs	Developed zone
169.	Pied Wheater <i>Oenanthe pleschanka</i>	common	M, B		+		+	
170.	Variable wheater <i>Oenanthe picata</i>	low	M, B				+	
171.	Finschs Wheater <i>Oenanthe finschii</i>	low	M, B				+	
172.	Black-eared Wheater <i>Oenanthe hispanica</i>	low	M, B				+	
173.	Deser Wheater <i>Oenanthe deserti</i>	low	M,B		+			
174.	Isabelline Wheater <i>Oenanthe isabellina</i>	low	M, B		+			
175.	Rufous Scrub Robin <i>Cercotrichas galactotes</i>	low	M,B		+			
176.	Common Nightingale <i>Luscinia megarhynchos</i>	low	M		+		+	+
177.	Thrush Nightingale <i>Luscinia luscinia</i>	low	M		+			
178.	Bearded Reedling <i>Panurus biarmicus</i>	common	R			+		
179.	Turkestan Tit <i>Parus bokharensis</i>	low	R		+			+
180.	House sparrow <i>Passer domesticus</i>	low	M					+
181.	Indian sparrow <i>Passer indicus</i>	common	M, B		+			+
182.	Eurasian tree sparrow <i>Passer montanus</i>	common	R		+			+
183.	Desert Finch <i>Rhodospiza obsoleta</i>	common	R		+			
184.	Reed bunting <i>Emberiza schoeniclus</i>	common	M, B		+	+		+
185.	Желчная овсянка <i>Emberiza bruniceps</i>	rare	M, B		+	+		+
186.	Corn Bunting <i>Emberiza calandra</i>	common	M					+

Note

Nature of stay: M - migration, B - breeding, W - wintering, R - resident

Conservation status:

UzRDB - Red Book of the Republic of Uzbekistan, IUCN - IUCN Red List.

Analysis of existing data showed that ornithological fauna of the project area is represented by 186 bird species, 23 of which are resident birds (Table 1). About 50 species are nesting. Many birds inhabit the territory during seasonal migrations or post-nesting nomadic migrations. According to the literature data 22 globally endangered species are found here. 37 species are registered in the National Red Book.

The typical inhabitants of the desert are larks, bramblings, pterocles, and small birds of prey.

Uzbekistan is located on the historical Central Asian migration route of birds from Western Siberia and Kazakhstan to Indo-Pakistan, Iran-Caspian and African flyways (Figure 2). The main flyways covering the territory of Uzbekistan are presented in the following scheme. Familiarity with this scheme shows that there are 3 flyways passing through the territory of Uzbekistan: Black Sea-Mediterranean, East African-West Asian and Central Asian.

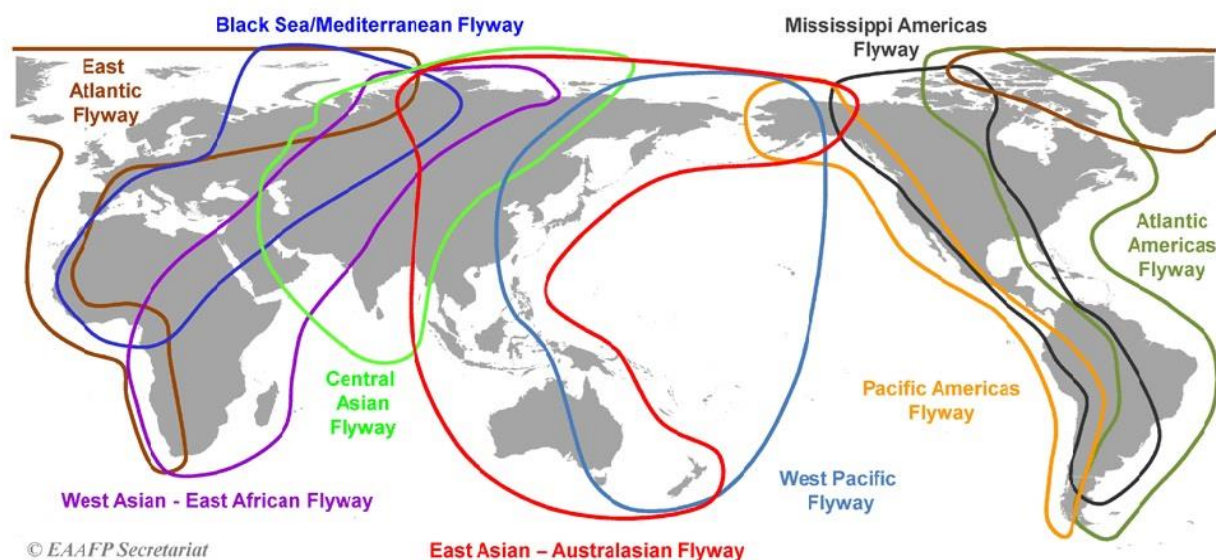


Figure 2. Main flyways (East Asian–Australasian Flyway Partnership Secretariat)

Of the 434 bird species inhabiting Uzbekistan, only 10-15% of the species is settled in different areas. The remaining birds are migratory.

Several major ecological groups can be distinguished among migratory birds according to their nature of stay:

- Species arriving to Uzbekistan for nesting from India, Pakistan, Afghanistan, Iran, North and West Africa.
- Species arriving to Uzbekistan for wintering from Western Siberia, Kazakhstan, Kyrgyzstan, Aral Sea region (outside Uzbekistan), Northern Caspian Sea region.
- Transit migrating birds crossing the territory of Uzbekistan during seasonal migrations and stopping here only for resting and feeding in order to replenish energy resources required to continue their flyway.

The main wintering grounds of birds are located mainly to the south of the average winter isotherm 0°C. In Uzbekistan, it passes approximately along the Zarafshan River. Consequently, all species arriving in Uzbekistan for wintering spend it in the southern regions of the republic, i.e. practically they cross the country in the southern direction.

In Uzbekistan the spring migration period starts from the end of February (in the south) to early March. So-called early migrants fly first and include geese, ducks, crow family species and others. The main flyway of many species through Uzbekistan takes place in March and April. There are also so-called late migrants, represented mainly by insectivore species. These are the birds such as swallows, orioles, Eurasian rollers, typical bee-eaters, nightjars, streptopelias and sparrows. In general, spring migration ends by the end of May. During the summer months, waders continue to migrate and, after reaching the tundra begin their return migration almost immediately.

Autumn migration starts in the second half of August and lasts almost until December. The main wintering grounds of various bird species in Uzbekistan are formed from October to December.

Thus, most of the year (nearly 9 months) in Uzbekistan there is a change in the species composition of birds and their territorial distribution.

Special studies of migration in the Central Asian region under the program "Asia" in the 1980s showed that the night migration of all groups of birds over the mountains and deserts of Central Asia and Kazakhstan passes everywhere from the eastern shore of the Caspian Sea to the eastern border of the Tian Shan. Moreover, up to 90% of all migrating birds fly over Central Asia at night and at considerable altitudes, while the rest fly during daylight time. According to Dolnik V.R. and Bolshakov K.V. (1985), the spring night flight

over deserts passes everywhere in a wide formation without forming densities along ecological waterways.

There are two general directions of night migration over Central Asia. One (northwest) is formed by birds that wintered in South Asia. The other (northeastern) is formed by both migrating birds that wintered from Africa to Iran and by birds that wintered in South Asia, but which go around the mountains and high mountain deserts of Central Asia. The overlapping of these three streams of different origin in the band from the western edge of the Himalayas to the central part of the Kopetdag leads to a sharply increased density of night flight in the area between the southwestern Tian Shan and the Kopetdag, persisting northward as far as the latitude of the Aral Sea. Thus, globally, migratory birds do not fly around the arid and mountainous areas of Central Asia in spring, which increases the likelihood of collisions between birds and OHTL.

In recent years, the world community has paid increasing attention to the conservation of cranes, one of the oldest systematic groups of birds. In Uzbekistan, mainly two species of cranes migrate: Demoiselle Crane *Anthropoides virgo* and Common Crane *Grus grus* (Lanovenko, Kreitzberg, 2002, Gavrilov, Van Der Ven. 2004). They are found during migration in many areas of the republic.

It has been determined that migrating birds cross the territory of the republic in spring mainly from southwest to northeast, and in autumn in the opposite direction. On their way they encounter various threats, including collisions with power lines. If OHTL is located perpendicular to the direction of bird movements, it poses a greater danger to birds than OHTL located parallel. The future OHTL Dzhanakeldy-Bash is located along the Kuldjuktai mountain massif, i.e. perpendicular to the prevailing direction of migrating birds, which means that it poses a certain danger.

Collisions with OHTL

The use of electricity is one of the achievements of technological progress of mankind. Various capacity OHTL (up to 500 kV) are used to transmit it from source to consumer, which pose a certain danger to migratory birds.

On the one hand, OHTL towers serve as roost sites for some species of birds, especially birds of prey, and especially in open landscapes, which attracts them to OHTL. On the other hand, when birds land on towers or fly between the wires, they are at risk of being electrocuted as a result of the resulting short circuit or simply from physical injury from striking wires. An increased risk of electrocution exists if birds have wet or damp feathers. Smaller birds landing on towers or wires are generally not at risk. However, bad weather conditions such as fog, rain or snow, as well as darkness, can make power lines invisible and therefore dangerous for any type of bird to collide with OHTL wires. As a result of the collision, birds can be physically injured, electrocuted, or burned in the resulting electrical arc. Falling burning birds can cause fires, both in natural habitats and in man-made landscapes. An international estimate is that 5 to 15% of all power lines can cause birds to collide with wires (IMBD Information, April 2005).

In Uzbekistan, there are known facts that during spring and autumn migrations medium and large size birds die on power lines, among them prevail mostly rare and endangered species - Steppe eagle, Golden eagle, Eastern imperial eagle, Osprey, Short-toed eagle, Saker falcon, White stork, Dalmatian pelican, Eurasian eagle-owl and others (Abdunazarov, 1987; Shernazarov, Lanovenko, 1994; Lanovenko, 2007, Lanovenko, 2017).

Surveys were conducted in Tashkent, Djizak, Surkhandarya, Kashkadarya, Bukhara, Namangan and Ferghana regions of the republic to establish the scale of bird mortality on OHTL (without specifying OHTL capacity). The length of surveyed lines was more than 2000 km in open landscapes (Abdunazarov, 1987). The estimated number of birds mortality on OHTL is up to 50 birds of prey in the Ferghana Valley, Samarkand and

Surkhandarya regions (mainly Buzzards and Common kestrels); from 50 to 100 birds in the Tashkent, Syrdarya and Kashkadarya regions (mainly Buzzards and Common kestrels); from 300 to 500 birds in the Jizzak region (Eagles, Buzzards, Ospreys, Kestrels); from 200 to 500 birds in the Navoi and Bukhara regions (Eagles, Buzzards, large Falcons, Kestrels). Moreover, among them, many species have a high conservation status, as they are listed in the national Red Book, the international list of globally threatened species, as well as in the annexes of international conventions on migratory species (Bonn) and CITES. Birds of prey tend to die by using OHTL towers as roost sites. To expand the geography and specify the species composition of birds of prey that die from electrocution, we will provide some materials of the same author (Abdunazarov, 1990) on birds of prey dying on 6-10 kV OHTL: during 1981-1984 in the Farish steppe (Jizzak region) on a 30 km section 3 Ospreys *Pandion haliaetus*, 16 Steppe Eagles *Aquila nipalensis*, 1 Eastern imperial eagle *Aquila heliaca*, 1 Golden Eagle *Aquila chrysaetus* and 3 Short-toed eagles *Circaetus gallicus* were found dead. On 26/04/89, 64 birds of prey of 12 species were recorded dead in the same area. Among them were 1 Osprey, 2 White-tailed Eagle *Haliaeetus albicilla*, 2 Short-toed eagles, 11 Steppe Eagles, 1 Golden Eagle, 1 Eastern imperial eagle and 2 Saker Falcons *Falco cherrug*. In both cases, all the mentioned species are listed in the Red Book of Uzbekistan (2019).

Birds of prey are generally more often die from electrocution when using OHTL towers as roost sites. In the central part of the Kyzylkum desert in September 2007, a Golden eagle, Steppe eagle, Griffon vulture and Houbara bustard were found dead from electrocution under the OHTL connected to the Navoi Mining and Metallurgical Plant (Kashkarov, 2007; IBA project newsletter in Uzbekistan, 2007). These species are also listed in the Red Book of Uzbekistan.

However, different species of birds often die as a result of direct collision with wires as well. Such species include small passerines (Larks, Warblers), Waders, Rails (Corn crane), Pterocles (black-bellied sandgrouse), quail and others. According to Nazarov A.P. and Zagrebin S.V. (1987), quail regularly collide with OHTL during spring and autumn migrations.

Constant monitoring to analyse the impact of OHTLs on birds was not conducted in Uzbekistan. In the Central part of the Kyzylkum desert in the period from 1997 to 2007, M.G. Mitropolsky (2009) collected remains of birds of prey that died on OHTL in order to collect shoulder bones. In total, he collected 71 specimens of 14 species of birds of prey in this area: *Accipiter gentilis* (1 specimen), *Buteo buteo* (1), *Buteo rufinus* (22), *Circus cyaneus* (2), *Circus aeruginosus* (1), *Aquila chrysaetos* (19), *A. heliaca* (2), *A. nipalensis* (7), *A. clanga* (5), *Aegypius monachus* (2), *Gyps fulvus* (2), *Neophron percnopterus* (1), *Circaetus gallicus* (3), *Falco tinnunculus* (2).

OHTLs located near water bodies, which are places of waterfowl concentration, pose a particular danger. According to the Institute of Zoology of the Academy of Sciences of Uzbekistan, Dalmatian Pelicans *Pelicanus crispus* regularly die on the 220 kV OHTL that runs from Kyzyltepa substation along the western shore of Tudakul Lake (Navoi region). During the 2002-2005 winter surveys, up to three dead birds were regularly found here. During the visit to the lake in January 2004, 7 dead burnt birds were found under wires at once (Lanovenko, 2007).

Birds have also been known to cause short-circuits in the electric power industry, causing outage of high voltage lines, resulting in economic losses due to power outages at enterprises, but not leading to bird deaths (Shernazarov & Lanovenko, 1994).

Some birds are killed by mechanical collisions with wires during flight, more often during poor visibility at night or unfavorable weather conditions. It is especially difficult to avoid collision with wires for large birds that do not have good maneuverability or fly with high speed. In Uzbekistan, there are known cases of cranes, black-bellied grouse, kestrel, quail, corncrake and many other species dying from collision with wires.

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One of the features of modern bird ecology is their adaptation to nesting on OHTL towers. In Central Kyzylkum, we have repeatedly found Kestrel *Falco tinnunculus* nests on the OHTL. Researches of O. Mitropolsky, E. Fotteler and G. Tretiakov (1987) established nesting of Golden eagle and Saker falcon on OHTL in Kyzylkum, which allowed these species to expand their breeding ground deep into the desert. According to Zinoviev S. estimate (1990), up to 40% of nests of the Golden Eagle and 33% of nests of the Saker Falcon were located in the Kyzylkum Desert on OHTLs.

Specific data on peculiarities of daily bird migration along the route of the future overhead line are missing. There is no direct evidence that there is any narrow migration route for migrating birds in the Project area. However, analysis of information on existing global bird migration routes and evidence of the existence of wide-frontage migration in the whole territory of Uzbekistan suggests it is passing along the Project route as well. Thus, it is possible to talk about bird migration in the area of the OHTL route and in the adjacent areas in a broader sense (at region level).

Calculation of bird mortality on OHTLs in the Kyzylkum desert.

There are no real statistics on bird deaths on OHTLs in Uzbekistan. There are data on bird mortality on the 220 kV OHTL running through the central part of the Kyzylkum desert from Yangigazgan to Uchkuduk and further to the north-east.

Like the project area, the Kyzylkum desert is an arid zone characterized by an open landscape and small desert lowlands. Bird migration through Kyzylkum is most active in spring. To determine the approximate level of bird mortality, available information on this OHTL was used. The surveyed 220 kV OHTL runs a short distance along a road, the total length of which is about 320 km. In the third decade of October, which is usually the time of late migrants' flyway in Uzbekistan, eight sections of 220 kV OHTLs with a total length of 140 km were surveyed in 2007 (Table 2).

Table 2. Data on birds collected dead under OHTLs in the central part of the Kyzylkum Desert based on the result of the October 2007 survey (Navoi region, Uzbekistan)

Survey date	Section name	OHTL length	Types and number of died birds	OHTL capacity, kV	Comments
18.10.2007	Karakata - Ayakkuduk	20 km	<i>Calandrella rufescens</i> – 4 <i>Galerida cristata</i> – 1 <i>Philloscopus collibita</i> – 1 <i>Sylvia communis</i> 1	220 кВ	(150-130 km)
18.10.2007	Route to Chimbay	15 km	<i>Gyps fulvus</i> – 1 <i>Aquila chrysaetos</i> – 1 <i>A. nipalensis</i> – 1 <i>Falco tonnunculus</i> – 1 <i>Galerida cristata</i> – 1 <i>Buteo rufinus</i> - 1	220 kV	(85-70 km)
19.10.2007	Route to Kyzylkuduk settlement	10 km	<i>Coturnix coturnix</i> – 1 <i>Calandrella rufescens</i> – 2	220 kV	From west to east (460-470 km)
19.10.2007		5 km	<i>Aquila chrysaetos</i> – 2 <i>Calandrella rufescens</i> – 1	220 kV	Under OHTL from north to south
19.10.2007		5 km	<i>Calandrella rufescens</i> – 2	220 kV	Along OHTL parallel to the railway
19.10.2007	Zeravshan - Uchkuduk	10 km	<i>Calandrella rufescens</i> – 1	220 kV	In Kuntay farm area (229-239 km)
19.10.2007	Zeravshan - Uchkuduk	10 km	<i>Calandrella rufescens</i> – 1 <i>Emberiza shoeniclus</i> - 1	220 kV	10 km NW Kuntay (241-251 km)
21.10.2007	Route to Akbaytal	30 км km	<i>Alauda arvensis</i> – 1 <i>Calandrella rufescens</i> – 3	220 kV	In Saginbay coll. area (75-105 km)
22.10.2007	Route to Kulkuduk settlement	10 km	No dead birds	220 kV	(15-25 km)
23.10.2007	Uchkuduk - Navoi	5 km under each, 15 total	No dead birds	220 kV	3 parallel OHTL (telegraph and 2 OHTL). Distance between them is 100-150 m (169-164 km)
24.10.2007	Kenimekh-Yangigazan	10 km	<i>Chlamydotis undulate</i> – 1 <i>Calandrella chelensis</i> – 1 <i>Calandrella rufescens</i> – 1 <i>Philloscopus collibita</i> – 1	220 kV	(40-45 km) from both sides of the road

Bird mortality rate calculated by us on this OHTL was 12.2 birds per 100 km. The dead birds were represented by 9 species. The dominant species is the Mediterranean short-toed lark *Calandrella rufescens*. The mortality rate of this species was 7.77 individuals per 100 km. This figure can be useful in comparative assessment of mortality along the OHTL in the Project area.

Identification of bird concentrations along the Project OHTL route and development of measures to reduce potential bird mortality during the Project implementation will reduce the current level of bird mortality.

MATERIALS AND METHODS

Field studies on the route were carried out to identify details of the landscape characteristic picture, as well as possible places of migratory birds' concentration. Introductory surveys were conducted in May and June 2021.

We were moving along the route between "Vantage Points" directly along the route line or near it depending on the availability of access roads. The distance from the route in some places was generally not more than 1-2 km. However, given the landscape homogeneity of the surveyed section, we deem it acceptable to draw analogies between the surveyed area adjacent to the route and the route itself.

Visual observations of birds were made during the route survey. Bird sighting points were also marked using GPS. Bird species membership was determined visually using field binoculars with 8x magnification Nikon and Fujifilm XT-20 digital cameras as well as audio recordings of bird voices (Xeno-canto Asia) and field bird identifiers (Mullarney, Svensson, Zetterstrom, Grant, 1999; Aye, Schweizer, Roth 2012).

Field surveys were conducted from 3 to 4 May and 19-20 June according to the methodology agreed by the client.

Surveys were conducted at 11 selected points, in 1 km radius sections. Duration of observations was not less than 40 minutes at each vantage point.

The territorial location of vantage points is shown in Figure 3.

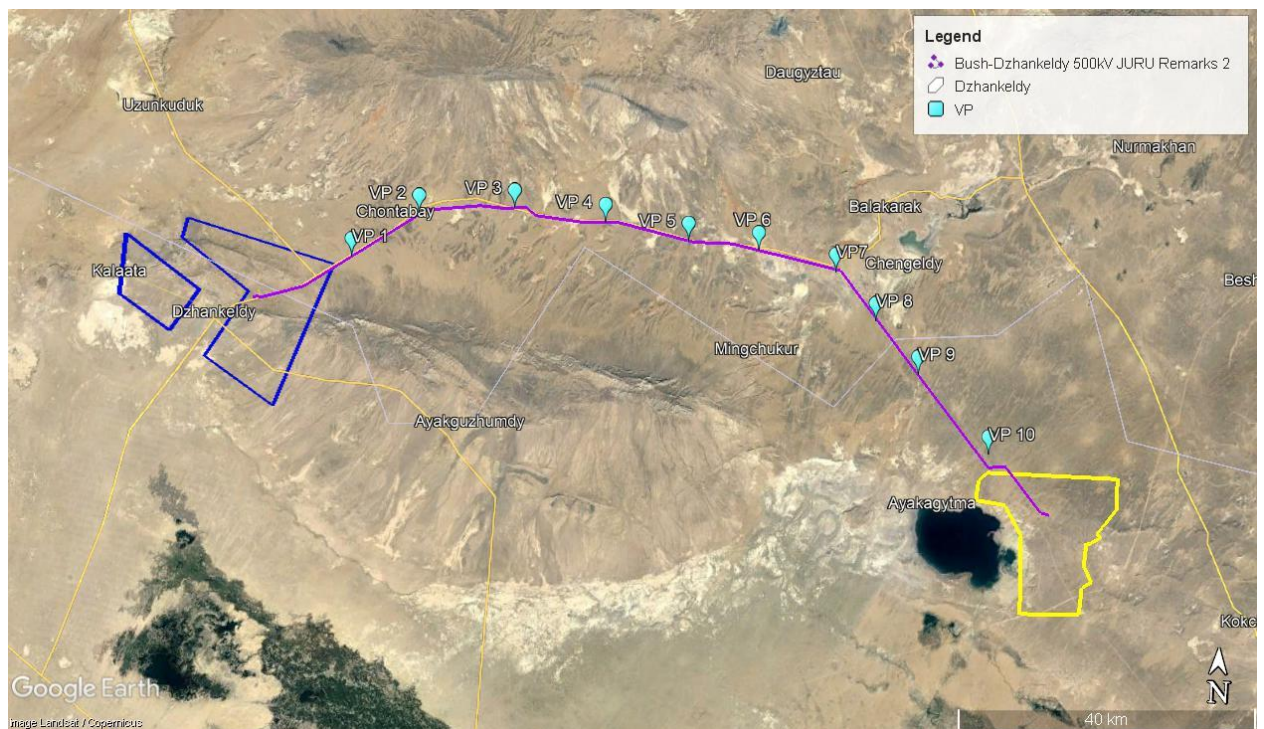


Figure 3. Vantage points on the route of the planned OHTL.

SURVEY RESULTS

According to the literature data, the prevailing directions of night and daytime bird migrations in Uzbekistan are north-eastern in spring and south-western in autumn (Dolnik, 1985). In accordance with the above-mentioned features of bird migrations in the region and the geographical direction of the route, it can be assumed that the greatest potential danger for migratory birds pose the section passing through the foothills of the northern slopes of Kuldjuktai mountains, where local streams of low-flying birds can occur. The line section from Dzhanakendy SS to Ayakagitma Lake goes in the eastern direction, i.e., practically perpendicular to the prevailing migration direction.

The Kyzylkum desert is a place of active migration and wintering of some species of large birds of prey, including buzzards, harriers, eagles and large falcons characterized by trophic type of migration. These birds do not migrate far, but constantly move in the right direction, simultaneously making foraging movements. This biological peculiarity of these birds determines the necessity of regular use of roost sites, so in steppe landscape and absence of tree vegetation, OHTL towers are very attractive for birds of prey, which creates a potentially dangerous situation.

Familiarization with the route of Project OHTL showed that the area of the project OHTL is represented by open habitats. During the survey along the Project route, we found nests of Common Kestrel on the existing and running parallel to OHTL-220. Nesting of the Common Myna *Acridotheres tristis* and House Sparrow *Passer domesticus* were observed in non-residential nests of Common Kestrel. None of these species has a high conservation status.

In the course of familiarization with the line route, no potential high-risk areas were identified. The summary list of the observed species is presented in a table 3.

Table 3. The summary list of the observed bird species

Species		Month						
		may	jun	jul	aug	sep	oct	nov
Black Kite	<i>Milvus migrans</i>					4		
Hen Harrier	<i>Circus cyaneus</i>				1	1		1
Long-legged Buzzard	<i>Buteo rufinus</i>	1	3	2	3	1	3	1
Common Buzzard	<i>Buteo buteo</i>				1	3		1
Short-toed Eagle	<i>Circaetus gallicus</i>	1						
Steppe Eagle	<i>Aquila nipalensis</i>					1		
White-tailed Sea-eagle	<i>Haliaeetus albicilla</i>						1	
Egyptian Vulture	<i>Neophron percnopterus</i>	1	2	2	2			
Common Kestrel	<i>Falco tinnunculus</i>	4	9	2	3	2	2	3
Chukar Partridge *	<i>Alectoris chukar</i>		5					
Houbara Bustard	<i>Chlamydotis undulata</i>	3	1					
Greater Sand Plover	<i>Charadrius leschenaultii</i>	18	5					
Kentish Plover	<i>Charadrius alexandrinus</i>	80						
Black-Headed Gull	<i>Larus ridibundus</i>						5	
Black-bellied Sandgrouse*	<i>Pterocles orientalis</i>		6	6	10	6		2
Rock Dove*	<i>Columba livia</i>		20	16	45	15	28	45
Laughing Dove*	<i>Streptopelia senegalensis</i>		2					
Eurasian Cuckoo	<i>Cuculus canorus</i>					2		
Eagle Owl*	<i>Bubo bubo</i>						1	
Little Owl*	<i>Athene noctua</i>	1	8		1		1	1
Egyptian Nightjar	<i>Caprimulgus aegyptius</i>			1				
Eurasian Roller	<i>Coracias garrulus</i>		2	5	2			
European Bee-eater	<i>Merops apiaster</i>	16	7		16			
Blue-cheeked Bee-eater	<i>Merops persicus</i>		80	45	26	16		

Hoopoe*	<i>Upupa epops</i>	2	1	3	1			
Barn Swallow	<i>Hirundo rustica</i>	14	39	18	16	5		
Crested Lark*	<i>Galerida cristata</i>	62	53	22	32	10	12	16
Short-toed Lark	<i>Calandrella rufescens</i>	8	11	4	22	45	71	
White-winged Lark	<i>Melanocorypha leucoptera</i>							30
Greater Hoopoe-lark	<i>Alaemon alaudipes</i>		4					
Yellow Wagtail	<i>Motacilla flava</i>				1			
White Wagtail	<i>Motacilla alba</i>				2		2	
Pied Wagtail	<i>Motacilla personata</i>						3	
Isabelline Shrike	<i>Lanius isabellinus</i>	1						
Great (Gray) Shrike	<i>Lanius excubitor</i>	1		3	2	1		
Steppe Grey Shrike	<i>Lanius pallidirostris</i>			4	4	1	2	
Pander's Ground-Jay*	<i>Podoces panderi</i>		1				1	2
Jackdaw	<i>Corvus monedula</i>						29	
Rook	<i>Corvus frugilegus</i>	1				21	93	74
Carrion Crow*	<i>Corvus corone</i>						4	4
Brown-necked Raven*	<i>Corvus ruficollis</i>				4	2		
Common Whitethroat	<i>Sylvia communis</i>	1						
Lesser Whitethroat	<i>Sylvia curruca</i>					1		
Desert Warbler	<i>Sylvia nana</i>		6	2	4			
Chiffchaff	<i>Phylloscopus collybita</i>	2				1		
Streaked Scrub Warbler*	<i>Scotocerca inquieta</i>	12	7	1	3	3	1	
Spotted Flycatcher	<i>Muscicapa striata</i>	1						
Common Stonechat	<i>Saxicola maurus</i>	4						
Northern Wheatear	<i>Oenanthe oenanthe</i>		4		4	2		
Black-necked Wheatear	<i>Oenanthe finschii</i>	6	11	7	7	2	2	2
Desert Wheatear	<i>Oenanthe deserti</i>	1	4	3	2	1		
Isabelline Wheatear	<i>Oenanthe isabellina</i>	16	22	11	20	4	6	6
Rufous-tailed Rock Thrush	<i>Monticola saxatilis</i>	1						
Indian Sparrow	<i>Passer indicus</i>	21	56	16	27	18	18	
Chaffinch	<i>Fringilla coelebs</i>							9
Desert Finch*	<i>Rhodospiza obsoleta</i>	8	38		11	5	16	
Common Rosefinch	<i>Carpodacus erythrinus</i>	5						
Total birds		292	407	173	272	173	301	197
Total species		28	27	20	28	26	21	15

Note: *-resident species

Survey results show that distribution of species across the surveyed sections is quite uniform. 57 bird species were observed during the surveys, 13 of them are resident. Representative species for the entire line route were Crested Lark, Isabelline Wheatear, Black-necked Wheatear, Streaked Scrub Warbler and Desert Finch.

The number of observed birds was higher in June, which could be explained by the end of the nesting period in small passerines, appearance of juveniles and less hidden way of life.

From rare species Egyptian vulture, Short-toed eagle, Houbara bustard and Eurasian roller were observed during the survey (table 4).

Table 4. Distribution of the threatened species on a project territory.

Species	Status	Observation place (VP)						
		may	jun	jul	aug	sep	oct	nov
Short-toed Eagle <i>Circus gallicus</i>	UzRDB -VU	AA						
Steppe Eagle	UzRDB-VU,					VP5		

<i>Aquila nipalensis</i>	IUCN - EN							
White-tailed Sea eagle <i>Haliaeetus albicilla</i>	UzRDB-VU						VP10	
Egyptian Vulture <i>Neophron percnopterus</i>	IUCN-EN, UzRDB-VU	VP 7	VP1, K	VP2, VP4-5	VP3, VP9			
Houbara bustard <i>Chlamydotis undulata</i>	UzRDB-VU, IUCN - VU	AA	D					
Eurasian Roller <i>Coracias garrulus</i>	IUCN - NT		VP10	VP6, VP9	VP8			

Note: AA – Ayakagitma Lake, D – Dzhankeldy plot, K – Kalaata village

Among the mentioned species, Houbara Bustard is the most vulnerable, as there are nesting sites for this species in the immediate vicinity of the proposed OHTL. Details on Houbara Bustard nesting, potential impacts and mitigation measures are presented in HB survey report.

Short-toed and Steppe Eagles are trophic migrating species and are not directly associated with the area.

Eurasian roller and Egyptian vulture usually nest on cliffs, no nesting sites of these species were identified in the project area. Egyptian vultures observed in spring and summer can be both nesting individuals in the Kuldjuktai massif and nonbreeding nomadic individuals.

The locations where the endangered bird species were observed are presented in Figure 5.

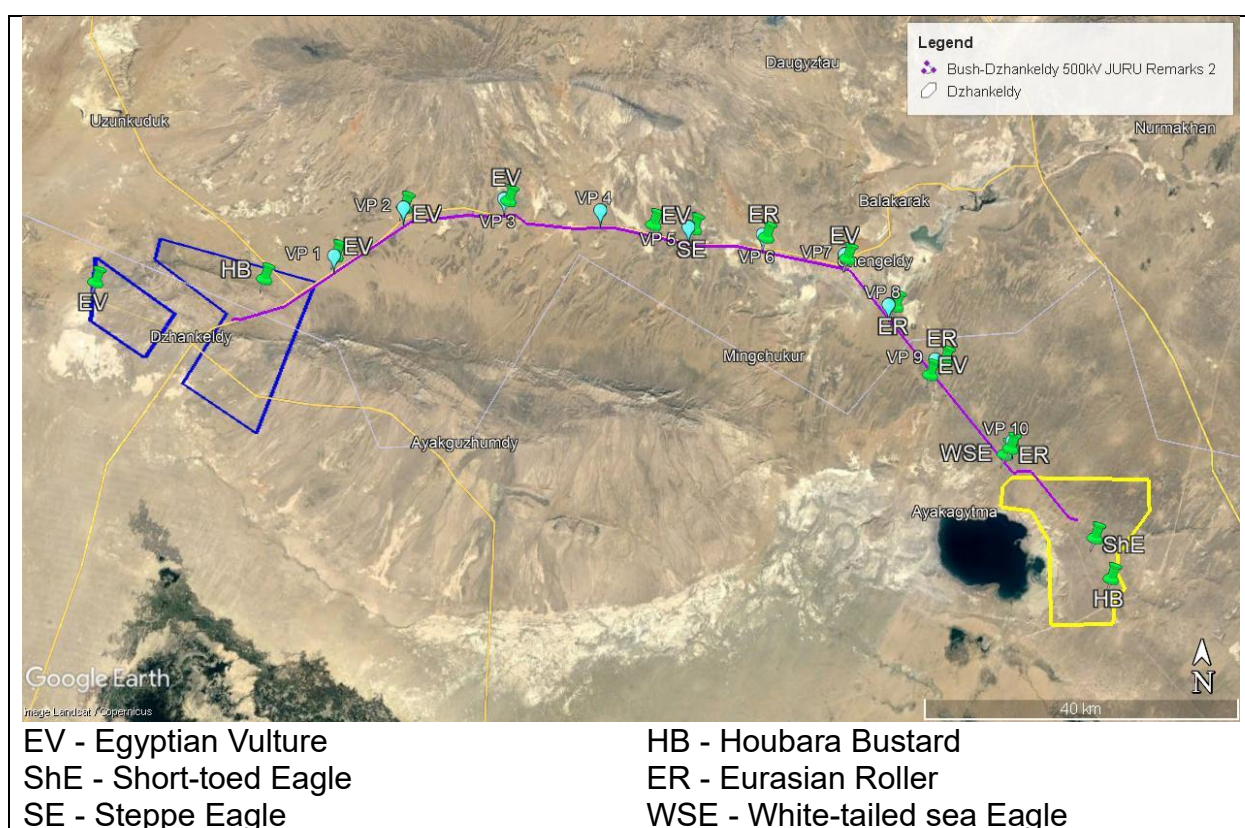


Figure 4. Locations of observation places of endangered species of birds in 2021.

Other species are common inhabitants of the Kyzylkum desert and widely distributed throughout the adjacent territory. No critical habitats (of special importance for nesting or feeding for the rare and other bird species) were identified.

Collection of dead birds under operating OHTL

At the same time with the visual observations of birds in selected locations along the project route, route surveys were conducted along existing and already operating OHTL located near the route. The aim was to collect dead birds and their remains under OHTL wires and towers to assess bird mortality on operating OHTL.

Sections of existing OHTL located in the immediate vicinity of the project line route were surveyed to find remains of dead birds under them (Table 5, Figure 4).

Table 5. Schedule for surveying sections of existing OHTLs in the project area.

Date	Route length (km)	Section	Coordinates of route beginning	Coordinates of route end	Dead birds found*
28.03.2021	12	Dzhankeldy-Kalaata	40°50'41.02"N 63°19'54.91"E	40°53'39.54"N 63°10'39.49"E	2
18.04.2021	12	Dzhankeldy-Kalaata	40°50'41.02"N 63°19'54.91"E	40°53'39.54"N 63°10'39.49"E	none
14.05.2021	12	Dzhankeldy-Kalaata	40°50'41.02"N 63°19'54.91"E	40°53'39.54"N 63°10'39.49"E	1
21.05.2021	12	Dzhankeldy-Kalaata	40°50'41.02"N 63°19'54.91"E	40°53'39.54"N 63°10'39.49"E	1
20.06.2021	12	Dzhankeldy-Kalaata	40°50'41.02"N 63°19'54.91"E	40°53'39.54"N 63°10'39.49"E	none
22.07.2021	17	VP9-VP10	40°42'54.61"N 64°35'34.16"E	40°50'35.88"N 64°28'10.35"E	1
19.08.2021	17	VP9-VP10	40°42'54.61"N 64°35'34.16"E	40°50'35.88"N 64°28'10.35"E	none
22.09.2021	17	VP9-VP10	40°42'54.61"N 64°35'34.16"E	40°50'35.88"N 64°28'10.35"E	none
11.10.2021	17	VP9-VP10	40°42'54.61"N 64°35'34.16"E	40°50'35.88"N 64°28'10.35"E	none
15.11.2021	17	VP9-VP10	40°42'54.61"N 64°35'34.16"E	40°50'35.88"N 64°28'10.35"E	none

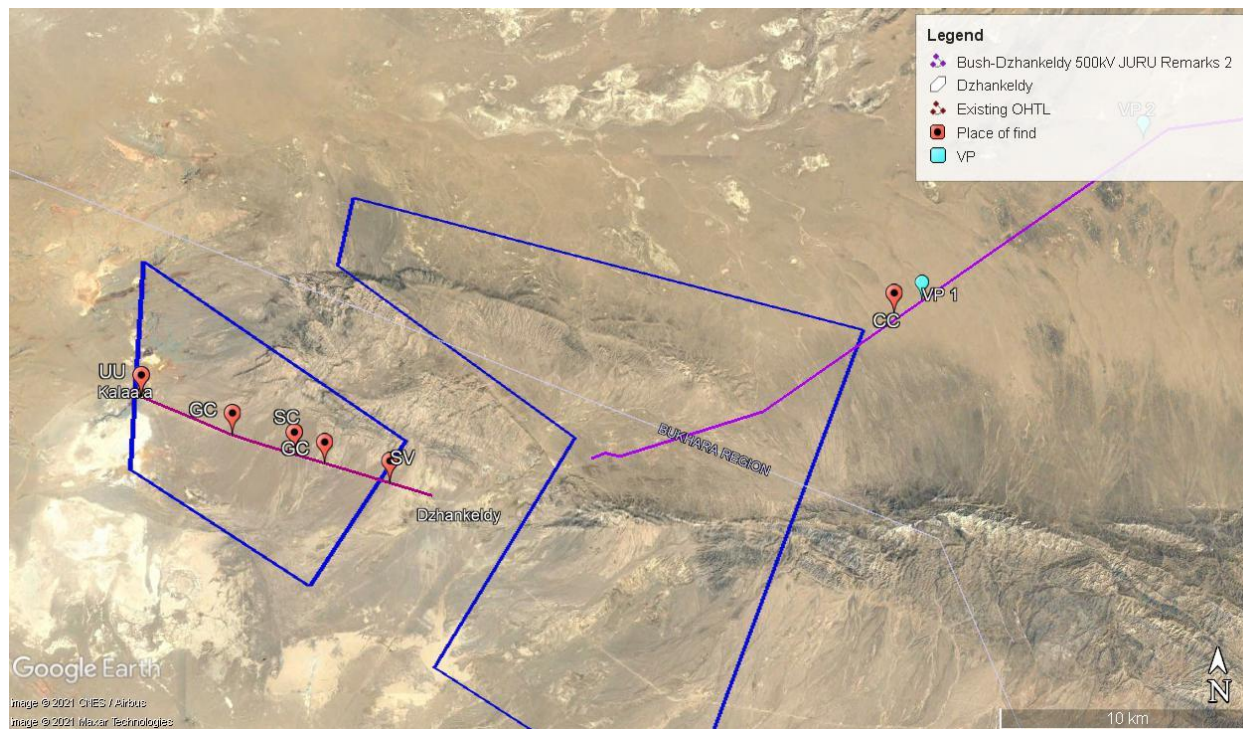
*- see Table 6

During the survey in 2021 the remains of 7 dead birds belonging to 6 species were found.

Table 6. List of dead birds found under operating OHTLs

№	Latin name	English name	Number of birds	Coordinates	Date
1.	<i>Upupa epops</i>	Hoopoe	1	N 40°53'36.11", E 63°10'57.38"	28.03.2021
2.	<i>Galerida cristata</i>	Crested lark	1	N 40°52'48.69", E 63°13'29.85"	21.05.2021
3.	<i>Galerida cristata</i>	Crested lark	1	N 40°52'12.47", E 63°16'4.17"	28.03.2021
4.	<i>Sylvia curruca</i>	Lesser Whitethroat	1	N 40°52'24.79", E 63°15'13.56"	14.05.2021
5.	<i>Sturnus vulgaris</i>	Common Starling	1	N 40°51'49.03", E 63°17'53.28"	28.03.2021

6.	<i>Buteo rufinus</i>	Long-legged Buzzard	1	N 40°48'16.52", E 64°30'24.89"	22.07.2021
7.	<i>Coturnix coturnix</i>	Common Quail	1	N 40°55'22.52" E 63°31'51.15"	12.10.2011



UU – Hoopoe CG - Crested lark
CC- Common Quail

CS - Lesser Whitethroat
SV – Common Starling



Figure 4. Locations of the dead birds.

The species found dead are widespread in the Kyzylkum desert and do not have any conservation status. The presumed cause of death for small passerines and the quail was collision with OHTL wire, for the Long-legged Buzzard – electrocution. Observed

sectors of the operational OHTLs were situated parallel to the Project OHTL. So it can be supposed, that the Project OHTL will be dangerous for birds and will require some protective measures like protective cases and markers.

ANALYSIS OF IMPACTS AND MITIGATION MEASURES

Power lines are a threat to migrating, nesting and wintering birds during their migration from feeding to resting places. During migration, this threat is greatly increased due to the accumulation of different bird species.

For some species (Falconiformes), the death from collision with OHTL or electrocution is higher than for others.

The impact of these threats can be mitigated through the development of appropriate measures.

Table 5. Analysis of impacts on ornithological fauna and mitigation measures for construction and operation of the Project OHTL

	Impacts:	Mitigation measures:
1	Loss of habitat as a result of construction works.	Strict compliance with the boundaries of land allotted for construction. Minimization of noise impact. Using only existing/constructed roads, control over vehicle traffic. Performing construction works during the non-breeding period. Carrying out land reclamation upon completion of works.
2	Pollution of the territory by construction and household waste. Spreading of Myna over the territory. Reduction of species and quantitative composition of desert species.	Organization and control over the timely collection and disposal of construction and household waste.
3	Disturbance of animals caused by the presence of people, moving vehicles, machinery work.	Strict compliance with the boundaries of land allotted for construction. Minimization of noise impact. Using only existing/constructed roads, control over vehicle traffic and people movements. Performing construction works during the non-breeding period. Limiting visits to bird habitats by construction and operating staff; Informing personnel about the need to preserve biodiversity.
4	Electrocution when birds use OHTL towers for nests and as roost sites (resting places).	Installation of protection cases that exclude electrocution of birds sitting on OHTL towers. Control the integrity of the insulation and installed cases.
5	Injury and death due to physical collision of birds with OHTL wires.	Equipping OHTLs with markers to ensure their visibility to birds. Control the integrity of the installed markers.

RECOMMENDED MEASURES FOR CONSERVATION OF ORNITHOLOGICAL FAUNA

- Obligatory ecological expertise of all project decisions;
- Establishment of a protection zone of at least 1 km around Lake Ayakagitma during the design and construction of all facilities in order to reduce disturbance of waterfowl inhabiting the water-body and preservation of their nesting and feeding places.
- Installation of protection boxes on OHTL towers to prevent accidental electrocution of birds on power lines.

- Installing signal markers on OHTLs in order to reduce bird mortality due to collisions with OHTL wires (markers warn birds of the danger and serve as a signal to change the altitude or direction of flight, thereby preventing collisions of birds with wires).
- Awareness of contractor personnel of vulnerable species of flora and fauna encountered in the project area and in need of protection;
- Regular ornithological monitoring (for example 4-6 times a year according to birds biological cycles) on project territories to identify and minimize potential adverse impacts during construction and operation of OHTLs and develop mitigation measures in a timely manner.
- Annual analysis of operational activities in the project area in order to identify potential negative impacts on biodiversity and implement appropriate corrective actions.

In general, the expected environmental impacts resulting from Project activities in the Dzhankeldy-Bash OHTL area will be of local nature, not exceeding the boundaries of the allotted areas. It is expected that the anthropogenic impact will not exceed the regenerative potential of the ecosystem.

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APPENDIX 1

Habitat's description.



VP 1 - Fixed sands. Artemisia, harmala. A place for livestock watering.



VP 2 - Fixed sands. *Artemisia*. Individual saxaul bushes.



VP 3. Sandy desert. *Artemisia*, saxaul.



VP 4 - Fixed sands, the dominant vegetation is *Artemisia terrata*. Two small takyr and between them an area of unfixed sands with several small barchans (sandhills). Sheep cote





VP 5 - Fixed sands. Artemisia



VP 6 - Fixed sands. Takyr on both sides of the asphalt road.



VP 7 - Clay desert, hills. Small cliffs.



VP 8 - Sandy desert with well-developed vegetation. Saxaul, Calligonum, Ferula, etc. The Karakata Depression is visible.



VP 9 - Sandy desert with clay areas. Two active power lines, railway.



VP 10 - Sandy desert with clay areas. Two active power lines, presumably 220 kV. Concrete and anchor poles. The Common Kestrel nests on concrete poles. The poles are also used as sitting point by other large predators. Under one of the poles were found pellets containing hair and bones of rodents, as well as fish scales.



VP 11 - Fixed sands. In the immediate vicinity of the point, there are two operating power lines, with a capacity of presumably 220 kV. Concrete and anchor poles. On a concrete support, the nest of a Common Kestrel.

There is an old nest of a large predator on an anchor pole close to Ayakagitma Lake. Judging by scattered tortoise shells and hedgehog skins, it was a nest of a Golden Eagle. At the time of the survey, Indian sparrows were nesting in the remains of the nest.

Bat roost search

Report Title	<u>Bat roost search</u>
Scope	BAT ROOST SEARCH
Areas Covered	DZHANKELDY TO BASH OHTL
Seasons Covered	SPRING 2021 / SUMMER 2021
Notes	

Bat roost search



PLANNED DZHANKELDY-BASH OHTL

CLIENT: 5 CAPITALS

Date: July 2021

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INTRODUCTION

Bats (*Chiroptera*) are the only mammals that have mastered active flight. Together with birds, these are the only modern vertebrates that have inhabited the air environment. Bats are the second largest order of mammals in Uzbekistan. At the moment, there are 21 species of Bats known in Uzbekistan, however, this order is the least studied, especially in remote desert areas.

This report contains the results of the field survey carried out along planned Dzhankeldy-Bash OHTL route along the north-eastern part of the Ayakagytna lake to the north-western part of the Kuldzhuktau ridge. Field visits was carried out on June 19, 20, 24 25, 2021.

The main purpose of the expedition was to confirm the presence/absence of bats in potential roosting places identified based on topographic and literary material. In case of bats location, it was planned to determine the species, their number and reproductive status (breeding/non-breeding individuals), the presence of brood colonies.

MATERIALS AND METHODS

The survey methodology consisted of two stages:

Desktop preparation, which was an analysis of detailed topographic maps of the area (scale: 1:100 000, 1:200 000) and Google Earth satellite images. The maps identified the locations (GPS coordinates) of potential bat roosts – caves, mines/tunnels, human buildings, wells, cattle cotes. Those locations were then transferred to the LocusPro smartphone application for further use in the field. A total of 16 places were identified for the survey at this stage.

Field work included a survey of potential roosts identified during the desktop stage. When a roost was found, it was thoroughly examined, both for the presence of bats themselves, and for signs of their presence – excrement, food remains (insect wings, legs, etc.). In addition to pre-identified roosts, during the field survey the most used bats roosts were found – the draining tunnels under the roads. These are concrete or iron structures (the latter are not used by Bats) of various sizes and shapes, laid under highways or railway tracks, in order to divert mudflows from the residual mountains during seasonal precipitation.

Each surveyed object was mapped, photographed, its brief description was made, including notes on the suitability of the objects for bats as either a temporary roost or a permanent one, notes on the potential degree of disturbance/threat. Where necessary the height, width and length of the roost were measured. In case of detection of Bats, the surface temperature was measured. All the draining tunnels examined in spring were re-examined in summer. We also examined areas that go beyond the project territory, because bats fly long distances (up to several kilometres) from their roosts in search of food.

When Bats were detected, their species, gender, age and number were determined. Species identification was carried out according to generally accepted methods (Kuzynkin, 1950; Bogdanov, 1953; Dietz, von Helversen 2004). The captured bats were examined, photographed and immediately released in the places of capture. We discovered two bat species - Ognev's serotine bat (*Eptesicus bottae ognevi*) and Common pipistrelle bat (*Pipistrellus pipistrellus*).

In total, 419 km were covered by survey transects, 39 potential roost places were examined.

Equipment

To navigate the terrain and record tracks, a smartphone (*BV9900E*) was used with the *LocusPro* application installed, with preloaded *Google Hybrid* and *Marshruty.ru* maps. Two binoculars were used to view the area: Nikon Aculon 10x42 and *Nikon Prostaff 7S 10x42*.

Photographing was carried out using smartphones (*BV9900E*) and *MIUI REDME 5+*, as well as two SLR cameras: *Nikon D3200* with a *Nikkor 18:200* lens and *Nikkon D3200* with a *Nikkor 50 mm* lens.

The following equipment was used for the examination of bat roosts: a torch (*Fenix HP30R*) (2), cloth bags (2), thick gloves (2), forceps (2), a tape measure (1), a surface electronic thermometer *TFA* (1), an electronic scale *SF-400* (1), a *Digital caliper 0-150 mm* caliper (1).

All the collected information was recorded in a notebook, the surveyed roosts and bats registration locations were mapped in the *LocusPro* smartphone application.

GEOGRAPHICAL FEATURES OF THE STUDIED AREA

The Kuldzhuktau Mountains, as well as the adjacent plain, are located in the Kuldzhuktau-Tamdytau district of the Kyzylkum district of the plain sub-province of the Turan province. The total length of the Kulzhuktau residual mountains is about 100 km, the width is 15 km, the maximum height is 785 m. The southern slopes are gentle, dissected by dry canyons; the northern ones are rocky and steep. The Kuldzhuktau mountains are composed mainly of crystalline shists and limestones; along the outskirts there are Jurassic, Cretaceous and Paleogene sedimentary strata, on the surface of which there are sifted sands.

There is no rain in the summer. The springs are few. On the foothill plain there is a gravelly desert with wells and artesian boreholes, the water is usually brackish or bitterly salty (Fig. 1).

Ayakagytna Lake is located in the Agytna depression, in the southern part of the Kyzylkum desert to the southeast of the ridge. Agytna depression's length is 35 km, width is 15 km, and surface area is 600 km². The minimum absolute height of the bottom is 133 m. The sides of the depression are smooth and steep (chinks). The bottom is a desert landscape with an extensive salt marsh. In the center of the depression there is a salt lake measuring 15x10 km. The lake is replenished with water through a collector from the Zarafshan River (Fig. 1).

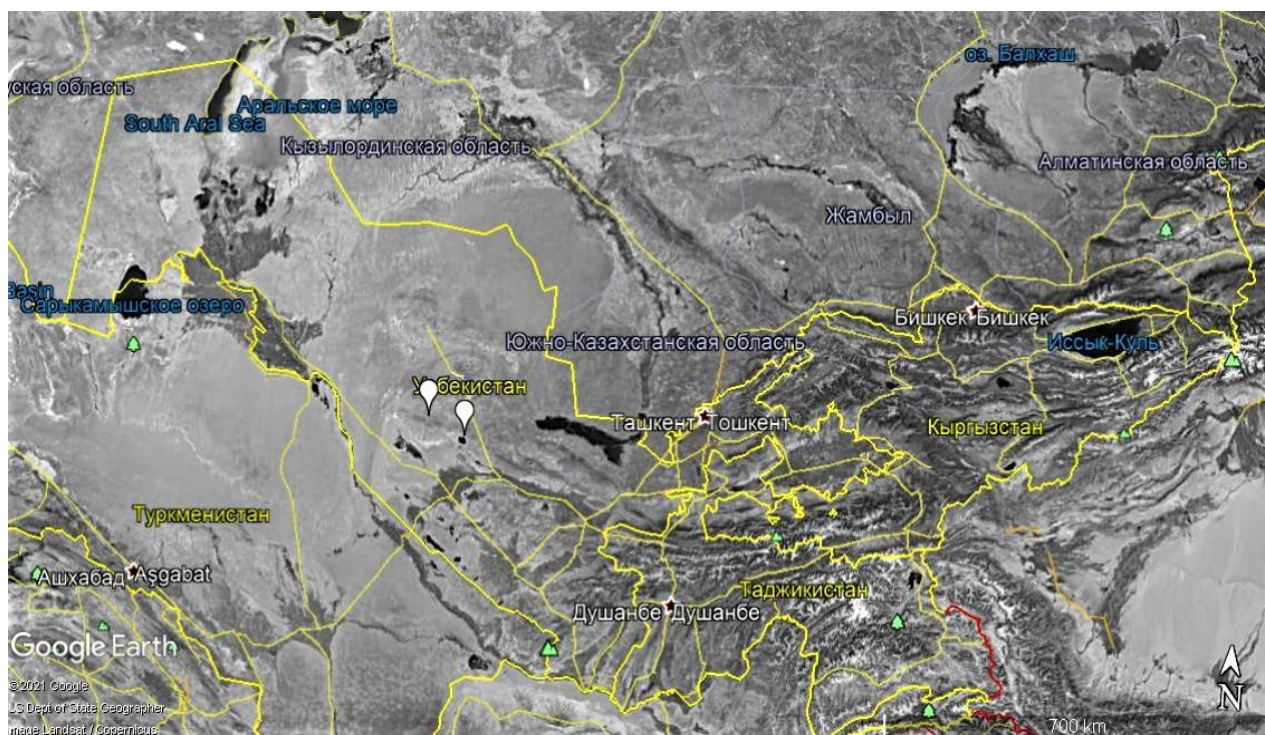


Figure 1 The location of the proposed power line in the context of Uzbekistan

The proposed power line with a total length of 128.5 km stretches from Zafarabad, along

the north-eastern part of the Ayakagytna lake to the north-western part of the Kuldzhuktau ridge (Fig. 2).



Figure 2 Location of the proposed power line

RESULTS

All the potential bat roosts in the studied region are anthropogenic – the draining tunnels under the roads, wells, sheep cotes, abandoned buildings (farms, small settlements), residential buildings in villages. We did not find bats in natural roosts. In total, two species of bats were discovered – Ognev's serotine bat (*Eptesicus bottae*) and Common pipistrelle bat (*Pipistrellus pipistrellus*).

A total of 39 potential habitats were visited, some of which were a complex consisting of an abandoned house and a hut, a house and a well, abandoned village etc. Thus, 32 potential roosts were examined, including draining tunnels under the roads (31), wells (1), shepherd huts/houses (4), residential buildings (1), abandoned school (1), abandoned settlements (1). The presence of bats was noted in 10 roosts; and according to the consultations with local residents one surveyed location bats use for wintering (Fig. 3).

In Appendix 1, all the potential roosts visited during the field trip are described in detail.

All the examined potential roosts were divided according to the degree of suitability for bats (Table 1):

1. 14 potential roost locations are **completely unsuitable** – these include metal draining tunnels under the roads that are heated under the sun in summer, and are excessively cooled if used in winter; as well as monolithic concrete draining tunnels without any cracks or the with cracks smoothed after repair work.
2. **Potentially used as short-term roosts:** these are mainly houses, wells and draining tunnels with shallow crevices (10 locations).
3. In the case of the Chintanbai village, where there are buildings with a lot of deep cracks, the buildings can be used both as temporary roosts and for breeding colonies (2 locations, 32 potential roosts).
4. **Roosts suitable for breeding** offspring (17 locations) are draining tunnels with deep crevices and houses (10 locations).
5. And, according to the consultations with local residents, one location is a **wintering roost**.

It is not known how much draining tunnels bats use in winter, but most likely, because of low temperatures, the concrete cools down significantly, which is not an acceptable condition for wintering.

Thus, 23 roosts turned out to be actually suitable for bats.

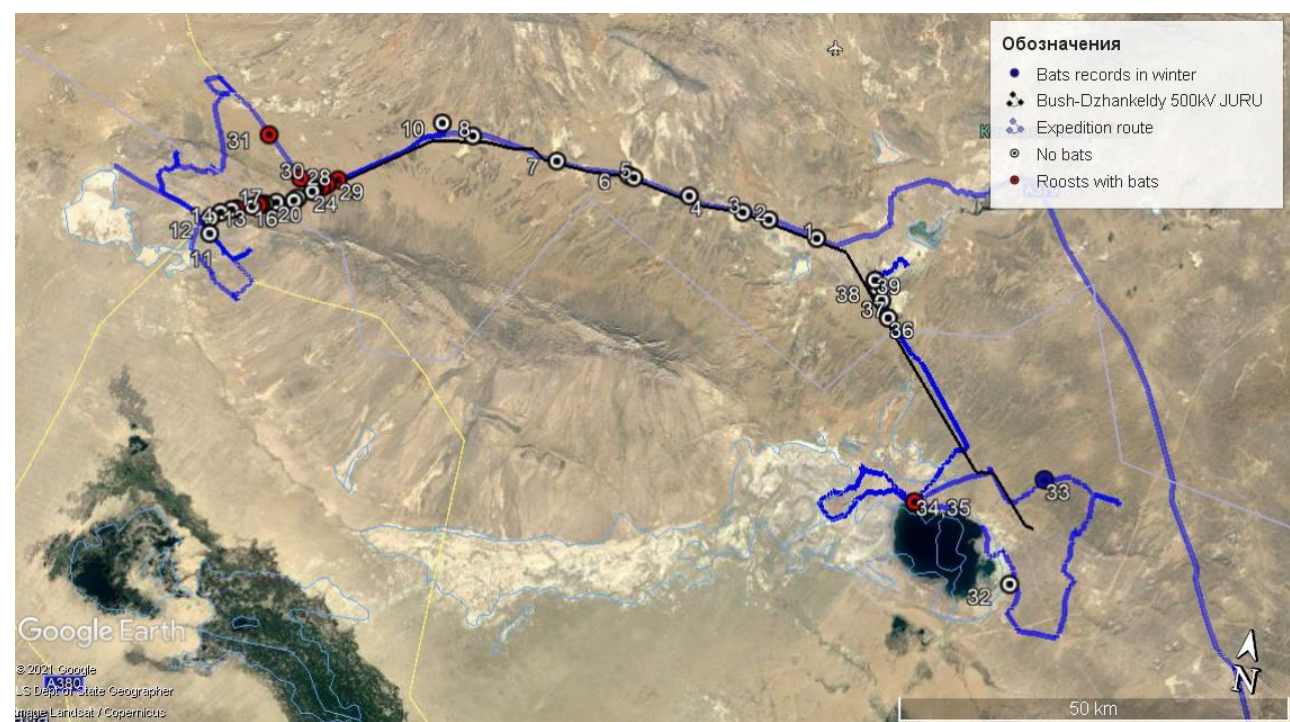


Figure 3. Surveyed areas and the presence of bats

Table 1 Assessment of the suitability of the surveyed roosts for bats***

Roost №	The degree of suitability for bats*	Degree of distress**
1	2	2
2	1	1
3	1	1
4	1	1
5	1	1
6	1	1
7	1	1
8	1	1
9	4	2
10	4	2
11	2	2
12	2	2
13	3	2
14	1	1
15	4	2
16	2	2
17	3	2
18	3	2

19	2	2
20	2	2
21	5	5
22	1	1
23	3	1
24	2	1
25	1	1
26	3	2
27	2	2
28	3	2
29	3	2
30	3	2
31	2	2
32	2	2
33	5?	4
34	3	1-2
35	3	1-2
36	1	1
37	1	1
38	1	1
39	1	1

Notes:

**1 – not suitable; 2 - places potentially used as temporary roosts; 3 - roosts suitable for breeding offspring; 4 – roosts suitable for wintering; 5 – absence/ presence is not known.*

*** 1-absent; 2-low; 3-average; 4-high; 5 - not known (given at the time of the survey).*

**** The numbering in table 2 corresponds to the number of roosts in Appendix 1.*

The level of existing anthropogenic threats in the studied territory has a different character, depending on the habitat. It is noted that the cracks used by bats are covered up in the draining tunnels during scheduled repair work. In villages, people sometimes purposefully destroy colonies and individual animals, sometimes anxiety occurs during repair work.

More detailed information on two species of bats recorded in the project territory is presented below.

Ognev's serotine bat

Ognev's serotine bat (LC, IUCN) is a widespread, but naturally small in numbers species in the studied region. Ognev's serotine bat is listed in the Red Book of Tajikistan (2015).

Ognev's serotine bat was observed only in the draining tunnels under the roads in the surveyed territory. We examined a total of 31 draining tunnels under the roads, bats were found in 4 tunnels, excrement in 5 tunnels, 11 tunnels appeared to be not suitable due to the lack of cracks and the metal structure (heated under the high temperatures). The remaining tunnels were suitable for bats, but apparently due to the naturally low density of these species are not yet inhabited (Fig. 7) All registered Ognev's serotine bats were found in the western part of the studied territory (*more detailed information on each tunnel is given in Appendix 1*).

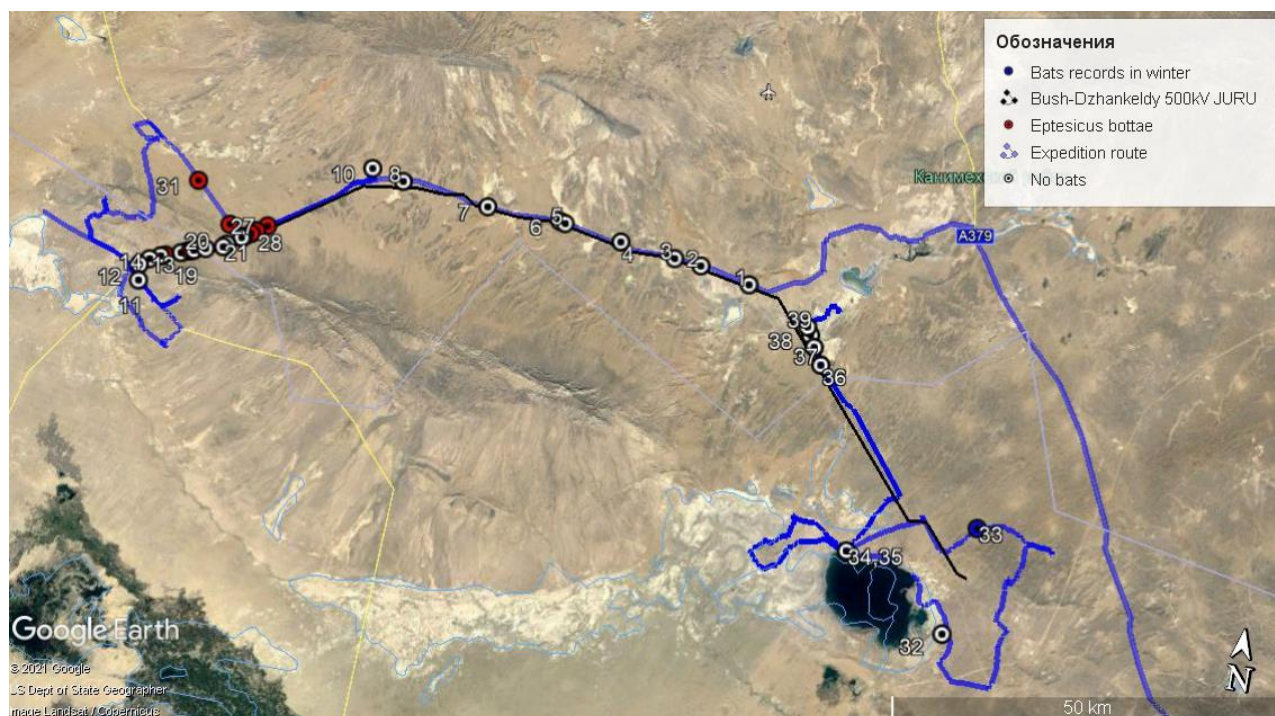


Figure 4. Places of registration of Ognev's serotine bats

In total, 35 Ognev's serotine bats were recorded, including 32 females and 3 males. Each draining tunnels was numbered by us (Fig. 4, Appendix 1). Table 3 shows the data on the gender and age composition of bats in each draining tunnel. From the collected data, it becomes obvious that breeding females keep separate colonies, males keep alone. The surface temperature inside the draining tunnels, even on the hottest days (up to 45° C), remains within the range of 31-35°C.

Table 2 Gender and age composition of Ognev's serotine bats in each surveyed draining tunnel

Draining tunnel №	♂	♀	Gender is not known	The presence of excrement	The surface temperature t°C	Comments
15	1	-		+	31	
17	-	-		+	32	
18	1	-		+	31	
26	-	-		+	33	Social signals of several animals
27	-	-		+	32	Excrement, apparently of a single bat
28	1	-		+	34	Numerous excrements, possibly the roost of several individuals
29	-	-		+	34	Bats' excrement. The bats themselves are not visible, due to the depth of the cracks
30	-	32		+	33	The females were pregnant, which was determined by palpation of the captured individuals
31	-	-		+	32	Single bat excrement. Apparently a rare visit. The animals themselves are not visible.

An obvious anthropogenic threat to Ognev's serotine bats is the regular repair work of draining tunnels, as a result of which the cracks inhabited by this species are smoothed. No other obvious anthropogenic threats were noted.

In general, the Ognev's serotine bat is a regularly occurring but naturally small in numbers species on the studied territory.

Common pipistrelle bat

Common pipistrelle bat (*Pipistrellus pipistrellus*) is one of the most common and widespread species of Uzbekistan (LC, IUCN), whose roosts are mainly confined to human buildings.

In Uzbekistan, according to literature data, the majority of male bats stay alone and disperse over a wide area in summer, while females form large colonies, which become obvious due to continuous squeaking (Bogdanov, 1953).

We found colonies of Common pipistrelle bats in the village of Ayakagytna (Fig. 8). We had an opportunity to inspect a residential building with the permission of the owner. Bats settled in the cracks of the window frames; when approaching, social squeaks were heard from afar and a significant accumulation of excrement was noted on the window sills. We managed to extract two individuals, which turned out to be females. It was impossible to extract the remaining bats without breaking out the frames, since the frame slots were very narrow. Given the manner of female Common pipistrelle bats to create separate colonies in summer, it was most likely a brood colony of females. The number of individuals, judging by the squeaks and the amount of excrement, was at least 30 individuals, probably more. The owner said that bats have been inhabiting the frames of their house for about 25 years.



Figure 5 Places of registration of the Common pipistrelle bat

The second building we examined in the village was an abandoned school. The window frames were examined. Visually, 17+7+4+6 bats were observed (34 individuals in total).

All captured bats appeared to be males. Definitely, the number of bats was much larger, since most of them were impossible to extract for examination. An inspection of the inner part of the school building was carried out. There was a significant accumulation of excrement of different sizes, which indicates the presence of at least two species of bats. All roosts were inaccessible for examination however.

Most likely, Common pipistrelle bat and other bat species inhabit most of the houses in the village, where there are suitable roosts, but it is necessary to enlist the support of the village authorities for inspection. In addition, there is a possibility that our actions may lead to the destruction of the colonies by local residents.

CONCLUSIONS

Our survey along planned Dzhankeldy-Bash OHTL, was carried out during the most important period in bats' life – pregnancy and breeding. This allowed us to obtain information on the biology of two species present in the project area – Ognev's serotine bat and Common pipistrelle bat.

As a result of the field visit, a significant area with 39 potential roosts was surveyed. 23 roosts turned out to be suitable for bats.

The level of existing anthropogenic threats in the studied territory is associated with human activity. The most significant threats are: the planned repair work in the draining tunnels under the roads, when the cracks that are used by the Ognev's serotine bats are being smoothed; and the destruction of bat colonies in residential settlements both purposefully and accidentally.

In general, the bats population density on the project territory is quite low, which is due to the harsh desert conditions and limited places of permanent roosts, which are mostly human buildings. Thus, the development of the desert territory and the development of infrastructure significantly affected the bats population. This issue needs to be studied in more detail.



RECOMENDATIONS


1. Conduct a survey of residential buildings in the village of Ayakagitma (with support from the mahalla committee), in which additional bat species can be identified;
2. Conduct a winter survey for the presence/absence of bats;
3. Conduct operational bat monitoring after the completion of the construction of the OHTL, especially during the period of seasonal migrations and breeding;
4. If monitoring is organized on the territory, it is necessary to organize the collection of Bat genetic material. For this purpose, it is necessary to obtain all permits from the State Committee of Ecology and the Academy of Sciences of the Republic of Uzbekistan.




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Appendix 1. The results of the potential bat roosts survey along planned Dzhankeldy-Bash OHTL and adjacent areas



No	N	E	Type of roost	Description	Presence/absence of bats	Photo
1	40,95084	064,27527	Concrete, partly iron draining tunnel under the road	Length 14 m, height 1 m. Double tunnel. Can be used as a temporary roost, not suitable for breeding and colonies.	Not detected	
2	40,96318	64,19725	Concrete, monolithic draining tunnel under the road	Length 6 m, height 130 cm. There are no suitable cracks.	Not detected	



3	40,96651	64,15542	Concrete, monolithic draining tunnel under the road	Length 6 m, height 130 cm. There are no suitable cracks.	Not detected	
4			Metal draining tunnel under the road	Not suitable as a roost	Not detected	
5	40,98539	63,979445	Metal draining tunnel under the road	Not suitable as a roost	Not detected	



6	40,98713	63,97076	Ruins and a well	The well is covered with mesh. There are no suitable cracks in the ruins. Not suitable as a roost	Not detected	 
7	40,98933	63,85701	Ruins	Old abandoned shepherd's hut Not suitable as a roost	Not detected	



8	41,00164	63,72103	Seasonal shepherd's hut	A concrete building used seasonally. There are no suitable craks. Not suitable as a roost	Not detected	
9	40,99816	63,67691	Chantanbay village	More than 20 ruined buildings, many cracks that are poorly visible. Suitable as a temporary roost, possibly permanent.	Not detected	

10	41.010657	63.670492	Chantanbay village	Mine galleries/shafts marked on the map were not found. There are buildings, suitable as a temporary roost, possibly permanent.	Not detected	
11	40,83426	63,34865	Concrete, draining tunnel under the road	Length 10 m, height 1 m. There are cracks, however not particularly deep. Can be used as a temporary roost, not suitable for breeding and colony.	Not detected	



12	40,85246	63,34482	Concrete, draining tunnel under the road	Length 12 m, height 115 m. There are suitable cracks, for temporary roost, not suitable for breeding and colony.	Not detected	
13	40,86101	063,35874	Concrete, draining tunnel under the road	Half-filled with debris flow. Length 13 m, height 80 cm. There are suitable deep cracks, suitable for breeding and colony.	Not detected	



14	40,86660	63,37482	Concrete, draining tunnel under the road	Filled with debris flow. Length 12 m, height 68 cm. There are almost no cracks. The existing ones are very narrow. Not suitable as a roost.	Not detected	
15	40,868440	63,38194	Concrete, draining tunnel under the road	Half-filled with debris flow. Length 13 m, height 93 cm. Suitable cracks for temporary roost.	1♂ <i>Eptesicus bottae</i> .	

16	40,87438	63,40488	Concrete, draining tunnel under the road	Half-filled with debris flow. Length 12 m, height 70 cm. There are suitable cracks at the joints of the blocks. The drain is surrounded by masonry, which also has cracks. Suitable as a temporary roost.	Not detected	
17	40,87760	63,41453	Concrete, draining tunnel under the road	Length 8 m, height 150 cm. Very deep cracks, possible presence of bat, as the cracks are not seen all the way through. Good roost, suitable for breeding.	A large quantity of excrement, probably bats were deep in the cracks.	



18	40,87843	63,41849	Concrete, draining tunnel under the road	Length 8 m, height 125 cm. Very deep cracks.	1♂ <i>Eptesicus bottae</i>	
19	40,87972	63,42350	Concrete, draining tunnel under the road	Length 8 m, height 130 cm. Suitable cracks for temporary roost.	Not detected	



20	40,88407	63,44077	Concrete, monolithic draining tunnel under the road	Length 8 m, height 93 cm. There is one suitable crack as a roost	Not detected	
21	40,88967	63,46703	Concrete, draining tunnel under the road	Length 8 m, height 77 cm. Very low, it is not possible to observe.	Not detected	



22	40,89353	63,47197	Concrete, draining tunnel under the road	Length 13.5 m, height 1.50. All cracks covered. Not a roost.	Not detected	
23	40,89524	63,47513	Concrete, draining tunnel under the road	Length 12 m, height 120 cm. There are numerous cracks, including deep ones. Good roost, suitable for breeding.	Not detected	



24	40,90385	63,49206	Concrete, draining tunnel under the road	Length 12 m, height 130 cm. There are suitable cracks for temporary roost.	Not detected	
25	40,90493	63,49377	Iron, draining tunnel under the roads	Not suitable as roost	Not detected	



26	40,90575	63, 49516	Concrete, Iron, draining tunnel under the road	Length 12 m, height 150 cm. Very deep cracks, not visible. Suitable for breeding.	There are bat excrement and social signals can be heard from several individuals.	
27	40,91068	63,50550	Concrete, draining tunnel under the road	Length 12 m, height 90 cm. There are cracks between the joints of the plates.	Excrement, probably of one bat individual	

28	40,91511	63,51283	Concrete, draining tunnel under the road	Length 16 m, height 150 cm. Very deep cracks, poorly visible. Suitable for breeding.	1♂ <i>Eptesicus bottae</i> There may be more bats, as indicated by a rather large amount of excrement of varying freshness	
29	40, 922764	63.528022	Concrete, draining tunnel under the road	Length 18 m, height 90 cm. Very deep cracks, poorly visible. Suitable for breeding	Bat excrement. The bats are not visible, due to the depth of the cracks.	

30	40,91698	63,47007	Concrete, draining tunnel under the road	Length 14 m, height 2 m. Very deep cracks.	Female colony of <i>Eptesicus bottae</i> .	
31	40,96154	63,40802	Concrete, monolithic draining tunnel under the road	Length 12 m, height 1 m. Cracks, although not deep. Suitable as a temporary roost.	A small amount of bat excrement. Obviously, a rare visit. No animals were visible.	

32	40,59091	64,64642	2 shepherd huts	There are numerous cracks, can be used as a temporary roost	Not detected	
33	40,71584	64,67643	Shepherd hut	<p>Lots of suitable cracks. According to consultations with local residents, they have seen bats, often in the winter time. Bats get into the cracks of the shepherd huts. If locals have access to bats, they kill them.</p>	Not detected, however, a potential wintering place	

34	40,66625	64,48523	Residential buildings	<p>Numerous colony. Bats sit in the cracks of the frame. According to local residents bats have been inhabiting the frames of their house for about 25 years.</p> <p>The owners do not touch them, despite the constant social noises and numerous excrements of bats.</p>	At least 30-40 individuals (<i>Pipistrellus pipistrellus</i>)	
35	40,66553	64,48219	School	<p>Abandoned building, with many cracks. Inside the building there are chimneys used by bats.</p>	<p><i>Pipistrellus pipistrellus</i> inhabit practically all frames of the building with cracks. Inside the building there are numerous excrements of various sizes.</p>	

36	40,87215	64,40363	Concrete, draining tunnel under the railway	Length 12 m, height 1 m. very narrow cracks, covered. Not suitable as roost.	Not detected	
37	40.891287	64.389363	Concrete, draining tunnel under the railway	Length 9 m, height 1 m. very narrow cracks, covered. Not suitable as roost.	Not detected	

38	40,90457	64,38103	Concrete, draining tunnel under the railway	Length 14 m, height 1 m. Cracks covered. Not suitable as roost	Not detected	
39	40.91268	64,37464	Concrete, draining tunnel under the railway	Length 12 m, height 1 m. Cracks covered. Not suitable as roost	Not detected	

Appendix 2. Photos



The male Ognev's serotine bat (*Eptesicus bottae ognevi*) in the draining tunnel (photo by M. Gritsina)



A house in the village of Ayakagytma with a colony of Common pipistrelle bat (*Pipistrellus pipistrellus*) (photo by M. Gritsina)



The excrement of bats in the village of Ayakagytma (photo by M. Gritsina)



Cracks in the window frames inhabited by bats in the village of Ayakagytma (photo by M. Gritsina)



Examination of the school building in the village of Ayakagytma (photo by M. Gritsina)



The excrement of bats in the school building in the village Ayakagytma (photo by M. Gritsina)



Examination of the draining tunnel (photo by A. Atakhodzhaev)



Examination of the draining tunnel and record keeping (photo by A. Atakhodzhaev)



Examination of the destroyed house (photo by M. Gritsina)

MAMMAL SURVEY

Report Title	<u>MAMMAL SURVEY</u>
Scope	MAMMALS
Areas Covered	DZHANKELDY WF / DZHANKELDY TO BASH OHTL
Seasons Covered	SPRING 2021 / SUMMER 2021
Notes	

MAMMAL SURVEY



DZANKELDY WIND FARM PROJECT

CLIENT: 5CAPITALS

Date: July 2021

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INTRODUCTION

The survey for terrestrial mammals (excluding bats) was **aimed** to establish the presence/absence, status and distribution of mammal species within the Dzankeldy project territory and its surrounding areas. In order to accomplish this the following steps were taken:

- Conducting a ground survey on mammal species (except for bats) throughout the study area including Aol and EAAA in Spring and Summer;
- Collecting data from camera traps (from April to June 2021) installed in the most suitable locations and collecting data from camera traps to get information about mammal species presence, distribution, seasonal dynamic and behavior;
- Collecting questionnaire data from local people on mammal species presence/absence, status and threats;
- Analysis of the preliminary field data including number of species and distribution; and
- Compiling a mammal species list based on field data, questionnaire data and data from literature sources, including endangered and non-endangered species.

The field surveys within the Dzankeldy project territory and its surrounding areas were conducted twice: in Spring (on April 15-18, 2021) and Summer (June 26-28, 2021).

LITERATURE REVIEW

The mammal fauna of the Central Kyzyl Kum, particularly within the area of the residual Kuldzhuktau mountains and foothills (where the Dzankeldy wind farm project territory is situated) is fragmentarily described in the fundamental works of I.I. Kolesnikov (1953) and G.I. Ishunin (1961, 1987), where the information on the distribution and biology of rodents, carnivores and ungulates is provided. In the monograph by T.Z. Zakhidov (1971) there is a description of the ecosystems of the Kyzyl Kum desert, and specific information about animals - vertebrates, including mammals of the Central Kyzyl Kum. In the encyclopedic reference book by O.P. Bogdanov (1992) and the Red Book of the Republic of Uzbekistan (2019) the basic information on the status of endangered species, general data on their biology, distribution, abundance and threats is given. These literature sources as well as scientific articles on distribution and ecology of several mammal species (Pavlenko & Davletshina, 1968; Volozheninov, 1981; Marmazinskaya & Gritsina, 2017; Gritsina et al, 2017; Gritsina, 2019; Bykova et al, 2020), supplemented by our own data collected during two field expeditions in April and June 2021 give us sufficiently enough data on the mammalian fauna in area of the Dzankeldy WF project and adjacent territories, as well as the basis to develop recommendations for the conservation of threatened mammalian species.

Totally, the list of mammals (except for bats) of the study area includes 24 species of 5 orders: *Insectivora*, *Lagomorpha*, *Rodentia*, *Carnivora* and *Artiodactula*, 5 of 24 species (Brandt's hedgehog, Marbled polecat, Caracal, Sand cat and Goitered gazelle) are included in the Red Book of Uzbekistan (2019) and the IUCN Red List. <https://www.iucnredlist.org> (Table 1), the presence of two more endangered species - Corsac fox and Steppe polecat requires confirmation.

MATERIAL AND METHODS

The survey was carried out in the Central Kyzylkum desert, in area of residual Kuldjuktai mountains (Northern, Southern, Northwest slopes, mountain foothills and low lands) (Fig. 1)

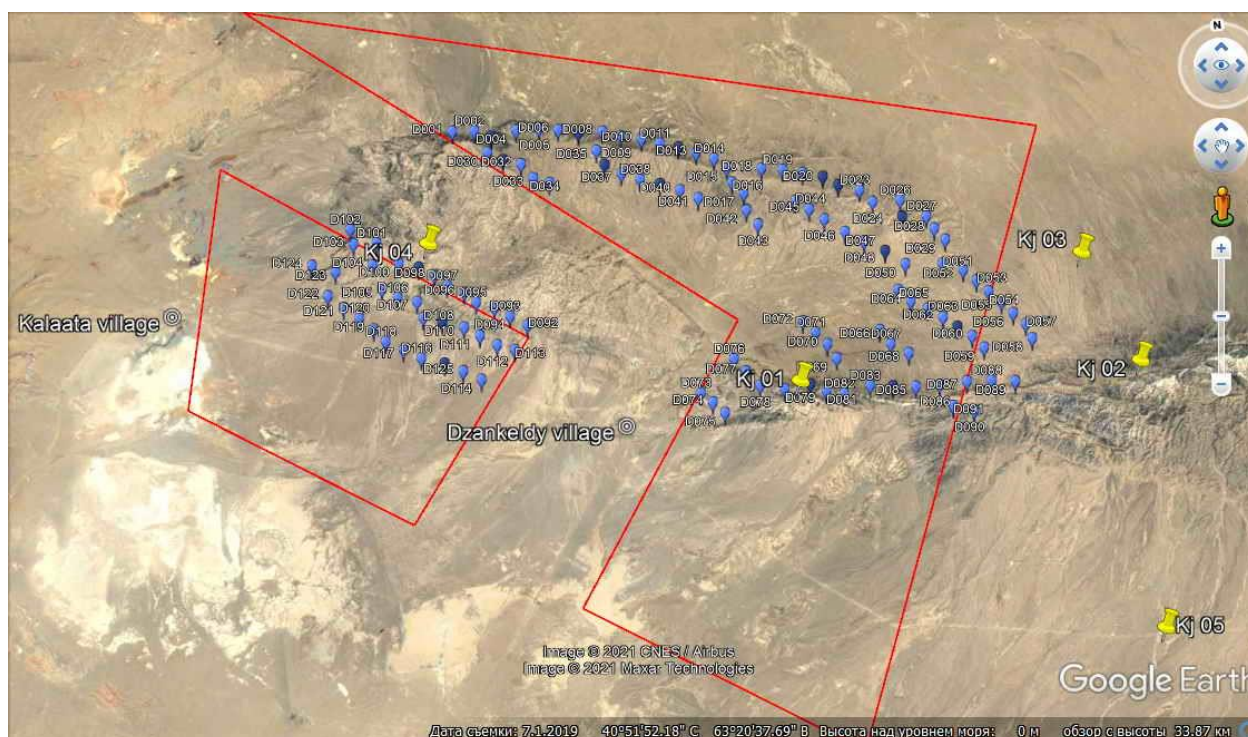


Figure 1 Map of the survey area (yellow points –camera traps locations, blue points - wind turbines)

During our survey, we used two basic methods:

1. Ground transect survey;
2. Camera trapping

During ground transect survey we studied the mammalian species number and species composition in walking transect survey. The length of each walking transect was 3 km in each monitoring point, with total length of 42 km (Tables 2, 3).

During the field survey, non-invasive approach was implemented, not related to the capture and killing of wild animals, including:

- visual observation of mammals both by eye and using 10x binoculars;
- registration of tracks of the vital activity of wild mammals, including animal tracks (paw footprints on the ground), feces, diggings, burrows, dead animals, etc.;

- taking photos of the animals, their tracks and traces of their vital activity, typical habitats.

Five standard Bushnell 119936C camera traps were installed from April 15-17 to June 26-28, 2021. Camera traps were installed for 2.5 months at 5 locations in various types of biotopes in the places of the most probable visit of wild animals (trails, watering points, animal marking places, and places of natural constrictions of relief) (Fig 1). In total we collected data of camera trapping for 265 camera traps/days. As a result 10673 captures were made including 1150 effective captures with animal records (Table 4, 5). In addition, we interviewed local people – citizens from Dzankeldy and Kalaata villages, and shepherds.

RESULTS AND DISCUSSION

Mammal species review

The **Order Insectivora** is represented by 4 species: **Long-eared hedgehog**, **Brandt's hedgehog**, **Lesser white-toothed shrew** and **Piebald shrew** (Table 1.).

The **Long-eared hedgehog** is a eurytopic species inhabiting all types of ecosystems from foothills to deserts; it does not avoid anthropogenic landscapes. We recorded it in the foothills of Northern Kuldzhuktau.

Brandt's hedgehog, near threatened (NT) species included in the Red Data Book of Uzbekistan (2019) was recorded in the project area - in degraded mountains of Central Kyzyl Kum (Pavlenko & Davletshina, 1953; Zakhidov, 1971; Volozheninov, 1981). The Brandt's hedgehog inhabits the foothills of the Kuldzhuktau, saline depressions with sandy hillocks, as well as clay and stony deserts. Brandt's hedgehog prefers to live in ravines and dry riverbeds. According to Nikolay Volozheninov number of this species on Kulzhuktau is 0.01 individuals/ha. We recorded Brandt's hedgehogs (black form) on camera traps (19 captures in three locations) (Table 4, 5) in the Northern Kulzhuktau (southern slope, the channel of a dried stream on the border between a sandy desert and a rock; rocky bottom of a mountain stream) and Southern Kulzhuktau (foothills clay desert) (Table 2, 3). Also, two dead hedgehogs (white form) were found on the road along the South Kuldzhuktau ridge. In addition, Timur Abduraupov (herpetologist for the project) made two records of this species in the western part of Kulzhuktau between Kalaata and Dzankeldy villages at a distance of 3.7 km from wind turbine D116 (June 22, 2021) and in the North-West of Kulzhuktau at a distance 1.8 km from turbine D001 and 2.3 km from turbine D101 (July 4, 2021).



Figure 2 Brandt's hedgehog (white form) killed on the road in Southern Kuldzhuktau (at the left) and black form of Brandt's hedgehog captured by camera trap in Northern Kuldzhuktau

Lesser white-toothed shrew is a hydrophilic species, and usually it inhabits the banks of water reservoirs, near wells, in oases. Lesser white-toothed shrew was recorded by Volozheninov (1981) in Central Kulzhuktau near the Tumbulak well. Another species - **Piebald shrew**, on the contrary, is psamophilous and lives in fixed and semi-fixed sands. We didn't find it, but both Zakhidov (1971) and Volozheninov (1981) wrote about its habitation in the Central Kyzylkum.

Tolai hare is the only representative of the **Order Lagomorpha** in the project area (Table 1). It is a typical inhabitant of river forests and reed thickets, it also occurs in the foothills and deserts. We recorded two young hares that died on the road in the vicinity of the Karakata depression (planned Dzankeldy-Bash OHTL) and near Dzankeldy village. Also hares were recorded by a camera trap in South Kuldzhuktau (one location, 9 captures) (Table 4, 5). In addition, shepherds informed us that Tolai hare is a common inhabitant of the foothills in Northern Kuldzhuktau.



Figure 3 Tolai hare killed on the road in the vicinity of Dzankeldy village (24.06.2021). Photo by Elena Bykova.

10 **rodents** were recorded in the project area (Table 1). The rodent community includes the synanthropic species - **House mouse**, as well as common inhabitants of the clay desert - **Small five-toed jerboa**, **Severtsov's jerboa**, **Yellow ground squirrel**. **Zaisan mole vole**, **Grey dwarf hamster**, and three species of gerbils, including **Great gerbil**, the **Libyan** and **Midday jirds** were also recorded in project area. Colonies of these species were observed in the survey area. It is interesting to note that many colonies of the Great gerbil were uninhabited, because of the natural depression of this rodent. Camera traps that we installed near the colonies of Great gerbil indicated that the uninhabited burrows were occupied by another species - Libyan jird, which is quite consistent with the theory of out-of-phase fluctuations in the abundance of Great gerbils and Gerbils of the genus *Meriones*. We made 16 captures of Libyan jird in the foothills of the Northern Kuldzhuktau (Table 4, 5). Such inhabitants of desert and semi-desert zones, psamophiles - **Long-clawed ground squirrel** and Midday jird inhabit the sandy massifs in the vicinity of the Karakata depression.



Figure 4 Libyan jird captured by camera trap in foothills of Northern Kuldzhuktau on the territory of the colony of Great gerbil

Red fox and **Asiatic wildcat** are the most common predators in desert biotopes and residual mountains in the survey area. Both species are widespread throughout the territory. We have recorded them by footprints, feces, and by camera traps. The fox was recorded in 4 locations in North and South Kuldzhuktau, in total 9 captures were made, a steppe cat - in 2 locations in North Kuldzhuktau - 4 captures were made (table 4, 5). In addition, the Asiatic wildcat was visually noted in the North-Western Kuldzhuktau in the vicinity of Kalaata (we found sleeping cat in a burrow), numerous feces of this species were found in shelters arranged in a rocky ridge located on the foothill plain in Southern Kuldzhuktau.



Figure 5 Asian wildcat during the day rest in a burrow in Northwest Kuldzhuktau. Photo by Alexander Esipov.



Figure 6 Toilet of Asian wildcat in foothills of the Southern Kuldzhuktau. Photo by Elena Bykova

The project area is inhabited by two more endangered cats - the **Caracal** and the **Sand cat** (Table 1). Turkmen Caracal is one of the rarest vertebrates in Central Asia (Heptner & Sludskii 1972). It is included as Critically Endangered (1CR) in the Red Data Books of Uzbekistan (2019), listed in Appendix I of the CITES. The classical faunistic works don't report about the presence of the caracal in Central Kyzyl Kum. The first data on this species for this territory, moreover, directly from the area of the planned project

(the vicinity of Dzankeldy and Kalaata villages) were collected by Mariya Gritsina and co-authors based on questionnaire surveys of local residents (245 respondents from 40 locations) (Gritsina, 2016, 2019). So, villagers of Kalaata in central Kyzylkum reported a caracal killed by herders on 20 March 2014 about 20km southwest of the village. Later, we found the carcass of a young female in the place indicated by the local people. The cat was caught in a leg-snare near a sheep pen. Also, villagers informed about another caracal killed by herders in 2012, which used to attack lambs in the calving period, killing up to 10 lambs at one time but leaving them uneaten. This information was confirmed by herders from the village of Dzankeldy. They told us that people from Kalaata killed three individual caracals between 2012 and 2013. An official of the Bukhara Regional Department of the State Committee for Nature Protection F. Salimov, observed caracals several times near the above-mentioned village of Dzankeldy and on the shore of lake Zamonbobo in the past 10–15 years. Unfortunately, we were not able to confirm these data using camera traps, but we also received data from shepherds about caracal sightings in the vicinity of the Kalaata (Table 2). Main threats of caracal are habitat degradation due to human development, severe winters, high snow level, decreasing of prey species (desert rodents and birds), persecution by humans and dogs.

Information about the presence of another endangered species in the Central Kyzyl Kum - **Sand cat** is found in the works of a number of authors (Bobrinsky et al., 1944; Gromov et al., 1963; Geptner, Sludsky, 1972; Gritsina, 2016). Sand cat listed in Red Data Book of Uzbekistan as Near threatened species (3NT) and Appendix II CITES. The status of the sand cat on the territory of the Republic of Uzbekistan needs to be clarified. Literature sources give very little data about findings of this species in the project area. For example, one adult sand cat was recorded to the south of Kalaata village on April 15, 2013. One more recording of sand cat was made by camera trap installed north of the village of Kalaata (northern Beltau Mountains, which are the western end of the Kuldzhuktau Mountains) on November 16, 2014 (Gritsina, 2016). The main threats are severe and snowy winters, habitat loss and degradation due to economic development (road construction, geodetic development and exploration) and watering of habitats for agricultural needs. The food competitors of the sand cat are the red fox and Asiatic wildcat.

We didn't found such a rare species as **Marbled polecat**, despite the efforts made. However, the presence of this species, whose biology is associated with the presence of prey species - colonial rodents - gerbils and ground squirrels, is indicated in the literature (Zakhidov, 1971). We also recorded marbled polecat in the adjacent territory in the

Karakata depression in early 1990s. There are some data from Central Kyzylkum about two more representatives of the Canidae family - the **Common wolf** and the **Corsac** (Zakhidov, 1981). Corsac listed in the Red Book of Uzbekistan. Wolf listed as a game species. However, during our survey and according to local people, the presence of these species was not confirmed. We also didn't confirmed the presence of the **Steppe polecat**, a rare species included in the Red Book of Uzbekistan (2019).

Table 1 - Characteristics of non-bat mammals in the project area and adjacent areas of Central Kyzylkum (Kuldzhuktau ridge, Navoi province, Dzankeldy project site)

№ п/п	Species	Conditional population estimate	Status of threat IUCN RedList/Uzbekis tan RDB	Sources
1	Long-eared hedgehog <i>Hemiechinus auritus</i> Gmelin, 1770	O-M	LC/-	Ground survey; Zakhidov, 1971; Volozeninov, 1981
2	Brandt's hedgehog <i>Paraechinus hypomelas</i> (Brandt, 1836)	P-E	LC/3NT	Camera trapping; road accident (Zafarabad); Pavlenko & Davletshina, 1953; Zakhidov, 1971; Volozeninov, 1981
3	Lesser white-toothed shrew <i>Crocidura suaveolens</i> Pallas, 1811	O-H	LC/-	Zakhidov, 1971; Volozeninov, 1981
4	Piebald shrew <i>Diplomesodon pulchellum</i> (Lichtenstein, 1823)	P-E	LC/-	Zakhidov, 1971; Volozeninov, 1981
5	Tolai hare <i>Lepus totai</i> Pallas, 1778	O-M	-	Ground survey, camera trapping, road accident (OHTL 115 km); Zakhidov, 1971
6	Long-clawed ground squirrel <i>Spermophilopsis leptodactylus</i> (Lichtenstein, 1823)	O-H	LC/-	Ground survey (OHTL 115 km); Kolesnikov, 1953; Zakhidov, 1971
7	Yellow ground squirrel <i>Spermophilus fulvus</i> (Lichtenstein, 1823)	O-M	LC/-	Ground survey; Zakhidov, 1971
8	Small five-toed jerboa <i>Allactaga elater</i> (Lichtenstein, 1825)	O-M	-	Ground survey; Zakhidov, 1971

9	Severtzov's jerboa <i>Allactaga severtzovi</i> Vinogradov, 1925	O-H	LC/-	Zakhidov, 1971
10	Great gerbil <i>Phomomys opimus</i> (Lichtenstein)	O-M	LC/-	Ground survey; Zakhidov, 1971
11	Libyan jird <i>Meriones libycus</i> Lichtenstein, 1823	O-M	LC/-	Ground survey; camera trapping; Zakhidov, 1971
12	Midday jird <i>Meriones meridianus</i> (Pallas, 1773)	O-M	LC/-	Ground survey; Zakhidov, 1971
13	Grey dwarf hamster <i>Cricetulus migratorius</i> Pallas, 1773	O-H	LC/-	Zakhidov, 1971
14	Zaisan Mole Vole <i>Ellobius tancrei</i> Blasius, 1884	O-M	LC/-	Ground survey; camera traps Zakhidov, 1971
15	<i>Mus musculus</i> Linnaeus, 1758	O-H	-/-	Ground survey; Zakhidov, 1971
16	Grey wolf <i>Canis lupus</i> (Linnaeus, 1758)	P-E	LC/-	Zakhidov, 1971 need to be confirmed
17	Corsac Fox <i>Vulpes corsac</i> (Linnaeus, 1768)	P-E	LC/2(VU:D)	Zakhidov, 1971; Red data book of Uzbekistan, 2019; need to be confirmed
18	Red fox <i>Vulpes vulpes</i> Linnaeus, 1758	O-M	LC/-	Ground survey; camera trapping; Zakhidov, 1971
19	Marbled Polecat <i>Vormela peregusna</i> (Güldenstädt, 1770)	P-E	VU/2(VU:D)	Zakhidov, 1971; Red data book of Uzbekistan, 2019
20	Steppe Polecat <i>Mustela eversmanii</i> Lesson, 1827	P-E	LC/2(VU:D)	Zakhidov, 1971; Red data book of Uzbekistan, 2019
21	Asiatic wildcat <i>Felis sylvestris ornate</i> Gray, 1830	O-M	-	Ground survey, camera trapping; Ishunin, 1961, 1987; Zakhidov, 1971
22	Sand cat <i>Felis margarita</i> Loche, 1858	P-E	LC/3NT	Ishunin, 1961, 1987; Zakhidov, 1971; Gritsina, 2016. 2019
23	Caracal <i>Caracal caracal</i> (Schreber, 1776)	P-E	LC/1(CR)	Ishunin, 1961, 1987; Zakhidov, 1971; Gritsina et al., 2016; Gritsina, 2019
24	Goitered Gazelle <i>Gazella subgutturosa</i> (Güldenstädt, 1780)	P-H	VU/3(VU)	Ground survey; questionatie data; Marmazinskaya & Gritsina, 2017; Gritsina et al, 2017; Red data

				book of Uzbekistan, 2019; Bykova et al, 2020
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Notes: Conditional estimate of the number: E - single, H - few, M - Numerous; O - common, R - rare. IUCN Red List categories: Extinct (EX); Extinct in the Wild (EW); Critically Endangered (CR); Endangered (EN); Vulnerable (VU); Near Threat (NT); Least concern (LC); Data Deficient (DD); Categories of the Red Data Book of the Republic of Uzbekistan (2019): Extinct 0 (EX); Extinct in the Wild 0 (EW); Critically Endangered 1 (CR); Endangered 1 (EN); Vulnerable 2 (VU: D); Naturally Rare 2 (VU: R); Near Threat 3 (NT); Data Deficient (DD).

The project area of the Dzankeldy WF is inhabited by the only species of wild ungulates - the **Goitered gazelle**. The animals inhabiting the foothills and desert plains of Kuldzhuktau ridge belong to the Central Kyzylkum population, the total number of which is about 3000-5000 individuals (Gritsina et al., 2016; Marmazinskaya, Gritsina, 2017; Bykova et al., 2020). According to Natalia Marmazinskaya (Red Data Book of Uzbekistan, 2019), 150-180 individuals inhabit Kulzhuktau area. During our survey, we recorded single individual of Goitered gazelle in the foothills of Northern Kuldzhuktau. We also obtained questionnaire data from local shepherds on the constant records of small groups of gazelles – groups of 2-5 individuals, the last of which was observed in April 15, 2021. In addition, gazelle droppings were found by Maria Gritsina (bat expert for the project) on the watershed line of Kuldzhuktau ridge in 100 m from the turbine D067. According to our expert assessment, about 50 individuals are found in the project area. Since the presence of a wolf has not been confirmed in the project area, it seems that Goitered gazelle has no natural predators. The main threats are poaching, habitat loss, habitat degradation and fragmentation due to economic development of the region, lack of forage in snowy winters, shepherd's dogs' depredation of calves, and human disturbance.

Ground transect survey

In April, 15-18 we conducted ground transect survey to collect spring data with focus on seasonal species (ground squirrels). Additionally, we used information about animals accidentally killed on the road in project area, particularly roads in the vicinity of Dzankeldy village. Also we used questionnaire data collected from local people. Totally 10 mammals have been registered visually and by the tracks of the vital activity (Table 2, 3), including 2 insectivores, 1 hare, four rodents, two carnivores and one ungulate

species. Two species - Brandt's hedgehog and Goitered gazelle are listed species. We also got questionnaire data on one more endangered species – Caracal as well as addition information about gazelles.

Table 2 – Mammals recorded on monitoring locations during field survey in the project area (Kuldzhuktau ridge, Navoi province, Dzankeldy project area) in April, 2021

# Monitoring site	Coordinates, WGS-84, grade/min/sec	Data	Biotope	Mammals recorded in monitoring site	Notes
Kj01 Northern Kuldzhuktau, 'Little Kuldzhuktau'	40°51'17.7" 63°24'02.8"	15.04.21	Foothills of Kuldzhuktau ridge, stepped hills, rocks turning into ridges, dry stream beds, separate sites of vegetation sandy deserts	<i>Phombomys opimus</i> <i>Meriones libycus</i> <i>Ellobius tancrei</i> <i>Hemiechinus auritus</i> <i>Vulpes vulpes</i>	livestock (domestic sheep) – 2 stocks (500+200 indi), sheep's traces, vegetation looks degraded, there is not watering places
				<i>Vulpes corsac</i> – a few <i>Felis silvestris ornate</i> – common <i>Vulpes vulpes</i> - common <i>Lepus tolai</i> – a few <i>Caracal caracal</i> – rare (Kalaata village vicinity) <i>Gazella subgutturosa</i> - a few, usually observer 2-5 individuals, last record was made 15.04. 2021, 2 gazelles observed in "Big Kuldzhuktau"	Questionnaire data from the local shepherd
Kj02 Northern Kuldzhuktau, 'Big Kuldzhuktau'	40°51'02.9" 63°31'33.8"	16.04.2021	Stony mountain steppe, stepped hills, rocks, dry stream beds, 540 m asl	<i>Meriones libycus</i> <i>Ellobius tancrei</i> <i>Vulpes vulpes</i>	Livestock: domestic goats (20), sheep (500), camels (scats)
Kj03	40°52'44.8'	16.04.2021	Mountain foothill clay semi desert	<i>Phombomys opimus</i>	

Northern Kuldzhuktau, 'Big Kuldzhuktau'	63°30'29.7"			<i>Meriones libycus</i> <i>Ellobius tancrei</i> <i>Gazella subgutturosa</i>	
Kj04 Western Kuldzhuktau Dzankeldy, Kalaata vill vicinity, lead mine, 'Cat's canyon'	40°54'12.2" 63°16'11.1"	17.04.2021	Dry gorge, rocks, gullies	<i>Meriones libycus</i> <i>Ellobius tancrei</i> <i>Felis silvestris ornate</i> <i>Mus musculus</i>	
Kj05 Southern Kuldzhuktau, Botanic station vicinity	40°46'34.5" 63°31'30.7"	18.04.2021	Foothill clay plain, dry stream bed, salsola & saxaul shrubs	<i>Phombomys opimus</i> <i>Paraechinus [Hemiechinus] hypomelas</i> <i>Felis silvestris ornate</i>	Camels scats and tracks

Table 3 – Number and species composition on walking transects, in April, 2021

##	Species	Monitoring location	route length (km) / surveyed area (ha)	Number, individuals/colonies/ burrows	Number assessment
Mammals					
1	<i>Hemiechinus auritus</i>	Kj01	3 km	1 skin	A few
2	<i>Paraechinus hypomelas</i> (white form)	Kj05	NA	2 killed on the road	A few
3	<i>Lepus totai</i>	Kj01	NA	2 ind. accidentally killed on the road; questionnaire data	Common
4	<i>Ellobius tancrei</i>	Kj01, Kj02, Kj03, Kj04	3+3+3 km	3+10 +2 + 5 inhabited colonies	Common

5	<i>Phombomys opimus</i>	Kj01, Kj03, Kj05	3+3 +3 km	2 (inhabited) + 6 (3 inhabited +3 uninhabited colonies)+ 2 (inhabited)	Common
6	<i>Meriones libycus</i>	Kj01, Kj02, Kj04	3+3 +3 km	2+5 + 4 inhabited colonies	Common
7	<i>Mus musculus</i>	Kj04	NA	3 ind. in pellets of little owl	Common
8	<i>Vulpes vulpes</i>	Kj01, Kj02	3+3 km	1 ind. visually +1 ind. by feces	Common
9	<i>Felis silvestris ornate</i>	Kj01, Kj04, Kj5	3 km	Questionnaire data, 1 ind. visually, feces	Common
10	<i>Gazella subgutturosa</i>	Kj03	3 km	1 ind. (track)	A few

Camera trapping

Camera trapping was conducted from April, 15-17 to June, 24-25 in different biotopes of Northern, Southern and Northwest Kuldzhuktau region in Dzankeldy project area, including mountain rocks and caves, stony dry streams, rocky canyons, clay foothill plains, saxaul shrub lands. During the installation of the camera traps we faced some challenges. Almost all project area is used by humans (grazing, mining, settlements, roads etc.). This level of development leads, firstly, to very limited number of places with good condition for wild animals, and secondly to a real threat for camera traps themselves to be stolen by local people. It took a lot of effort and ingenuity to hide the camera traps, and often it was impossible.

However, despite the difficulties, the camera traps recorded 7 species of wild mammals, including 1 bat, which was not possible to identify (Table 4, 5).

Table 4 - List of mammals captured by camera traps in the Dzankeldy WF project area (Kuldzhuktau ridge) from April 15 to June 25, 2021

##	Species	Number of captures					
		Kj 01	Kj 02	Kj 03	Kj 04	Kj 05	Total
1	Brandt's hedgehog <i>Paraechinus hypomelas</i>	3	-	4	-	5	12
2	Bat unidentified	1	-	-	-	-	1
3	Tolai hare <i>Lepus totai</i>	-	-	-	-	6	6
4	Libyan jird <i>Meriones libycus</i>		16	-	-	-	16
5	Zaisan Mole Vole <i>Ellobius tancrei</i>	1	-	-	-	-	1
6	Red fox <i>Vulpes vulpes</i>	3	3	1	-	2	9
7	Asiatic wildcat <i>Felis sylvestris ornate</i>	3	1	-	-	-	4

The total number of captures of wild mammals was 49. The number of captures of wild mammals per camera trap ranged from 0 (Kj 04, where only livestock was recorded) to 20 (Kj 02). The number of wild mammal species recorded by one camera trap ranged from 0 to 5 (Kj 01).

The largest number of records was made of **Libyan jird** but all the records were made only on one location. Once there were two animals in the shot. Brandt's hedgehog was captured 12 times by three cameras. The fox was recorded 9 times by four cameras.

Tolai hare was recorded 6 times by one camera trap. Wildcat was recorded 4 times by two cameras. Finally, the mole vole was captured once.

In addition, camera traps recorded a large number of livestock (sheep, goats, horses, camels), people (on foot and on motorcycles), as well as birds (e.g. Houbara bustard *Chlamydotis undulata*), reptiles (e.g. Desert monitor *Varanus griseus* and Russian tortoise *Agrionemys horsfieldii*) and invertebrates.

This confirms that camera trapping is a very good method for capturing species like Brandt's hedgehog, and such species as wildcat and species with secretive nocturnal lifestyle, like wild cats. Our research also showed that cameras are very successful in registering foxes, hares and a number of animals that use shelters in the summer time (see photos from camera traps in Appendix).

Table 5 – Camera trap locations, nearest wind turbines and mammals recorded by camera traps in the Dzankeldy WF project area (Kuldzhuktau ridge) from April 15 to June 25, 2021

# Monitoring loc	Coordinates, WGS-84, (N E A)	## Turbine / distance (km)	Biotop	Start /finish records	Camera traps / days	total captures/ effective captures	Mammals recorded on monitoring location	Number of records / max number of individuals
Kj 01	40°51'17.7" 63°24'02.8" 374	D079 / 0.41 D080 / 0.44 D081 / 0.94	Foothills of Kuldzhuktau ridge. stepped hills, rocks turning into ridges, dry stream beds, separate sites of vegetation sandy deserts	15.04 / 24.06	71	1500 / 281	Brandt's hedgehog Bat undefined Zaisan Mole Vole Red fox Asian wildcat	3 1 1 3 3
Kj 02	40°51'02.9" 63°31'33.8" 528	D058 / 3.17 D057 / 3.45 D089 / 3.66	Stony mountain steppe, stepped hills, rocks, dry stream beds, 540 m asl	16.04 / 25.06	40	5096 / 109	Libyan jird Red fox Asian wildcat	16 / 2 3 1
Kj 03	40°52'56.5" 63°30'30.9" 397	D056 / 2.55 D057 / 2.56 D058 / 2.83	Foothill maintain clay semi desert	16.04 / 30.06	15	2613 / 130	Brandt's hedgehog Red fox	4 1
Kj 04	40°54'12.2" 63°16'11.1" 285	D099 / 0.68 D100 / 0.94 D098 / 0.97	Dry gorge, rocks, gullies	17.04 / 24.06	69	696 / 53	Only domestic animals	-
Kj 05	40°46'34.1" 63°31'30.7" 312	D090 / 8.83 D089 / 8.90 D088 / 9.24	Foothill clay plain, dry stream bed, salsola & saxaul shrubs	17.04 / 25.06	70	768 / 577	Brandt's hedgehog Tolai hare Red fox	5 6 2

Ground transect survey along planned Dzankeldy WF-Bash WF OHTL

On April, 14 and June 20-22 we conducted ground transect survey to collect data about mammal species along planned Dzankeldy WF-Bash WF OHTL in Navoi region.

We used a method of ground transect survey with walking transects each 10 km. We stopped each 10 km and walked approximately 1 km from the planned OHTL line, to gather information about mammals (and other animals) including:

- visual observation of mammals both by eye and using 10x binocular;
- registration of tracks of the vital activity of wild mammals, including animal tracks (paw foot prints on the ground), feces, digging, burrows, dead animals, etc.;
- taking photo of the animals, their tracks and traces of their vital activity, typical habitats.

We also collected data during driving between transects where it was possible along planned Dzankeldy WF-Bash WF OHTL. Totally we conducted 10 walked transects at Dzankeldy WF-Bash WF with total length 10 km (table 6). The length of the vehicle transects between walking ones at Dzankeldy WF-Bash WF was 50 km. In addition, we used data kindly provided by our colleagues, particularly by Timur Abduraupov who get information about nocturnal mammals during his nocturnal reptilian survey with headlight.



Figure 7 Typical view of the wormwood-ferula steppe in spring (Dzankeldy WF-Bash WF OHTL)

Table 6. Data on mammals (and other vertebrates) inhabited along planned OHTLs collected along planned Dzankeldy WF-Bash WF OHTL in April, June 2021

# transect	Biotop	Mammals	Other wild and domestic animals
Transect 1	Wormwood <i>Artemisia terrae-albae</i> and <i>Ferula assa-foetida</i> steppe with single saxaul <i>Haloxylon</i> spp.	Great gerbil (1 inhabited colony) Libyan jird (1 inhabited colony) Yellow ground squirrel (1 indi) Zaisan Mole Vole (1 inhabited colony)	Steppe Agama <i>Trapelus sanguinolentus</i> (1 indi) Domestic sheep tracks and droppings
Transect 2	<i>Tamarix</i> spp. shrub land in a dry clay bed	Great gerbil (1 inhabited colony) Libyan jird (1 inhabited colony)	Steppe Agama <i>Trapelus sanguinolentus</i> (1 indi)
Transect 3	Wormwood <i>Artemisia terrae-albae</i> and saxaul <i>Haloxylon</i> spp. plain with <i>Calligonum</i> spp.	Great gerbil (1 inhabited colony) Libyan jird (1 inhabited colony) Yellow ground squirrel (3 indi) Zaisan Mole Vole (1 inhabited colony)	
Transect 4	Sandy desert with wormwood <i>Artemisia terrae-albae</i> with <i>Salsola</i> spp., <i>Ferula assa-foetida</i> and <i>Tulipa lehmanniana</i>	Libyan jird (1 inhabited colony) Zaisan Mole Vole (1 inhabited colony)	Central Asian tortoise <i>Testudo horsfieldii</i> (3 indi) Sunwatcher <i>Phrynocephalus helioscopus</i> (1 indi) Domestic sheep tracks and droppings
Transect 5	Sandy desert with wormwood <i>Artemisia terrae-albae</i> with <i>Salsola</i> spp., <i>Ferula assa-foetida</i>	Midday jird (1 inhabited colony) Small five-toed jerboa (1 indi, tracks and diggings) Tolai hare (1 indi, scats)	
Road 1 10 km		Great gerbil (1 inhabited colony) Zaisan Mole Vole (1 inhabited colony)	Central Asian tortoise <i>Testudo horsfieldii</i> (6 indi) Desert monitor <i>Varanus griseus caspius</i> (1 indi)

Transect 6	Sandy desert with wormwood <i>Artemisia terrae-albae</i> with <i>Salsola</i> spp., <i>Ferula assa-foetida</i>	Red fox (2 indi, tracks and scats) Mustella spp. (tracks and scats)	Central Asian tortoise <i>Testudo horsfieldii</i> (7 indi)
Road 2 10 km		Long-clawed ground squirrel (1 indi) Zaisan Mole Vole (3 inhabited colony)	Central Asian tortoise <i>Testudo horsfieldii</i> (45 indi) Camels
Transect 7	Sandy desert with wormwood <i>Artemisia terrae-albae</i> with <i>Ferula assa-foetida</i>	Long-clawed ground squirrel (1 indi, diggings) Small five-toed jerboa (1 indi, tracks) Zaisan Mole Vole (1 inhabited colony) Midday jird (1 inhabited colony) Red fox (1 indi, tracks)	Central Asian tortoise <i>Testudo horsfieldii</i> (1 indi)
Road 3 10 km		Zaisan Mole Vole (1 inhabited colony)	Central Asian tortoise <i>Testudo horsfieldii</i> (17 indi)
Transect 8	Sandy desert with wormwood <i>Artemisia terrae-albae</i> and <i>Tulipa lehmanniana</i>	Zaisan Mole Vole (8 inhabited colony) Small five-toed jerboa (1 indi, tracks)	Central Asian tortoise <i>Testudo horsfieldii</i> (1 indi) Steppe Agama <i>Trapelus sanguinolentus</i> (1 indi)
Road 4 10 km		Tolai hare (1 indi, killed on the road)	Central Asian tortoise <i>Testudo horsfieldii</i> (8 indi)
Transect 9	Sandy desert with wormwood <i>Artemisia terrae-albae</i> , saxaul <i>Haloxylon</i> spp and <i>Peganum harmala</i>	Long-clawed ground squirrel (1 indi, tracks, diggings) Midday jird (1 inhabited colony) Red fox (1 indi, tracks)	Central Asian tortoise <i>Testudo horsfieldii</i> (tracks), Central Asian Racerunner <i>Eremias velox</i> (1 indi) Sand grouse <i>Pterocles</i> spp. (tracks)
Road 5 10 km		Long-clawed ground squirrel (1 indi)	Central Asian tortoise <i>Testudo horsfieldii</i> (30 indi)

Transect 10	Clay desert on the foothill plain of Kuldzhuktau	Tolai hare (1 indi, killed on the road) Yellow ground squirrel (1 indi) Libyan jird (1 inhabited colony)	Central Asian tortoise <i>Testudo horsfieldii</i> (4 indi)



**Figure 8 Zaisan Mole Vole's colony (left); Red fox scats (right), Dzankeldy WF-Bash WF OHTL.
Photo by Elena Bykova**



**Figure 9 Tolai hare scats (left) and hare killed on the road (right), Dzankeldy WF-Bash WF OHTL.
Photo by Elena Bykova**



Figure 10 Desert monitor near great gerbil burrow. Photo by Alexander Esipov

CONCLUSION

As a result of the survey (Table 7), 10 mammalian species were recorded in the Dzankeldy project area, including 5 species listed in the Red Data Book of Uzbekistan and IUCN Red List: Brandt's hedgehog (NT, UzRB/LC, IUCN), Marbled polecat (VU, UzRB/VU, IUCN), Caracal (CR, UzRB/LC, IUCN), Sand cat (NT, UzRB/LC, IUCN) and Goitered gazelle (VU, UzRB/VU, IUCN). In addition, according to literature data two endangered species - Corsac (VU, UzRB/LC, IUCN) and Steppe Polecat (LC, IUCN) can be found in this area, but this information requires confirmation.

Table 7. Summary list on the mammals recorded in area of the Dzankeldy WF project (ground survey April/June, 2021; camera trapping, April- June, 2021)

	NAME OF SPECIES		IUCN /RDB STATUS	TOTAL NO. OBSERVED
	LATIN	ENGLISH		
1	<i>Hemiechinus auritus</i>	Long-eared hedgehog	LC/-	1 individuals
2	<i>Paraechinus hypomelas</i>	Brandt's hedgehog	LC/3NT	4 individuals/12 camera trap captures
3	<i>Lepus totai</i>	Tolai hare	-	2 individuals/6 camera trap captures
4	<i>Ellobius tancrei</i>	Zaisan Mole Vole	LC/-	20 inhabited colonies/1 camera trap capture
5	<i>Phomobomys opimus</i>	Great gerbil	LC/-	7 inhabited colonies
6	<i>Meriones libycus</i>	Libyan jird	LC/-	11 inhabited colonies/16 camera trap captures
7	<i>Mus musculus</i>	House mouse		3 individuals
8	<i>Vulpes vulpes</i>	Red fox	LC/-	2 individuals/9 camera trap captures
9	<i>Felis silvestris ornate</i>	Asiatic wildcat	-	1 individuals/4 camera trap captures
10	<i>Gazella subgutturosa</i>	Goitered Gazelle	VU/3(VU)	2 individuals

Critical habitats for Goitered gazelles are foothills of Northern Kulzhuktau. Main threats for Goitered Gazelle are: habitat loss, degradation and fragmentation, water deficiency, competition with domestic livestock for pastures, poaching by local people and human disturbance.

Critical habitats for felids (Caracal and Sand cat) are the areas of Western slopes of Kuldzuktau ridge located in the vicinity of Dzankeldy and Kalaata villages. Main threats for these species are severe winters, decreasing number of prey, habitat loss,

degradation and fragmentation due to human development, human disturbance, severe winters, high snow level, persecution by humans and dogs.

Critical habitats for Brandt's Hedgehog are located in mountains and foothills of Northern and Southern Kuldzhuktau. Main threats for this species are habitat fragmentation and road accidents.

Table 8. Summary list on the mammals recorded in area of the Dzankeldy WF-Bash WF OHTL (ground transect survey, each 10 km 1 km transect, April/June 2021*

	NAME OF SPECIES		IUCN /RDB STATUS	TOTAL NO. OBSERVED
	LATIN	ENGLISH		
1	<i>Paraechinus hypomelas</i>	Brandt's hedgehog	LC/3NT	2 individuals**
2	<i>Lepus totai</i>	Tolai hare	-/game sp	3 individuals
3	<i>Spermophilus fulvus</i>	Yellow ground squirrel	LC/-	5 individuals
4	<i>Spermophilopsis leptodactylus</i>	Long-clawed ground squirrel	LC/-	4 individuals
5	<i>Ellobius tancrei</i>	Zaisan Mole Vole	LC/-	17 inhabited colonies
6	<i>Phombomys opimus</i>	Great gerbil	LC/-	4 inhabited colonies
7	<i>Meriones libycus</i>	<i>Libyan jird</i>	LC/-	5 inhabited colonies
8	<i>Meriones meridianus</i>	<i>Midday jird</i>	LC/-	3 inhabited colonies
9	<i>Allactaga elater</i>	Small five-toed jerboa	-	3 individuals + 2 individuals**
10	<i>Allactaga severtzovi</i>	Severtzov's jerboa	LC/-	2 individuals**
11	<i>Mustela sp.</i>	-	-	1 individual (species unidentified)
12	<i>Vulpes vulpes</i>	Red fox	LC/-	4 individuals
13	<i>Gazella subgutturosa</i>	Goitered Gazelle	VU/3(VU)	4 individuals**

Notes:

*10 transects and road between transects

** data received outside of transects during walking transect survey with headlight, data provided by Timur Abduraupov

Our observations (Table 8) has shown that the project area (OHTL Dzankeldy WF-Bash WF) is inhabited by at least 13 mammals including 2 Insectivores, 1 hare, 8 rodents, 2 carnivores and 1 ungulate. This list includes two endangered species – Brant's hedgehog and Goitered gazelle. But also could include one more threatened species – Marbled Polecat *Vormela peregusna* that we recorded in this area in the past. Currently we found scats of unidentified *Mustelidae* species that could be an evidence of the presence of rare Mustelid. All this records were made in area of Karakata depression and surrounded area, which can be identified as a critical habitat for mammals. In addition, we recorded two more endangered reptiles – Desert monitor and Russian tortoise that supported our conclusion.

In fact, we developed basis for continuous monitoring in the area of Dzankeldy project (zero monitoring). We recommend continuing monitoring of mammals both during the construction period and after commissioning of the Dzankeldy wind farm. Since the territory of the planned project is inhabited by threatened species, including globally threatened species – Goitered gazelle, it is necessary to develop measures to maintain populations of this species at a stable level or better through creating micro-reserves, public awareness and strengthening the capacity building of the regional biodiversity rangers to combat poaching.

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Appendix: Records from camera traps



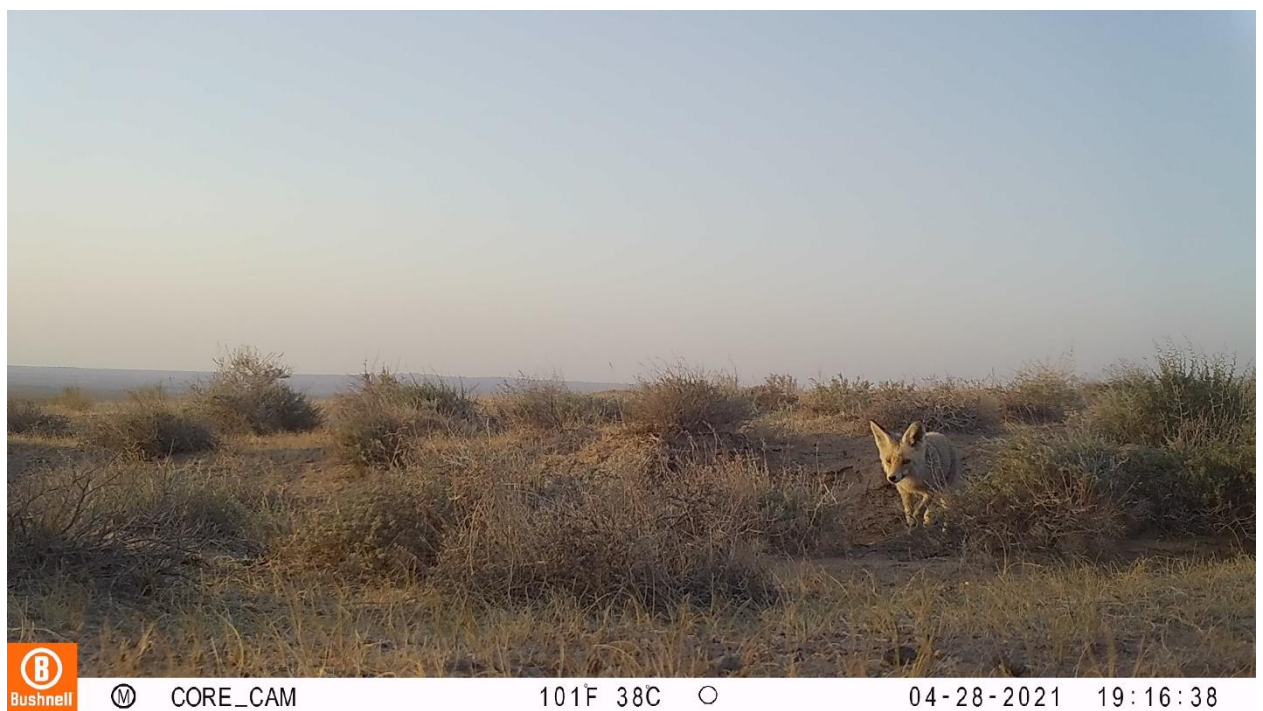
Tolai hare (Kj 05 site) in shade of a small cave in Southern Kuldzhuktau



Asian wildcat marks the individual territory, foothills on Northern Kuldzhuktau (Kj2 site)



Asiatic wildcat captured by camera traps in Northern Kuldzhuktau (Kj1 site)



Red fox hunt at the colony of great gerbil, foothills on Northern Kuldzhuktau (Kj2 site)



Brandt hedgehog in Northern Kuldzhuktau (Kj3 site)



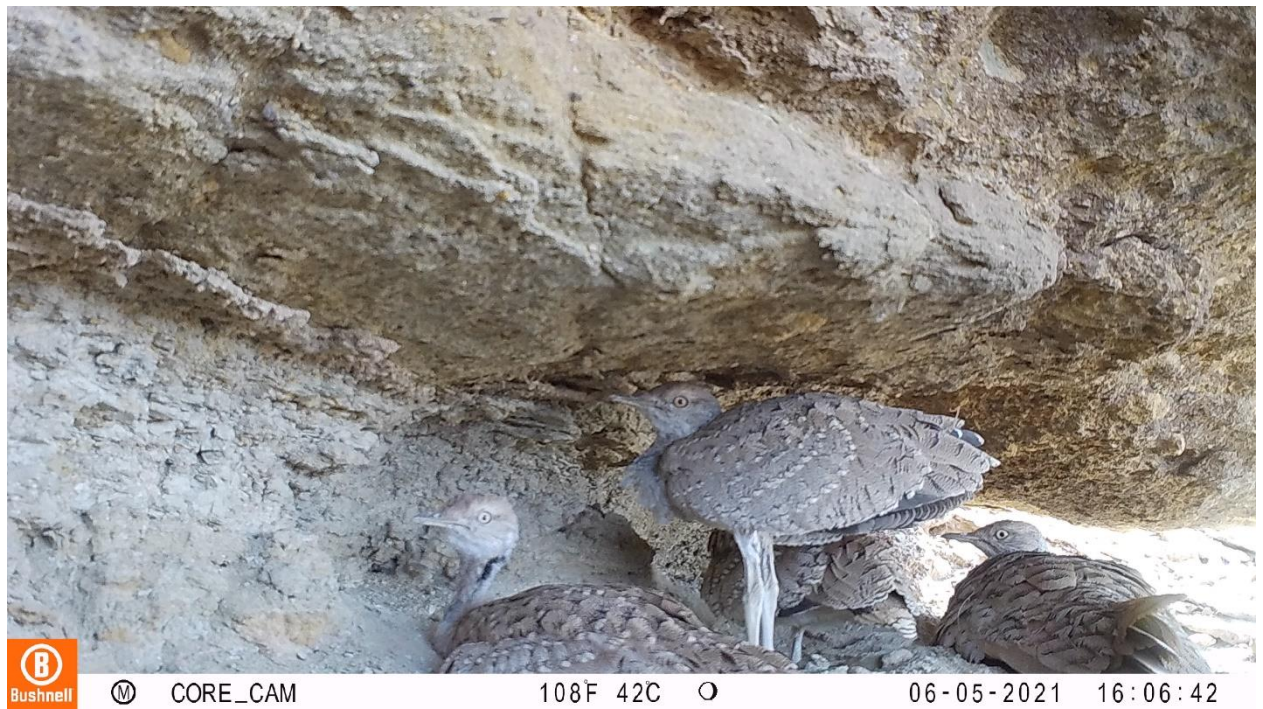
Zaisan Mole Vole in Northern Kuldzhuktau (Kj1 site)



Russian tortoise in Northern Kuldzhuktau (Kj3 site)



Desert monitor in Southern Kuldzhuktau (Kj 05 site)



Houbara bustard chicks in shade of small cave in Southern Kuldzhuktau (Kj 05 site)



Chukars (*Alectoris chukar*) in Northern Kuldzhuktau (Kj1 site)



Domestic goat captured by camera trap in NW Kuldzhuktau (Kj4 site)



Domestic sheep captured by camera trap in Northern Kuldzhuktau (Kj3 site)

Herpetological survey

Report Title	Herpetological survey
Scope	HERPETOFAUNA
Areas Covered	BASH WF / BASH TO KARAKOL OHTL / DZHANKELDY WF / DZHANKELDY TO BASH OHTL
Seasons Covered	SPRING 2021 / SUMMER 2021
Notes	

HERPETHOLOGICAL SURVEY



BASH WIND FARM PROJECT
DZHANKELDY WIND FARM PROJECT
CLIENT: 5CAPITALS
Date: July 2021

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INTRODUCTION

Uzbekistan is located in the central part of Central Asia and has common borders with five countries - Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Afghanistan in the south. This geographical location at the junction of a number of biogeographic regions determines the antiquity, diversity, origin and complex genetic relationships of flora and fauna. The gene pool of wild animals inhabiting the territory of the Republic of Uzbekistan is unique. Our country is an important habitat for endemic species and subspecies of animals of Central Asian origin. Most of it is represented by native fauna (Yunusov et al., 2015).

Nowadays, it becomes increasingly clearer that sustainable nature management is the only right way for the further development of humanity.

One of such sustainable approaches is the introduction and use of alternative energy sources.

It should be noted that Resolution No. UP-5544 "On Approval of the Strategy of Innovative Development of the Republic of Uzbekistan for 2019-2021" (President of the Republic of Uzbekistan, 21 September 2018) prescribes an increase in the portion of electric energy production using renewable energy sources to the level of at least 20% by 2025.

In addition, Resolution No. PP-4422 "On accelerated measures to improve the energy efficiency of economic and social sectors, introduce energy-saving technologies and develop renewable energy sources" (President of the Republic of Uzbekistan, 22 August 2019) approves long-term target parameters for the development of renewable energy sources and organisational and practical measures for further development of renewable energy sources.

This resolution prescribes an increase in the portion of electricity production using renewable energy sources to at least 25% by 2030.

To achieve these targets, the government has developed a plan to build almost 10 GW of new renewable energy facilities, including 5 GW of solar (excluding the capacity of individual households), 3 GW of wind and 1.9 GW of hydroelectric power plants.

At the same time, the construction of new renewable energy facilities with a total capacity of more than 10 GW and the modernization of existing hydroelectric power plants will ensure the production of more than 37 billion kWh of electricity by renewable energy facilities (in 2018 – 5.9 billion kWh), as well as expected annual savings of more than 8.1 billion m³ of natural gas.

This report presents a faunal overview of the territories designed for the construction of wind power plants in the Bukhara region: Dzankeldy (in the western foothills of the Kuldzhuktau residual mountains) and Bash (near the northern chinks of the Ayak-Agitma depression). The report also contains the results of a survey of the projected power transmission lines that will connect Dzankeldy and Bash wind farms and OHTL that will connect Bash wind farm with Karakul substation.

HISTORY OF THE STUDY OF THE REGION

The history of the study of reptiles inhabiting the territory of Uzbekistan, as was the case with other vertebrates in Central Asia, began with the trip of E. A. Eversmann and K. Pander from Orenburg to Bukhara (October 1820 – April 1821). The few and occasional collections of E. A. Eversmann, transferred to the University of Berlin, were processed by Prof. G. Lichtenstein and published in 1823 as an appendix to the work of E. A. Eversmann (Bogdanov, 1960).

A. P. Khoroshkhin left Jizzakh in April 1872 and drove along the foot of the Nuratau Range and past the Aristan-Beltau mountains, and arrived in Tamdy, from where he travelled to the Aktau and Bukantau mountains. However, A. P. Khoroshkhin was not a specialist and did not collect reptiles, and in the book published in 1876 he mentioned only a tortoise, monitor lizard and sand racer.

G. Ye. Grum-Grzhimailo travelled across Uzbekistan with his expedition in 1885 (see Fauna of the Uzbek SSR, vol. II). His collections were processed by A. M. Nikolsky (1915).

The book by A. M. Nikolsky 'Reptiles and amphibians of the Turkestan general-governorship' is a complete literary summary of that time, was published in 1899. The author processed the materials of A. P. Fedchenko and others who collected them in Central Asia. The paper provides information on the distribution of 7 species of amphibians, 3 species of tortoises, 42 species of lizards and 28 species of snakes. Of these, 2 species of amphibians, 1 tortoise species and more than half of the species of lizards and snakes were caught in the territory of Uzbekistan (Sultanov, Persianova, 1982).

In 1933, 1934 and 1935 A. M. Andrushko collected in the central part of Kyzylkum more than 700 individuals of reptiles. Her article published in 1953 lists 23 species and specifies their distribution across biotopes. 7 species of reptiles (Transcaspian bent-toed gecko, Turkestan thin-toed gecko, Reticulated toad-headed agama, Striped racerunner, Tatory sand boa, Spotted whip snake, Diadem snake) were for the first time discovered in this part of the desert.

O. P. Bogdanov in his work "Fauna of the Uzbek SSR. Amphibians and reptiles" (1960) provides data that he collected in Central Kyzylkum in 1949, 1950, 1954 and 1955.

N. N. Shcherbak (1974) studied racerunners (genus *Eremias*) throughout their habitat, including the central part of Kyzylkum, in particular, in the area near the towns of Zaravshan and Uchkuduk.

The publication of D. A. Bondarenko and E. A. Peregontseva (2017) describes the spatial distribution of the Russian tortoise *Testudo horsfieldii* in Uzbekistan, mostly in the central part of the Kyzylkum desert.

Also, this report presents the author's personal data collected during field studies of the area in 2012, 2014, 2015, 2018 and 2019.

The list of reptiles is given according to the latest updated reptile database

(http://www.reptile-database.org/data/Reptile_checklist_2019_07.xlsx.)

PHYSIOGRAPHICAL DESCRIPTION OF THE RESEARCH AREA

The Kyzylkum physiographical region (Fig. 1) is located almost in the very center of the flat part of Central Asia, which is associated with truly desert landscape. It includes the western part (belonging to Uzbekistan) of the Kyzylkum Desert (its northern and eastern parts are on the territory of Kazakhstan). In the north lies the border of the region with Kazakhstan, in the south-west – with Turkmenistan, in the east is the Mirzachul area, in the south-east – the Zarafshan area and in the west – the lower Amudarya area (Gulomov et al., 2013).

The surface of the area slopes slightly down from south-east to north-west. The average altitude above sea level is 200-300 m, in the south-east the heights reach 350-400 m, in the north-west – only 100 m. The lowest point is the Mingbulak depression 12 m below sea level. The highest point is Aktau peak (922 m) in the Tamdytau Mountains (Gulomov et al., 2013).

The Kyzylkum Desert in the north-west is bordered by the Aral Sea, in the north-east by the Syr Darya, in the east by the spurs of the Tien Shan and Pamir Alai, in the south-west by the Amu Darya. The area of the desert is about 300 thousand square kilometers (Yugai, 1964).



Figure 1 Satellite image with the territory of the Kyzylkum desert highlighted (Wikipedia, source file: Whole world – land and oceans.jpg)

The Kyzylkum Desert is a plain generally sloping to the north-west (altitudes above sea level range from 300 meters in the south-east to 53 meters in the northwest); it has a

number of closed depressions and highly dissected isolated residual (island) mountains – Bukantau (764 m), Kuldzhuktau (up to 785 m), Tamdytau (922 m) and others, composed of strongly dislocated and metamorphosed Paleozoic shales, hornstones, limestones, granites. (Yugai, 1964). The mountains are barren and mostly have levelled peaks and rocky, heavily cut slopes. Between these mountains are the Mingbulak, Karakata, Mullali and Ayakagitma depressions. The lower parts of these depressions are occupied by *solonchaks*, *takyrs* and sands (Gulomov et al., 2013).

Most of the desert is occupied by extensive sandy areas composed of semi-fixed sands. The most widespread are meridionally-oriented sandy ridges. The relative height of the ridges is from 3 to 30 m, with a maximum of up to 75 m. The flat portions are composed of Cenozoic clays and sandstones, in the north and north-west – loamy and mixed sandy and loamy river sediments. A characteristic feature of the Kyzylkum desert is the existence in its central and south-western parts of isolated low mountains – residual (island) mountains. These are Bukantau, Dzhetytau, Tamdytau, Kuldzhuktau, as well as Sultanuzdag in the west. All of them are remnants of Paleozoic (Hercynian) folded chains located on the continuation of the structures of the northern chains of the Pamir-Alai (Turkestan and Nuratau Ranges) and formed by the latest tectonic processes. The elevations are composed of highly dislocated and metamorphosed Paleozoic slates, limestones and granites. The tops and crests of many of the residual (island) mountains have levelled surfaces used for unirrigated farming. The slopes of the residual (island) mountains are strongly dissected; at the feet there are aprons composed of pebbly and sandy accumulations, which often contain fresh groundwater and in some places feed the springs that supply mining villages with water. The area of the residual (island) mountains also features flat hilly elevations and plateaus of the cuesta type, composed of slightly disturbed Cretaceous and Paleogene sedimentary rocks (marls, sands, clays). Another characteristic feature is the existence of extensive closed basins (the Karakat and Ayakagytm basins) in the central and south-western parts of the desert (Gulomov et al., 2013).

Loose sand dunes are found near human settlements and around wells. In most cases, the exposure of the sands is the result of excessive grazing and trampling of vegetation by livestock near watering holes, as well as the use of shrubs and saxaul for fuel (Gulomov et al., 2013).

Sheep and goats, as well as camels and horses and, to a lesser extent, cattle graze in the Kyzylkum desert. The organization of pasture use and the creation of new wells made it possible to significantly increase the livestock population (Gulomov et al., 2013).

Large artesian basins were discovered in the central and south-western parts of the desert. Agriculture is beginning to develop near artesian wells in depressions, where melons and pumpkins are cultivated and experimental stations are established to provide livestock with additional feed (Gulomov et al., 2013).

CLIMATE, WATER, SOIL AND VEGETATION

The climate of the Kyzylkum physiographical region is arid and sharply continental. It is characterized by high summer temperatures, a very low level of annual precipitation and a strong fluctuation of daily and annual temperatures (Gulomov et al., 2013).

Winter in Kyzylkum is cold. The reason for this is the frequent invasions of dry and cold Arctic air masses and the Siberian anticyclone from the north. On such days, the air temperature drops sharply to $-31-35^{\circ}\text{C}$. Western air masses bring precipitation and a slight increase in temperature. The average temperature in January in the north of Kyzylkum is $-5-10^{\circ}\text{C}$, in the middle part $-2-4^{\circ}\text{C}$, in the south $-1-2^{\circ}\text{C}$ (Gulomov et al., 2013).

With the coming of spring, the temperature gradually rises and rainfalls become quite frequent. Nature awakens and the earth becomes covered with ephemeral plants. The precipitation season is already over in April. In the long summer period (lasts more than 150 days), the air temperature is the same almost throughout. This is due to the large amount of solar radiation (total annual radiation is 120 kcal per 1 cm^3) and the penetration of hot tropical air masses from the south. The average temperature in the southern and central parts is $+30^{\circ}$, in the north $+26 + 28^{\circ}\text{C}$; on some days the temperature reaches $+48^{\circ}\text{C}$. At this time, the sands warm up to $+75 + 80^{\circ}\text{C}$.

Autumn in Kyzylkum is usually dry. There is little precipitation (up to 75–100 mm annually), and it is unevenly distributed over the seasons. The largest portion of the annual amount of precipitation falls in spring (up to 48%) and winter (up to 30%), but the evaporation rate reaches 1,000–1,500 mm (Gulomov et al., 2013).

The region has a significant stock of groundwater. The dynamic amount of groundwater is 58–60 m^3/sec . The groundwater is salty. Fresh artesian waters are available in the strata of the Mesozoic and Paleogene sediments. Also, mineral thermal waters were found in the Paleozoic deposits (Gulomov et al., 2013).

In Kyzylkum, sandy and mixed sandy and loamy soils are widespread in the plains, foothills and on the slopes of the elevations – grey-brown soils, and in the basins – solonchak and marshy solonchak soils (Gulomov et al., 2013).

More than 600 plant species grow in the Kyzylkum area. They are dominated by ephemerals and ephemeroids with a short spring growing season: bulbous bluegrass, sedge, *Bromus danthoniae*, tulips, snowdrops, *Ixiolirion*, *Cousinia microcarpa*. When the hot season sets in, they wither. Plants adapted to droughts and solonchaks continue to grow in summer (Gulomov et al., 2013).

Calligonum, white saxaul, *Stipagrostis*, sand acacia inhabit fixed sands. Sagebrush and weed widely occur on grey-brown soils (Gulomov et al., 2013).

Black saxaul, tamarisk, *Climacoptera crassa*, *Halocnemum* grow on solonchak and solonchak-marshy soils, *Gamanthos* – on takyr (Gulomov et al., 2013).

METHODS OF CONDUCTING HERPETOLOGICAL FIELD SURVEY

During the field survey an attempt was made to assess the status of reptiles and amphibians in the study area (specification of the species and quantitative composition, territorial distribution, including places of concentration, the state of habitats). However, it should be noted that cold weather did not allow for a full survey in this area, while single records of reptiles do not give a complete understanding of the composition of the biodiversity in the area. Therefore, the combination of field survey and desktop analysis was used.

Field studies were carried out according to generally accepted zoological methods for identifying species composition. The following methodological guidelines were used in the survey: L. G. Dinesman, M. L. Kaletskaya (1978), V. M. Makeev, A. T. Bozhansky (1988) and N. N. Shcherbak (1989), D. A. Bondarenko, Chelintsev, (1996). Literature sources and statistical data had been processed.

The main research method used was mixed stationary and transect survey. Points and transects for conducting research were outlined at the project monitoring stations in accordance with different types of habitats.

The field research methodology reflects the following aspects:

- species composition in the study area;
- distribution across habitats;
- daily and seasonal changes in activity;

Thus, the method of quantitative assessment was based on the ecology of the species under consideration, landscape and geographical conditions, season and type of work.

The quantitative assessment of reptiles and amphibians was mainly based on the transect survey. The transect method consists in counting individuals along a fixed long line (transect), on both sides of it, with the duration of the survey determined by the known distance, which is selected depending on the type of reptile and the area, but does not exceed 1 km in one way. In this case, all individuals encountered on the transect are registered, regardless of the distance they are identified at. The perpendicular distance is measured between the transect axis and each individual. The results obtained are used to calculate the density of recorded reptiles. The one-kilometer transect was chosen because heaviest errors arise when long transects are used for species that, like the Russian Tortoise, have high density, daily and seasonal activity cycles fluctuations with high peak values, and are caused by incorrect selection of a minimum survey area for a particular species (Vashetko et al, 2001).

The Russian tortoise population density (D) was calculated using the following formula (Bondarenko, Chelintsev, 1996):

$$D = \frac{n}{2LB}$$

where n – number of animal individuals recorded on the transect; L – length of the transect; B – formula to calculate an effective width of the survey strip:

$$B = W(0,79F + 0,21F^4)$$

where W – width of the limited strip on both sides of the transect axis; F :

$$F = \frac{2y}{W}$$

The use of perpendicular distances to carry out survey on a strip of limited width excludes underestimation of the population density of the Russian tortoise caused by a decrease in their detectability in remote parts of the survey strip, regardless of the degree of its limitation (Bondarenko and Chelintsev, 1996).

The survey method for the Southern Even-fingered Gecko (*Alsophylax laevis*) is different from the method of accounting for other reptile species. This is mainly due to the small size, secretiveness and other aspects of the biology of this species such as nocturnalism.

Southern Even-fingered Gecko (*Alsophylax laevis*) is distinguished by the acoustic interaction between individuals, but louder signals are noted in males. Acoustic signals of females are practically not audible in the field. The signals of males, under ideal weather conditions, can be heard within a radius of 100 meters or more.

Before starting accounting of Southern Even-fingered Gecko, it is necessary to identify the optimal biotope for this species. Since the Southern Even-fingered Gecko is a stenobiont species, the survey should be carried out only on a suitable biotope.

The method of accounting for the Southern Even-fingered Gecko (*Alsophylax laevis*) is carried out after sunset; the surveyor takes a position on the optimal biotope, preferably on a hill so that the acoustic signals reach the surveyor better. After taking the position, the surveyor must observe absolute silence and not turn on the lighting devices. The acoustic signals produced by the Southern Even-fingered Gecko in the accounting radius, which on average covers 1 ha, are recorded in a notebook with information about the direction of the acoustic signals and the distance to the gecko.

Since only males can be heard, the resulting density should be multiplied by a factor of 0.3 when extrapolating. This coefficient is derived from the males: females ratio in a gecko population (2 males per one female in average).

The abundance of the reptiles in habitats was estimated using the following population density scale for 1 ha (Kuzynkin, 1962): 0.1 – 0.9 – rare, 1.0 – 9.9 – common, 10.0 and higher – abundant.

RESULTS

This section provides historical data and data collected during the field trips carried out in Spring and Summer of 2021. Also, in this section, the primary abundance of reptiles found at the accounting points (transects) and the average density derived by analyzing the primary data at each of the accounting points are shown. These data will help to create a map of the abundance and distribution of reptiles in the project area in the future, as well as help to create an action plan to reduce the burden on the populations.

The basis for compiling the list of herpetofauna of the studied territory was the modern list of amphibian fauna of Uzbekistan, consisting of 3 species from two families and the list of reptile species of Uzbekistan, consisting of 62 species from 13 families.

Herpetological survey in the Dzhankeldy WF project area (Kuldzhuktau residual mountains)

Herpetological survey in this area is of particular interest because there are various biocenoses and, consequently, the species diversity of reptiles is very rich. The most concerning species is critically endangered Southern Even-fingered Gecko (*Alsophylax laevis*), which was first found in this area last century. However, it should be noted that Southern Even-fingered Gecko inhabiting this territory is more likely to be a separate new species (Figure 2). And most likely it is an even rarer and endemic species that inhabits only this territory. Currently, the active study of this species is being conducted. Due to the fact that this species is the only representative of vertebrates on the project territory that is included in the Red List of the International Union for Conservation of Nature (IUCN Red List) with the status CR - critically endangered, survey on this particular species was given priority.



Figure 2 Southern Even-fingered Gecko at Dj 8 point in April 2021 (adult male)

The first field visit was made in April 2021. April is the period of the highest activity of the Russian tortoise (*Testudo horsfieldii*), which is also listed in the Red List of the International Union for Conservation of Nature (IUCN Red List) as VU - vulnerable. However, April appeared to be not optimal for the gecko survey this year, since night temperatures were still quite low, and the weather in the desert is not stable at this time of the year. During this period, the very first individuals appear on the surface, while most are waiting for warmer weather. In connection with the above, the accounting of this species in April is not indicative. More information that is accurate was collected during the summer survey, when an absolute number of individuals were active. As for the Caspian monitor (*Varanus griseus caspius*), the situation is almost the same as with the gecko, in April only some individuals were active. The Desert sand boa (*Eryx miliaris*) is active in both spring and summer, but this species can be observed in the daytime only in spring (Figure 3).



Figure 3 Young Desert sand boa (*Eryx miliaris*) at Dj 20 point in April 2021

The second field visit was carried out in June 2021. In the summer months, it is almost impossible to find Russian tortoise on the territory, since this species has a period of aestivation (summer hibernation). Occasionally in summer, individual tortoises can be seen on the surface in those places where the green juicy grass is preserved. No such places were found on the project territory, as well as the tortoises themselves in the summer period. For other listed species, such as the Southern Even-fingered Gecko and Caspian monitor, summer is the period of the highest activity.

All 4 species are listed also in the Red Book of the Republic of Uzbekistan and were found in the project area around the Kuldzhuktau residual mountains.

Table 1 List of reptile species inhabiting the Dzankeldy WF project area

№	Species	Species presence acc. to literary sources	Author's earlier personal data	April 2021 field expedition data	June 2021 field expedition data	Endemism	Conservation status		
							UzRDB	IUCN	CITES
Family <i>Buфонidae</i> (toads)									
1	Turan Toad <i>Bufoles turanensis</i>	+	+	+		UZ, TJ, TM			
2	Marsh frog <i>Pelophylax ridibundus</i>	+	+	+				LC	
Family <i>Testudinidae</i> (tortoises)									
1	Russian tortoise <i>Testudo horsfieldii</i>	+	+	+			2 (VU)	VU	II
Family <i>Gekkonidae</i> (geckoes)									
2	Southern Even-fingered Gecko <i>Alsophylax laevis</i>	+		+	+	UZ, TM	VU:D	CR	
3	Caspian Bent-Toed Gecko <i>Tenuidactylus caspius</i>	+	+	+	+			LC	
4	Turkestan thin-toed gecko <i>Tenuidactylus fedtschenkoi</i>	+	+	+	+	UZ, TJ, TM, KZ			
Family <i>Agamidae</i> (agamas)									
5	Steppe agama <i>Trapelus sanguinolentus</i>	+	+	+	+				
6	Sunwatcher toad-headed agama <i>Phrynocephalus helioscopus</i>	+	+	+	+				
7	Reticulated toad-headed agama <i>Phrynocephalus reticulatus</i>	+	+	+	+	UZ, TM		LC	
Family <i>Lacertidae</i> (true lizards)									
8	Rapid Lizard <i>Eremias velox</i>	+	+	+	+				
9	Aralo-Caspian racerunner <i>Eremias intermedia</i>	+		+					
Family <i>Varanidae</i> (monitor lizards)									

10	Caspian Monitor <i>Varanus griseus caspius</i>	+	+				2 (VU:D)		I
Family Boidae (Boas)									
11	Desert sand boa <i>Eryx miliaris</i>	+		+			3 (NT)		II
Family Colubridae (colubrid snakes)									
12	Sand racer <i>Psammophis lineolatus</i>	+	+	+					
13	Spotted whip snake <i>Hemorrhois ravergieri</i>	+		+	+				
14	Spotted desert racer <i>Platycephalus karelinii</i>	+	+						
15	Dice Snake <i>Natrix tessellata</i>	+	+						

Notes: UzRDB– species/subspecies listed in the Red Data Book of Uzbekistan (2019) (CR – critically endangered; VU – vulnerable; NT – near-threatened); IUCN – species included in the Red List of the International Union for Conservation of Nature (VU - vulnerable; NT – near-threatened); CITES I, II – species listed in the appendices (I, II) to the Convention on International Trade in Endangered Species of Wild Fauna and Flora; Endemism: AF - Afghanistan, KZ – Kazakhstan; TM – Turkmenistan; KG – Kyrgyzstan; TJ – Tajikistan; UZ – Uzbekistan.

According to processed information, the author's personal data and two field survey results, currently, the Dzankeldy wind farm project area is inhabited by 2 amphibian species and 15 reptile species belonging to 7 families (Table 1). The total number of amphibian species comprises 66,6% of the total diversity of the amphibian fauna of Uzbekistan, reptiles – 24,2%. Among them, 4 species are included in the Red Book of the Republic of Uzbekistan (2019) (26,7% of the total number of species inhabiting the project area), 2 species are included in the Red List of the International Union for Conservation of Nature (IUCN Red List) (13,3% of total number of species inhabiting the project area) and 3 species – in the Appendices to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (20% of the total number of species inhabiting the project area).

Spring survey (April 2021)

The first field trip to the survey points in the area of the Kuldzhuktau residual mountains was carried out from April 17 to 20, 2021. During the spring survey of the project area, 22 km of hiking routes (transect) were completed. The transects passed through pre-selected survey points and their 1 kilometer radius (Figure 4).

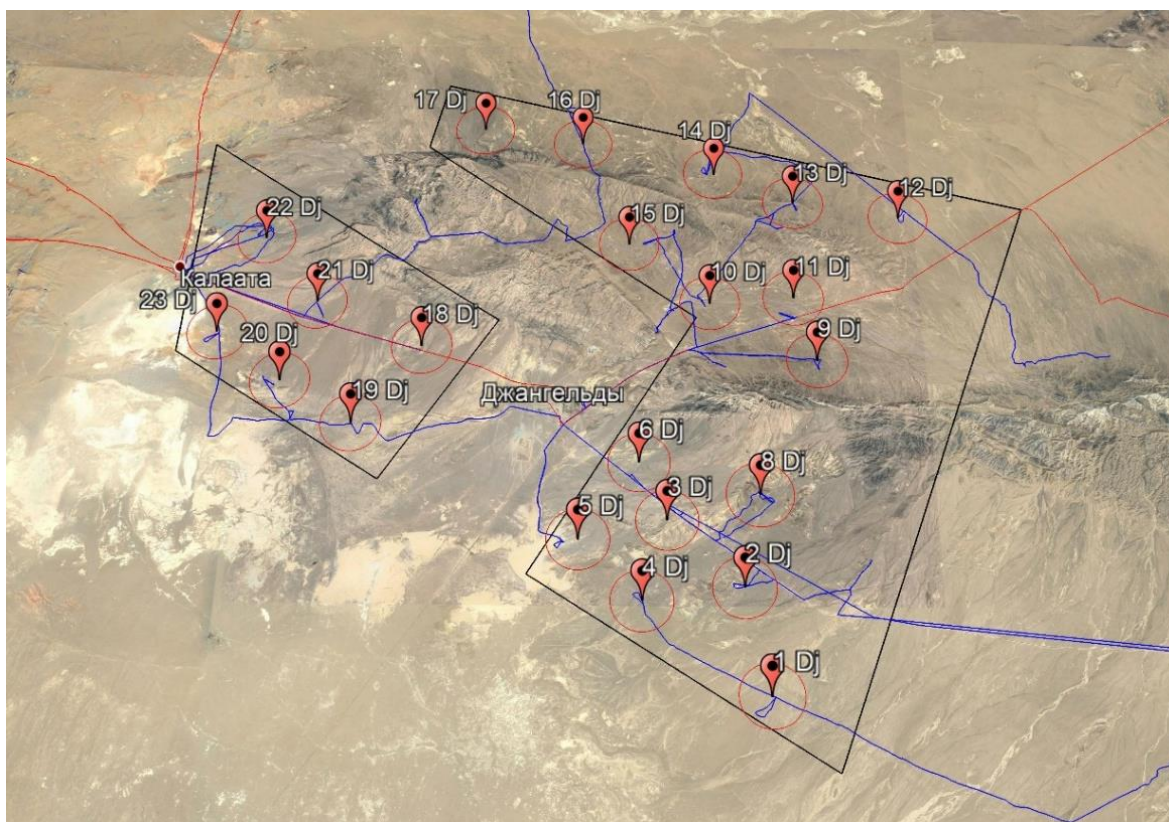


Figure 4 Observation points and transects on the Dzankeldy project territory in spring 2021

Reptile survey was carried out both during the day (Figure 5) and at night. Moreover, in some points that were identified as potential habitats of the Southern Even-fingered Gecko during the day, both day and night surveys were carried out, in places that were identified as not suitable biotope for the Southern Even-fingered Gecko, night records were not carried out.



Figure 5 Photographing a Desert sand boa at the Dj 20 point in April 2021

The average night air temperature in April was 18 °C, the soil temperature was 17 °C, the air humidity was 35%. These values are not high enough for the reptile nocturnal survey.

During the survey of the territory, we recorded 11 reptiles species (17.7% of the total number of reptiles species), of which 3 species (27.3% of the number of species encountered) - Russian tortoise, Desert sand boa and Southern Even-fingered Gecko are included in the Red Book of the Republic of Uzbekistan, and two (18.2% of the number of species encountered) of them are included in the Red List of the International Union for Conservation of Nature (IUCN Red List).

The highest density of the Russian tortoise on the project territory during the Spring survey was recorded at Dj 13 point and amounted to 3.99 ind/ha. However, similar number of 2 tortoises per transect was observed at several other points: Dj 9, Dj 10, Dj 12 and Dj 14. The Russian tortoise was found at 8 points, which is 38% of the total number of observation points (21 points), most of which are located in the northern foothill part of the Kuldzhuktau mountains (Figure 6). It is worth noting that the Russian tortoise is not a numerous species throughout the project area.



Figure 6 Russian tortoise at Dj 10 point in April 2021

The highest density of Southern Even-fingered Gecko on the project territory, during the first field trip, was recorded at 3 points: Dj 3, Dj 6, Dj 18 and amounted to 3 ind/ha on each of them. However, as mentioned above, the spring abundance and density indicators for this species can not be considered indicative, due to low night temperatures and small percentage of individuals coming to the surface (Figure 7).

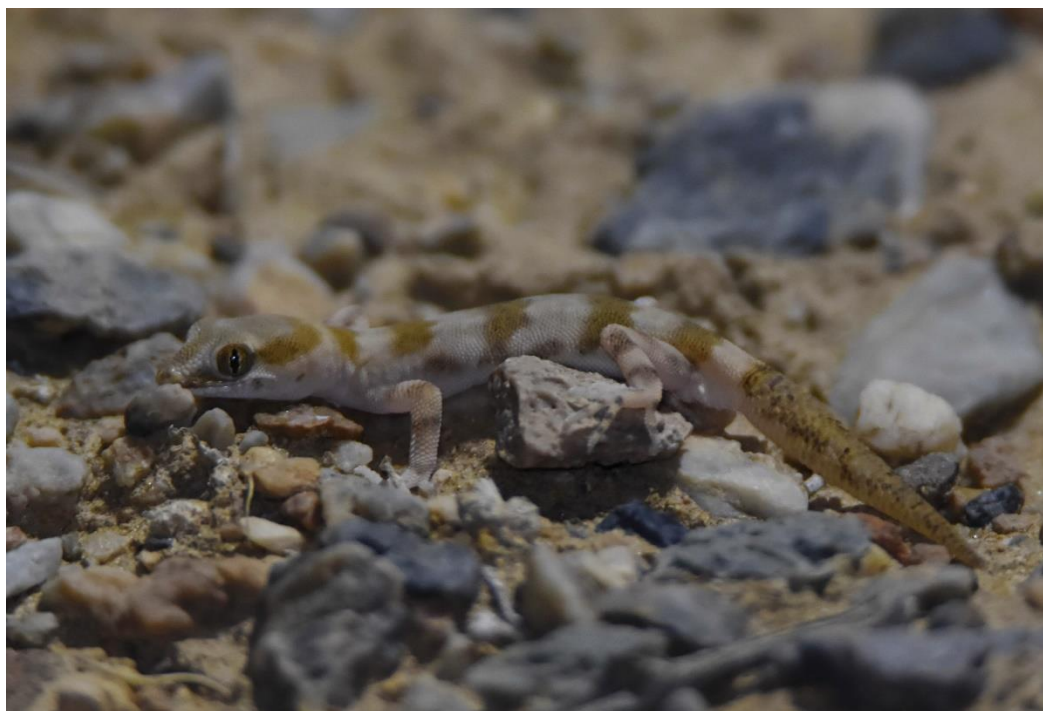


Figure 7 Southern Even-fingered Gecko at Dj 6 point in April 2021

In general, the reptiles' species composition is typical for this geographical area.

Table 2 Primary data and the density of reptiles at the accounting points in the area of the Kuldzhuktau outlier in the spring of 2021

No	Species	No. of recorded animals	Population density on the site, inds/ha	Biotope	Transect length	Date and time	Air temperature	Soil temperature	Humidity, %
Dj 1				Rubbly-clayey plain with depressions, Artemisia association	1 km	20.04.21	C24,9°	C30,9°	29%
1	<i>Phrynocephalus reticulatus</i> Reticulated toad-headed agama	3	1,5						
3	<i>Eremias intermedia</i> Aralo-Caspian racerunner	4	2						
Dj 2				Rubbly-clayey plain with cliffs and elevations, Artemisia-Ferula association	1 km	19.04.21	C29,8°	C38,4°	17%
1	<i>Trapelus sanguinolentus</i> Steppe agama	1	1						

Dj 3				Multicolour uplands, rubbly-clay depressions Artemisia association	1 km	19.04.21	C18,2°	C17,2°	22%
1	<i>Alsophylax laevis</i> Southern Even-fingered Gecko	2	3						
Dj 4				Rubbly-clayey plain with depressions, Artemisia association	1 km	20.04.21	C23,3°	C27,2°	30%
1	<i>Phrynocephalus reticulatus</i> Reticulated toad-headed agama	2	1						
2	<i>Trapelus sanguinolentus</i> Steppe agama	1	1						
3	<i>Eremias intermedia</i> Aralo- Caspian racerunner	2	1						
Dj 5				Rubbly-clayey plain, sparse wormwood and saxaul bushes	1 km	19.04.21	C24,3°	C32,7°	17%
1	<i>Phrynocephalus helioscopus</i> Sunwatcher toad-headed agama	1	0,5						
Dj 6				Multicolour uplands, rubbly-clay depressions Artemisia association	1 km	19.04.21	C18,0°	C18,6°	28%
1	<i>Alsophylax laevis</i> Southern Even-fingered Gecko	2	3						
Dj 8				Multicolour uplands, rubbly-clay depressions Artemisia association	1 km	19.04.21	C20,3°	C19,1°	22%
1	<i>Alsophylax laevis</i> Southern Even-fingered Gecko	1	1,3						
Dj 9				Hilly sandy foothills, sarzagan association	1 km	19.04.21	C29,0°	C37,4°	18%
1	<i>Testudo horsfieldii</i> Russian tortoise	2	0,89						
2	<i>Tenuidactylus fedtschenkoi</i> Turkestan thin-toed gecko	1	0,2						
3	<i>Trapelus sanguinolentus</i> Steppe agama	1	1						
4	<i>Eremias velox</i> Rapid Lizard	1	0,5						
Dj 10				Rubbly-clayey plain with depressions,	1 km	18.04.21	C29,0°	C44,8°	30%

				Artemisia association					
1	<i>Testudo horsfieldii</i> Russian tortoise	2	2,78						
2	<i>Trapelus sanguinolentus</i> Steppe agama	1	1						
Dj 11				Hilly sub-sandy foothill plain, in some places the sections are rubbly-sandy, Artemisia-saxaul formation, in in some places along sai (small water flow) Tamarix	1 km	19.04.21	C27,5°	C27,7°	18%
1	<i>Tenuidactylus fedtschenkoi</i> Turkestan thin-toed gecko	1	0,2						
2	<i>Trapelus sanguinolentus</i> Steppe agama	1	1						
3	<i>Eremias velox</i> Rapid Lizard	2	1						
Dj 12				Rubbly-sandy desert, sai (water flow) from the Kuldjuktai Mountains, Artemisia-Ferula association, Tamarix and Peganum harmala along sai	1 km	18.04.21	C23,5°	C24,3°	18%
1	<i>Testudo horsfieldii</i> Russian tortoise	2	0,85						
2	<i>Tenuidactylus caspius</i> Caspian Bent-Toed Gecko	1	0,2						
Dj 13				Hilly loamy plain, Artemisia-ferula association	1 km	18.04.21	C27,5°	C30,0°	17%
1	<i>Testudo horsfieldii</i> Russian tortoise	2	3,99						
2	<i>Eremias intermedia</i> Aralo-Caspian racerunner	2	1						
Dj 14				Clay foothills, Artemisia-ferrula association	1 km	18.04.21	C28,1°	C29,2°	18%
1	<i>Testudo horsfieldii</i> Russian tortoise	2	0,3						
2	<i>Trapelus sanguinolentus</i> Steppe agama	2	2						
Dj 15				Rubbly-sandy hummocky foothill desert, Artemisia - ferula association	1 km	18.04.21	C29,7°	C42,3°	18%

1	<i>Testudo horsfieldii</i> Russian tortoise	3 trace	–						
2	<i>Trapelus sanguinolentus</i> Steppe agama	1	1						
Dj 16				Rubbly-sandy foothills, Artemisia- ferula association	1 km	17.04.21	C25,4°	C27,9°	23%
1	<i>Testudo horsfieldii</i> Russian tortoise	3	1,4						
2	<i>Trapelus sanguinolentus</i> Steppe agama	1	1						
Dj 18				Rubbly plain with clay cliffs, Artemisia association	1 km	17.04.21	C17,6°	C16,4°	38%
1	<i>Alsophylax laevis</i> Southern Even-fingered Gecko	2	3						
Dj 19				Rubbly-sandy hummocky foothill desert, Artemisia - ferula association	1 km	18.04.21	C27,7°	C36,2°	21%
1	<i>Tenuidactylus caspius</i> Caspian Bent-Toed Gecko	1	0,4						
2	<i>Phrynocephalus reticulatus</i> Reticulated toad-headed agama	2	1						
3	<i>Trapelus sanguinolentus</i> Steppe agama	6	6						
4	<i>Eremias intermedia</i> Aralo- Caspian racerunner	2	1						
Dj 20				Rubbly plain, Artemisia-ferula association	1 km	18.04.21	C32,2°	C36,8°	24%
1	<i>Phrynocephalus reticulatus</i> Reticulated toad-headed agama	2	1						
2	<i>Trapelus sanguinolentus</i> Steppe agama	2	2						
3	<i>Eremias intermedia</i> Aralo- Caspian racerunner	1	0,5						
4	<i>Eremias lineolata</i> Striped Racerunner	1	0,2						
5	<i>Eryx miliaris</i> Desert sand boa	1	-						
Dj 21				Rubbly-sandy foothills, Artemisia- ferula association	1 km	17.04.21	C23,8°	C25,8°	26%
1	<i>Phrynocephalus reticulatus</i> Reticulated toad-headed agama	2	1						

Dj 22				Rubbly-sandy plains Artemisia-ferula association	1 km	18.04.21	C21,1°	C20,2°	40%
1	<i>Phrynocephalus reticulatus</i> Reticulated toad-headed agama	3	1,5						
Dj 23				Rubbly plain with depressions and chakalaks (large hillocks up to 1-3 m in height) Artemisia- Ferula association	1 km	18.04.21	C24,7°	C25,0°	32%
1	<i>Testudo horsfieldii</i> Russian tortoise	1	1,3						
2	<i>Phrynocephalus reticulatus</i> Reticulated toad-headed agama	2	1						
3	<i>Trapelus sanguinolentus</i> Steppe agama	1	1						
4	<i>Eremias intermedia</i> Aralo- Caspian racerunner	1	0,5						

It is worth noting that almost the entire southern foothill part of Kuldzhuktau is a potential habitat for the Southern Even-fingered Gecko (see points DJ 1, 2, 3, 4, 5, 6, 8, 11, 18, 19, 20, 21, 22, 23). On the contrary, most of the northern sub-mountain plain of Kuldzhuktau, as well as the outlier itself, is unsuitable habitat for this species. However, such rare and listed in the Red Book of the Republic of Uzbekistan species as: Russian tortoise, Caspian monitor, and Desert sand boa inhabit the entire area of the construction of the Dzankeldy wind farm.

Summer survey (June 2021)

The second field trip to the survey points in the area of the Kuldzhuktau residual mountains was carried out from June 19 to 22, 2021. The priority of this field visit was to conduct the quantitative assessment of Southern Even-fingered Gecko population at the points identified in spring as the most suitable. During the summer survey of the project area, 6 km of hiking routes (transect) were completed. The transects passed through pre-selected survey points and their 1 kilometer radius (Figure 8).

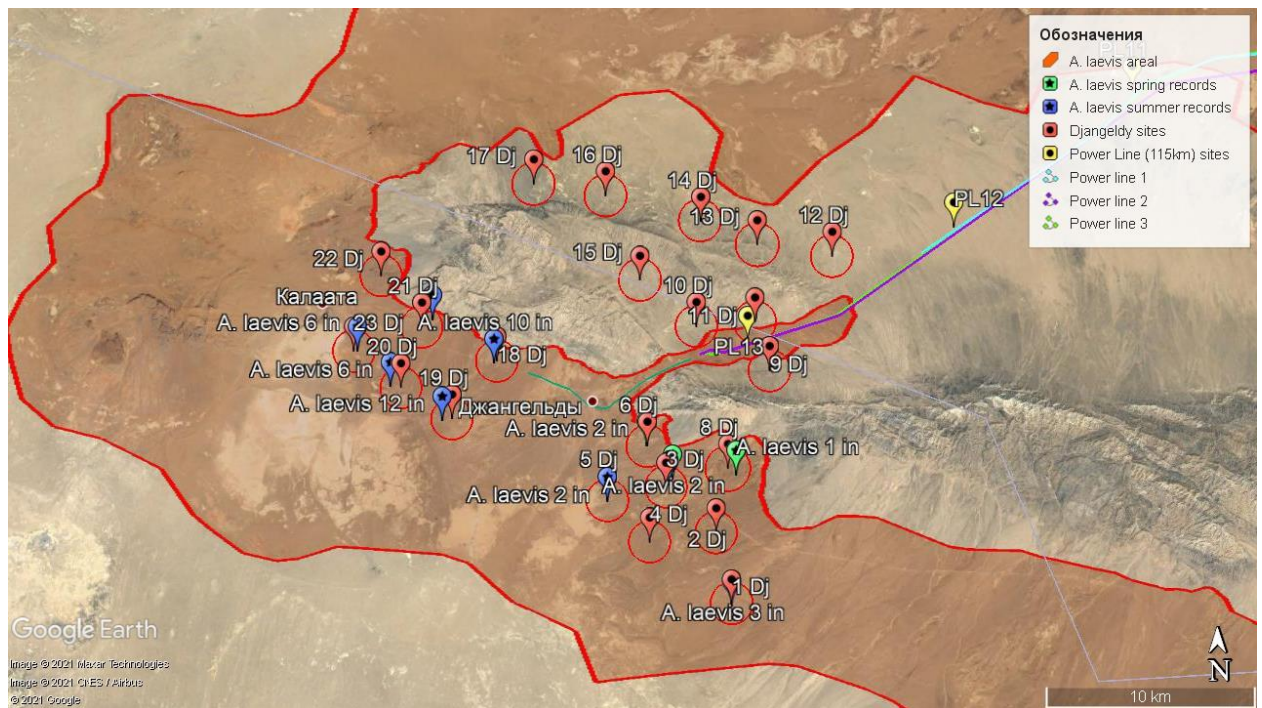


Figure 8 Survey points on the Dzankeldy WF project territory, as well as locations where the Southern Even-fingered Gecko was observed in summer and the areal range for the Southern Even-fingered Gecko population in the vicinity of the settlements of Dzankeldy and Kalaata

Reptile survey was carried out mainly at night – after sunset and before the night coolness, until about 2 am, when the activity of the Southern Even-fingered Gecko decreases (Figure 9). However, at some points, the survey was also conducted during the daytime.



Figure 9 Nocturnal survey with a headlamp

The average night air temperature in June was 26-27°C, the soil temperature was 27-28°C, the air humidity was 20-25%. These values are ideal for the nocturnal reptile survey, including the Southern Even-fingered Gecko.

During the survey of the territory, we recorded 8 reptiles species (12,9% of the total number of reptiles species), of which 1 species (12,5% of the number of species encountered) - Southern Even-fingered Gecko is included in the Red Book of the Republic of Uzbekistan, and 1 species - Southern Even-fingered Gecko (12,5% of the number of species encountered) of them are included in the Red List of the International Union for Conservation of Nature (IUCN Red List). The variety of species for the second field visit turned out to be less than for the first, due to the narrow focus and specifics of the summer survey.

Table 3 Primary data and the density of reptiles at the accounting points in the area of the Kuldzhuktau outlier in the summer of 2021

No	Species	No. of recorded animals	Population density on the site, inds/ha	Biotope	Transect length	Date and time	Air temperature	Soil temperature	Humidity, %
Dj 1				Rubbly-clayey plain with depressions, Artemisia association	1 km	22.06.21	C24,1°	C25,3°	29%
1	<i>Alsophylax laevis</i> Southern Even-fingered Gecko	3	4						
Dj 2				Rubbly-clayey plain with cliffs and elevations, Artemisia-ferula association	1 km	22.06.21	C29,8°	C23,4°	17%
1	<i>Tenuidactylus caspius</i> Caspian Bent-Toed Gecko	1	-						
2	<i>Phrynocephalus helioscopus</i> Sunwatcher toad-headed agama	2	2,7						
Dj 3				Multicolour uplands, rubbly-clay depressions Artemisia association	1 km	19.06.21	C26,2°	C25,6°	18%
1	<i>Alsophylax laevis</i> Southern Even-fingered Gecko	4	5,3						
Dj 4				Rubbly-clayey plain with depressions, Artemisia association	1 km	22.06.21	C23,3°	C23,0°	30%
1	<i>Tenuidactylus caspius</i> Caspian Bent-Toed Gecko	2	2,4						
Dj 5				Rubbly-clayey plain, sparse sagebrush and saxaul bushes	1 km	22.06.21	C24,3°	C23,6°	17%
1	<i>Alsophylax laevis</i> Southern Even-fingered Gecko	2	2,7						
Dj 6				Multicolour uplands, rubbly-clay depressions Artemisia association	1 km	19.06.21	C25,9°	C24,6°	18%

1	<i>Trapelus sanguinolentus</i> Steppe agama	1	-						
Dj 8				Multicolour uplands, rubbly-clay depressions Artemisia association	1 km	19.06.21	C24,3°	C22,7°	18%
1	<i>Tenuidactylus fedtschenkoi</i> Turkestan thin-toed gecko	3	4,5						
Dj 18				Rubbly-clayey plain with cliffs and elevations, Artemisia association	1 km	21.06.21	C27,0°	C29,3°	17%
1	<i>Alsophylax laevis</i> Southern Even-fingered Gecko	10	13,3						
Dj 19				Rubbly-sandy hillock desert, Artemisia-saxaul association	1 km	22.06.21	C28,0°	C27,2°	18%
1	<i>Alsophylax laevis</i> Southern Even-fingered Gecko	12	16						
2	<i>Trapelus sanguinolentus</i> Steppe agama	2	-						
3	<i>Tenuidactylus caspius</i> Caspian Bent-Toed Gecko	3	4,7						
Dj 20				Rubbly plain, Artemisia-saxaul association	1 km	22.06.21	C25,5°	C25,3°	18%
1	<i>Alsophylax laevis</i> Southern Even-fingered Gecko	6	8,1						
2	<i>Hemorrhois ravergeri</i> Spotted whip snake	1	-						
Dj 21				Rubbly-sandy foothills, Artemisia- ferula association	1 km	21.06.21	C25,6°	C24,1°	18%
1	<i>Alsophylax laevis</i> Southern Even-fingered Gecko	4	5,3						
Dj 22				Rubbly plain with clay cliffs, Artemisia-saxaul association	1 km	22.06.21	C28,6°	C32,3°	17%
1	<i>Phrynocephalus reticulatus</i> Reticulated toad-headed agama	4	2,5						
2	<i>Eremias velox</i> Rapid Lizard	1	-						
Dj 23				Rubbly plain with depressions and chakalaks (large hillocks up to 1-3 m	1 km	21.06.21	C25,5°	C24,1°	18%

				in height) Artemisia-Ferula association					
1	<i>Alsophylax laevis</i> Southern Even-fingered Gecko	6	8,1						

The highest density of Southern Even-fingered Gecko on the project territory, during the summer field trip, was recorded at Dj 19 point and amounted to 16 ind/ha (Figure 10).

As a result, Southern Even-fingered Gecko was found at 8 survey points during the summer field trip, which is 38% of all the survey points on the project territory. However, it must be noted that we did not find Southern Even-fingered Gecko at several points on potentially suitable biotope due to bad weather conditions during the survey period, namely due to strong wind: the wind speed sometimes reached 15-18 m/s. The following points (on which we did not observe the gecko during the summer survey) are still potential for Southern Even-fingered Gecko: Dj 2, 4, 6, 8, 22, 10 and 11.



Figure 10 Southern Even-fingered Gecko on Dj 19 point in June 2021 (adult male)

In general, the reptiles' species composition is typical for this geographical area.

Herpetological survey in the Bash WF project area (Ayak-agitma lake)

The first field visit was conducted in April 2021. April is the period of the highest activity of the Russian tortoise (*Testudo horsfieldii*), which is also listed in the Red List of the International Union for Conservation of Nature (IUCN Red List) as VU - vulnerable. However, April appeared to be not optimal for the gecko survey this year, since night temperatures were still quite low, and the weather in the desert is not stable at this time of the year. During this period, the very first individuals appear on the surface, while most are waiting for warmer weather. In connection with the above, the accounting of this species in April is not indicative. More information that is accurate was collected during

the summer survey, when an absolute number of individuals were active. As for the Caspian monitor (*Varanus griseus caspius*), the situation is almost the same as with the gecko, in April only some individuals were active. The Desert sand boa (*Eryx miliaris*) is active in both spring and summer, but this species can be observed in the daytime only in spring.

The second field visit was conducted in June 2021. In the summer months, it is almost impossible to find Russian tortoise on the territory, since this species has a period of aestivation (summer hibernation). Occasionally in summer, individual tortoises can be seen on the surface in those places where the green juicy grass is preserved. No such places were found on the project territory, as well as the tortoises themselves in the summer period. For other listed species, such as the Southern Even-fingered Gecko and Caspian monitor, summer is the period of the highest activity.

All 4 species are listed also in the Red Book of the Republic of Uzbekistan and were found in the project area near Ayak-agitma lake.

Table 4 List of reptile species inhabiting the Bash WF project area

№	Species	Species presence acc. to literary sources	Author's earlier personal data	April 2021 field expedition data.	June 2021 field expedition data	Endemism	Nature conservation status		
							UzRDB	IUCN	CITES
Family <i>Buфонidae</i> (toads)									
1	Turan Toad <i>Buфotes turanensis</i>	+	+	+		UZ, TJ, TM			
Family <i>Testudinidae</i> (tortoises)									
1	Russian tortoise <i>Testudo horsfieldii</i>	+	+	+			2 (VU)	VU	II
Family <i>Gekkonidae</i> (geckoes)									
2	Southern Even-fingered Gecko <i>Alsophylax laevis</i>	+			+	UZ, TM	VU:D	CR	
3	Comb-toed Gecko <i>Crossobamon eversmanni</i>	+				UZ, TJ, TM, KZ, IR, AF			
4	Caspian Bent-Toed Gecko <i>Tenuidactylus caspius</i>	+	+	+	+			LC	
5	Turkestan thin-toed gecko <i>Tenuidactylus fedtschenkoi</i>	+	+	+	+	UZ, TJ, TM, KZ			
6	Common Wonder Gecko <i>Teratoscincus scincus</i>	+	+	+		UZ, TJ, TM, KG, IR,CN			
Family <i>Agamidae</i> (agamas)									
7	Steppe agama <i>Trapelus sanguinolentus</i>	+	+	+	+				
8	Sunwatcher toad-headed agama <i>Phrynocephalus helioscopus</i>	+	+	+	+				

9	Lichtenstein's Toadhead Agama <i>Phrynocephalus interscapularis</i>	+	+	+		UZ, TM, KZ			
Family Lacertidae (true lizards)									
10	Rapid Lizard <i>Eremias velox</i>	+	+	+	+				
11	Aralo-Caspian racerunner <i>Eremias intermedia</i>	+		+					
12	Sand Racerunner <i>Eremias scripta</i>	+		+					
Family Varanidae (monitor lizards)									
13	Caspian Monitor <i>Varanus griseus caspius</i>	+	+	+			2 (VU:D)		I
Family Boidae (Boas)									
14	Desert sand boa <i>Eryx miliaris</i>	+		+			3 (NT)		II
Family Colubridae (colubrid snakes)									
15	Sand racer <i>Psammophis lineolatus</i>	+	+	+					
16	Spotted whip snake <i>Hemorrhois ravergieri</i>	+		+	+				
17	Spotted desert racer <i>Platyceps karelinii</i>	+	+	+					
18	Dice Snake <i>Matrix tessellata</i>	+	+						

Notes : UzRDB– species/subspecies listed in the Red Data Book of Uzbekistan (2019) (CR – critically endangered; VU – vulnerable; NT – near-threatened); IUCN – species included in the Red List of the International Union for Conservation of Nature (VU - vulnerable; NT – near-threatened); CITES I, II – species listed in the appendices (I, II) to the Convention on International Trade in Endangered Species of Wild Fauna and Flora; Endemism: AF - Afghanistan, KZ – Kazakhstan; TM – Turkmenistan; KG – Kyrgyzstan; TJ – Tajikistan; UZ – Uzbekistan.

According to processed information, the author's personal data and two field survey results, currently, the Bash wind farm project area is inhabited by 1 amphibian species and 18 reptile species belonging to 7 families (Table 4). The total number of amphibian species comprises 33,3% of the total diversity of the amphibian fauna of Uzbekistan, reptiles – 29,03%. Among them, 4 species are included in the Red Book of the Republic of Uzbekistan (2019) (22,2% of the total number of species inhabiting the project area), 2 species are included in the Red List of the International Union for Conservation of Nature (IUCN Red List) (11,1% of total number of species inhabiting the project area) and 3 species – in the Appendices to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (16,7% of the total number of species inhabiting the project area).

Spring survey (April 2021)

The first field trip to the survey points in the area of the Ayak-agitma lake was carried out from April 20 to 22, 2021. During the spring survey of the project area, 14 km of hiking routes (transect) were completed. The transects passed through pre-selected survey points and their 1 kilometer radius (Figure 10).

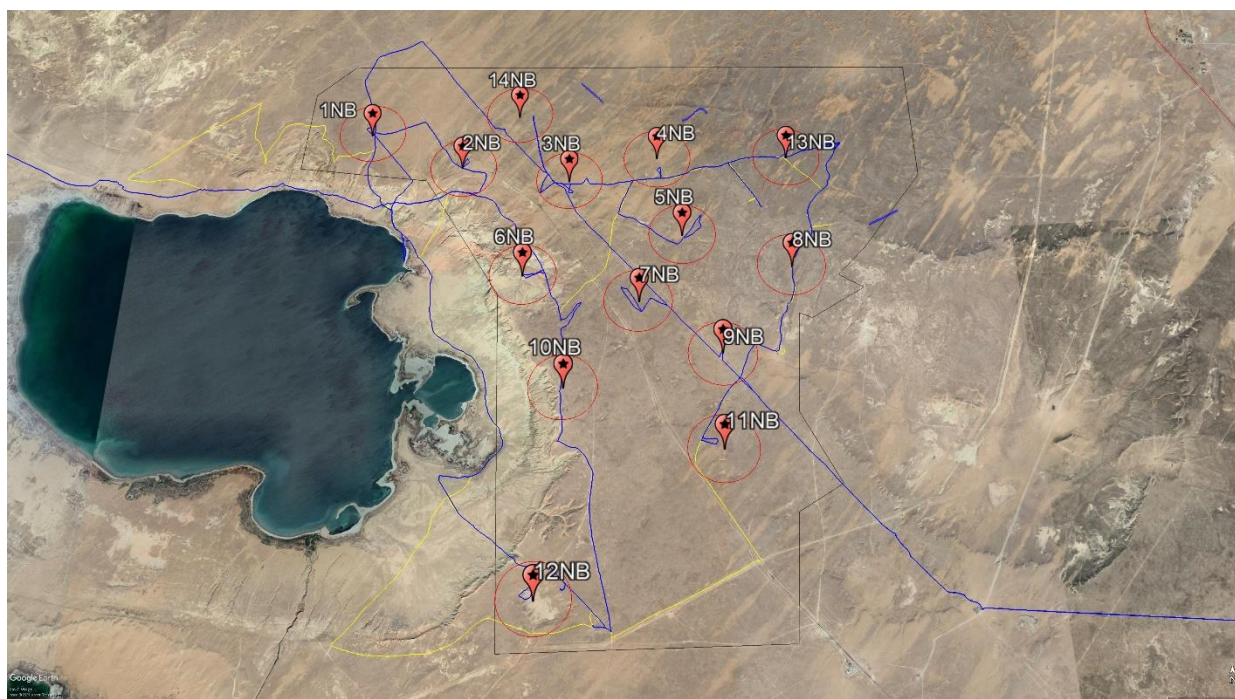


Figure 11 Observation points and transects on the Bash project territory in spring 2021

Reptile survey was carried out during the daytime, since the night temperature was too low for reptile activity. The situation was worsened by a strong gusty wind. Wind speed reached 16-18 m/s. However, during the daytime surveys, points on suitable for Southern Even-fingered Gecko biotope were examined for the possibility of conducting surveys in the summer.

The average night air temperature in April was 14 °C, the soil temperature was 11-12 °C, the air humidity was 38%. These values are not high enough for the reptile nocturnal survey.

During the survey of the territory, we recorded 7 reptiles species (11,3% of the total number of reptiles species), of which 3 species (42,8% of the number of species encountered) - Russian tortoise, Desert sand boa and Caspian monitor are included in the Red Book of the Republic of Uzbekistan, and one (14,3% of the number of species encountered) of them is included in the Red List of the International Union for Conservation of Nature (IUCN Red List).

Table 5 Primary data and the density of reptiles at the observation points in the area of Lake Ayak-Agitma in the spring of 2021

No	Species	No. of recorded animals	Population density on the site, inds/ha	Biotope	Transect length	Date and time	Air temperature	Soil temperature	Humidity, %
	NB 1			Loamy plain, Artemisia- Calligonum association,	1 km	20.04.21	C30,3°	C32,3°	21%

				Peganum harmala and Ferula					
1	<i>Testudo horsfieldii</i> Russian tortoise	2	0,8						
2	<i>Trapelus sanguinolentus</i> Steppe agama	1	-						
NB 2				Loamy plain, Artemisia- Calligonum association, Peganum harmala and Ferula	1 km	20.04.21	C33,4°	C35,6°	19%
1	<i>Testudo horsfieldii</i> Russian tortoise	2	1,6						
2	<i>Eremias velox</i> Rapid Lizard	6	8,7						
NB 3				Small-hill sands, Artemisia- Calligonum- Ferula association	1 km	21.04.21	C19,3°	C29,0°	37%
1	<i>Testudo horsfieldii</i> Russian tortoise	2	3,1						
2	<i>Trapelus sanguinolentus</i> Steppe agama	1	-						
NB 4				Fixed hilly sands, Artemisia-- Calligonum- Ferula association	1 km	21.04.21	C18,7°	C23,2°	22%
1	<i>Testudo horsfieldii</i> Russian tortoise	4	3,03						
2	<i>Trapelus sanguinolentus</i> Steppe agama	1	-						
NB 5				Fixed hilly sands, Artemisia-- Calligonum- Ferula association	1 km	21.04.21	C19,3°	C23,7°	23%
1	<i>Trapelus sanguinolentus</i> Steppe agama	2	1,8						
NB 6				Clay hilly plain crossed by ravines Artemisia association	1 km	20.04.21	C28,2°	C33,8°	20%
1	<i>Testudo horsfieldii</i> Russian tortoise	2	0,22						
2	<i>Trapelus sanguinolentus</i> Steppe agama	2	2,3						
3	<i>Eremias velox</i> Rapid Lizard	1	-						
4	<i>Eryx miliaris</i> Desert sand boa	1	-						

NB 7				Clay plain, Artemisia association	1 km	20.04.21	C28,7°	C34,7°	20%
1	<i>Trapelus sanguinolentus</i> Steppe agama	1	-						
NB 8				Fixed hilly sands, Artemisia-association	1 km	21.04.21	C23,5°	C31,5°	20%
1	<i>Testudo horsfieldii</i> Russian tortoise	13	3,6						
2	<i>Eremias velox</i> Rapid Lizard	2	3,1						
3	<i>Varanus griseus</i> Caspian Monitor	1	0,06						
NB 9				Clay plain, Artemisia association	1 km	21.04.21	C21,7°	C35,1°	31%
1	<i>Testudo horsfieldii</i> Russian tortoise	2	0,5						
2	<i>Eremias velox</i> Rapid Lizard	3	4,7						
NB 10				Clay hilly plain crossed by ravines, wormwood association	1 km	20.04.21	C27,1°	C28,0°	22%
0									
NB 11				Clay plain, Artemisia-Saxaul association	1 km	21.04.21	C23,1°	C33,6°	19%
1	<i>Testudo horsfieldii</i> Russian tortoise	2	1,6						
2	<i>Phrynocephalus helioscopus</i> Sunwatcher toad-headed agama	2	2,7						
NB 12				Clay hilly plain, Artemisia association	1 km	20.04.21	C22,7°	C19,4°	24%
0									
NB 13				Fixed hilly sands, Artemisia-Saxaul association	1 km	21.04.21	C19,1°	C29,3°	22%
1	<i>Testudo horsfieldii</i> Russian tortoise	6	2,6						
NB 14				Clay plain, Artemisia-Ferula association	1 km	21.04.21	C16,5°	C26,0°	41%
1	<i>Eremias velox</i> Rapid Lizard	2	3,1						
2	<i>Psammophis lineolatus</i> Sand racer	1	-						

The highest density of the Russian tortoise on the project territory during the Spring survey was recorded at NB 8 point and amounted to 3.6 ind/ha. However, similar number of 2 tortoises per transect was observed at several other points: NB 3, NB 4 and NB 13. The Russian tortoise was found at 9 points, which is 64,3% of the total number of observation points (14 points). It is worth noting that the Russian tortoise is not a numerous species throughout the project area.

The points located along the chinks of the Ayak-Agitma depression were identified as the most promising points for the summer Southern Even-fingered Gecko survey.

In general, the reptiles' species composition is typical for this geographical area.

Summer survey (June 2021)

The second field trip to the survey points in the area of the Ayak-Agitma lake was carried out from June 22 to 24, 2021. The priority of this field visit was to conduct the quantitative assessment of Southern Even-fingered Gecko population at the points identified in spring as the most suitable. During the summer survey of the project area, 13 km of hiking routes (transect) were completed. The transects passed through pre-selected survey points and their 1 kilometer radius (Figure 8).

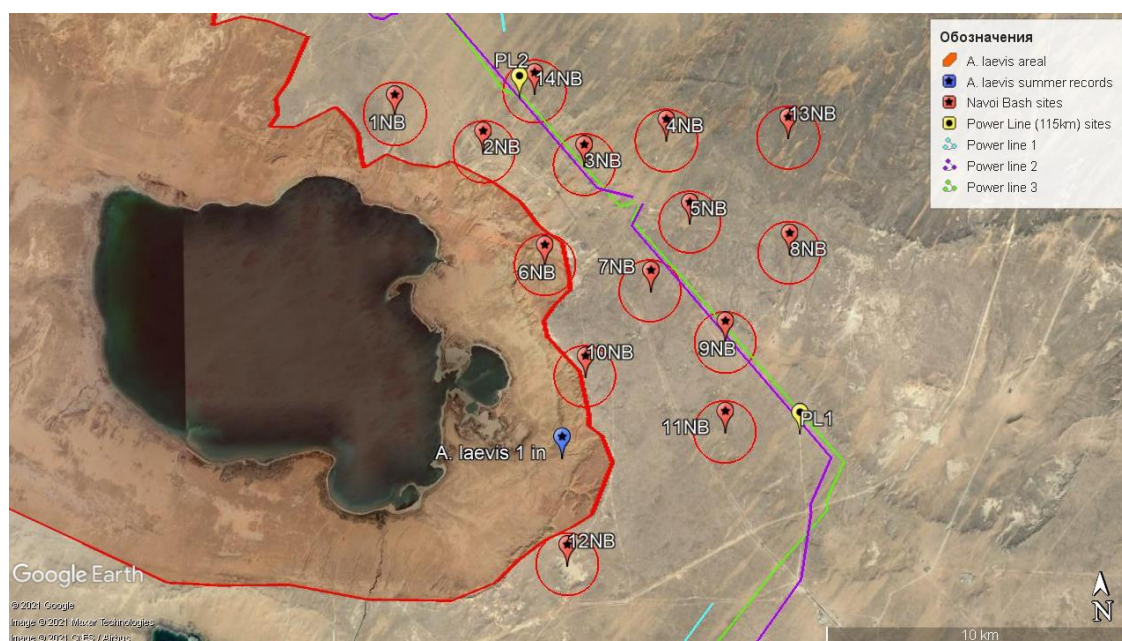


Figure 12 Survey points on the Bash WF project territory, as well as location where the Southern Even-fingered Gecko was observed in summer and the areal range for the Southern Even-fingered Gecko population in the vicinity of the Ayak-Agitma lake

Reptile survey was carried out mainly at night – after sunset and before the night coolness, until about 2 am, when the activity of the Southern Even-fingered Gecko decreases.

The average night air temperature in June was 27°C, the soil temperature was 28°C, the air humidity was 20%. These values are ideal for the nocturnal reptile survey, including the Southern Even-fingered Gecko.

However, the windy weather did not allow us to find many Southern Even-fingered Gecko. The wind speed reached 10-12 m/s.

Table 6 Primary data and the density of reptiles at the accounting points in the area of Lake Ayakagitma in the summer of 2021

No	Species	No. of recorded animals	Population density on the site, inds/ha	Biotope	Transect length	Date and time	Air temperature	Soil temperature	Humidity, %
NB 1				Loamy plain, Artemisia-- Calligonum- Ferula association	1 km	22.06.21	C30,3°	C32,3°	21%
0									
NB 2				Loamy plain, Artemisia- Calligonum association, Peganum harmala and Ferula	1 km	22.06.21	C33,4°	C35,6°	19%
0									
NB 6				Clay hilly plain crossed by ravines, Artemisia association	1 km	24.06.21	C28,2°	C33,8°	20%
0									
NB 10				Clay hilly plain crossed by ravines, Artemisia association	1 km	24.06.21	C27,1°	C28,0°	22%
0									
NB 12				Clay hilly plain crossed by ravines, Artemisia association	1 km	23.06.21	C22,7°	C19,4°	24%
0									
NB 15 levis				Clay hilly plain crossed by ravines, Artemisia association	1 km	23.06.21	C22,7°	C24,8°	19%
1	<i>Alsophylax laevis</i> Southern Even-fingered Gecko	1	1,3						

During the survey of the territory, we recorded 1 reptiles species - Southern Even-fingered Gecko - (1,6% of the total number of reptiles species), which is included in the Red Book of the Republic of Uzbekistan (100% of the number of species encountered), and included in the Red List of the International Union for Conservation of Nature (IUCN Red List) (100% of the number of species encountered). The variety of species for the second field visit turned out to be less than for the first, due to the narrow focus and specifics of the summer survey.

Herpetological survey along planned Dzhankeldy-Bash OHTL

During the construction of new power lines, there are great risks that some populations of rare and endemic species may be destroyed, in this regard, it is necessary to conduct detailed field studies for such populations.

The field trip to the survey points in the area along planned Dzhankeldy-Bash OHTL was carried out from June 19 to 25, 2021. During the summer survey of the project area, 13 km of hiking routes (transect) were completed. The transects passed through pre-selected survey points and their 1 kilometer radius (Figure 13).

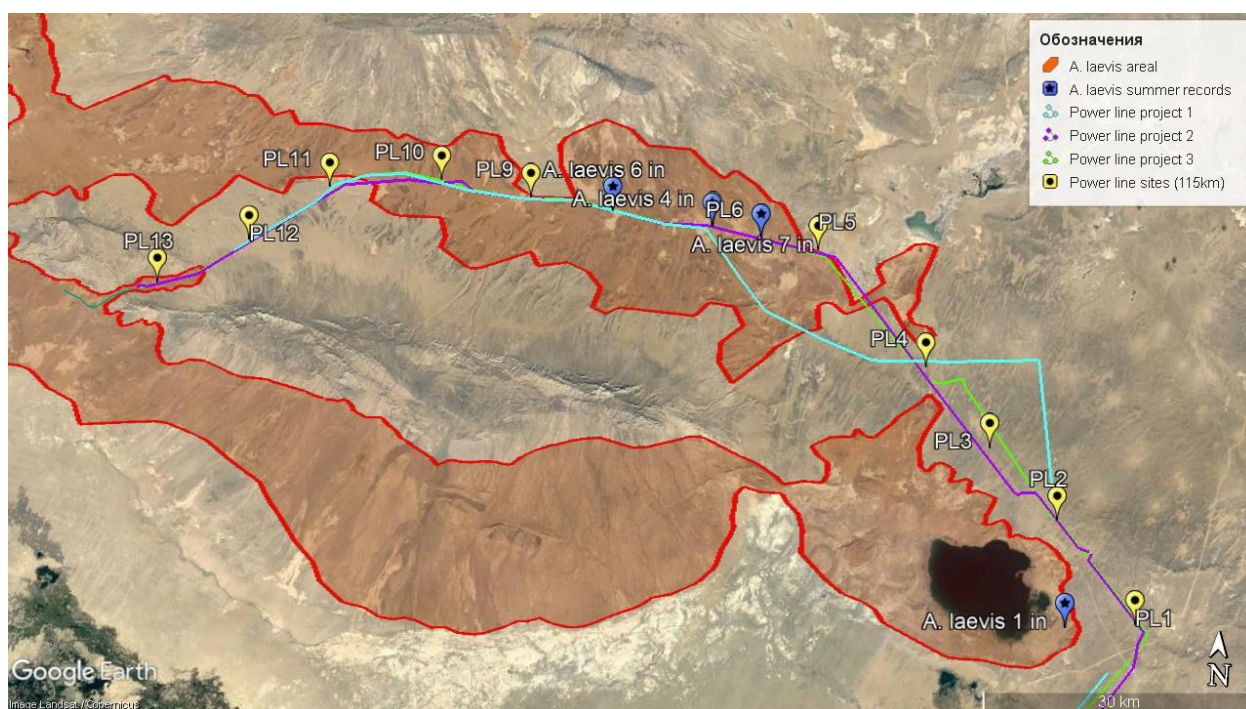


Figure 13 Survey points along planned Dzhankeldy-Bash OHTL, as well as locations where the Southern Even-fingered Gecko was observed in summer and the areal range for the Southern Even-fingered Gecko population

The main purpose of this field trip was to identify the areal of Southern Even-fingered Gecko population on the project territory. In the summer months, it is almost impossible to find Russian tortoise on the territory, since this species has a period of aestivation (summer hibernation). Occasionally in summer, individual tortoises can be seen on the surface in those places where the green juicy grass is preserved. No such places were found on the project territory, as well as the tortoises themselves in the summer period. However, we found many burrows of this species at many survey points. For other listed species, such as the Southern Even-fingered Gecko and Caspian monitor, summer is the period of the highest activity.

Table 7 List of reptile species inhabiting the project area along planned Dzhankeldy-Bash OHTL

№	Name of species	The presence acc. to literary sources	Author's earlier personal data	June 2021 field expedition data	Endemism	Endemism		
						UzRDB	IUCN	CITES
Family Bufeniode (toads)								
1	Turan Toad <i>Bufotes turanensis</i>	+	+		UZ, TJ, TM			
Family Testudinidae (tortoises)								
1	Russian tortoise <i>Testudo horsfieldii</i>	+	+	+		2 (VU)	VU	II
Family Gekkonidae (geckoes)								
2	Southern Even-fingered Gecko <i>Alsophylax laevis</i>	+		+	UZ, TM	VU:D	CR	
3	Comb-toed Gecko <i>Crossobamon evermanni</i>	+			UZ, TJ, TM, KZ, IR, AF			
4	Caspian Bent-Toed Gecko <i>Tenuidactylus caspius</i>	+	+	+			LC	
5	Turkestan thin-toed gecko <i>Tenuidactylus fedtschenkoi</i>	+	+		UZ, TJ, TM, KZ			
6	Common Wonder Gecko <i>Teratoscincus scincus</i>	+	+	+	UZ, TJ, TM, KG, IR, CN			
Family Agamidae (agamass)								
7	Steppe agama <i>Trapelus sanguinolentus</i>	+	+	+				
8	Sunwatcher toad-headed agama <i>Phrynocephalus helioscopus</i>	+	+					
9	Lichtenstein's Toadhead Agama <i>Phrynocephalus interscapularis</i>	+	+		UZ, TM, KZ			
Family Varanidae (monitor lizards)								
10	Rapid Lizard <i>Eremias velox</i>	+	+	+				
12	Sand Racerunner <i>Eremias scripta</i>	+						
Family Varanidae (monitor lizards)								
13	Caspian Monitor <i>Varanus griseus caspius</i>	+	+	+		2 (VU:D)		I
Family Boidae (Boas)								
14	Desert sand boa <i>Eryx miliaris</i>	+				3 (NT)		II
Family Colubridae (colubrid snakes)								
15	Sand racer <i>Psammophis lineolatus</i>	+	+					

16	Spotted whip snake <i>Hemorrhois ravergeri</i>	+						
17	Spotted desert racer <i>Platyceps karelinii</i>	+	+					

Notes : UzRDB – species/subspecies listed in the Red Data Book of Uzbekistan (2019) (CR – critically endangered; VU – vulnerable; NT – near-threatened); IUCN – species included in the Red List of the International Union for Conservation of Nature (VU - vulnerable; NT – near-threatened); CITES I, II – species listed in the appendices (I, II) to the Convention on International Trade in Endangered Species of Wild Fauna and Flora; Endemism: AF - Afghanistan, KZ – Kazakhstan; TM – Turkmenistan; KG – Kyrgyzstan; TJ – Tajikistan; UZ – Uzbekistan.

According to processed information, the author's personal data and the field survey results, currently, the project area along planned Dzankeld-Bash OHTL is inhabited by 1 amphibian species and 17 reptile species belonging to 7 families (Table 7). The total number of amphibian species comprises 33,3% of the total diversity of the amphibian fauna of Uzbekistan, reptiles – 27,4%. Among them, 4 species are included in the Red Book of the Republic of Uzbekistan (2019) (23,5% of the total number of species inhabiting the project area), 2 species are included in the Red List of the International Union for Conservation of Nature (IUCN Red List) (11,7% of total number of species inhabiting the project area) and 3 species – in the Appendices to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (17,6% of the total number of species inhabiting the project area).

Reptile survey was carried out both during the day and at night. Moreover, in some points that were identified as potential habitats of the Southern Even-fingered Gecko during the day, both day and night surveys were carried out, in places that were identified as not suitable biotope for the Southern Even-fingered Gecko, night records were not carried out. Nocturnal survey was carried out after sunset and before the night coolness, until about 2 am, when the activity of the Southern Even-fingered Gecko decreases.

The average night air temperature was 22 °C, the soil temperature was 20 °C, the air humidity was 17%. These values are not high enough for the reptile nocturnal survey.

Since most of the project area runs along the highway, it was decided that in addition to the transect survey along planned OHTL, we would record the roadkill on the highway No. 4P61. So for 79.5 km of this highway, we found 2 young Caspian monitors (Figure 14), 2 Common Wonder Geckos and 4 Steppe agamas.



Figure 14 A young individual of Caspian monitor killed on highway No. 4P61 in Summer 2021

Table 8 Primary data and the density of reptiles at the survey points along planned Dzankeld-Bash OHTL in the summer of 2021

No	Species	No. of recorded animals	Population density on the site, inds/ha	Biotope	Transect length	Date and time	Air temperature	Soil temperature	Humidity, %
PL 1				Sub-sand hilly plain, Artemisia saxaul association	1 km	25.06.21	C34,1°	C53,6°	16%
1	<i>Testudo horsfieldii</i> Russian tortoise	4 holes	-						
2	<i>Trapelus sanguinolentus</i> Steppe agama	6	8,9						

PL 2				Clay plain, Artemisia-Ferula association	1 km	25.06.21	C34,4°	C52,4°	16%
1	<i>Eremias velox</i> Rapid Lizard	4	5,7						
PL 3				Sub-sand hilly plain, Artemisia saxaul association	1 km	25.06.21	C34,8°	C48,1°	16%
0									
PL 4				Sub-sand hilly plain, Artemisia saxaul association	1 km	25.04.21	C33,7°	C47,2°	16%
2	<i>Trapelus sanguinolentus</i> Steppe agama	1	-						
PL 5				Semi-fixed hilly sands, Artemisia saxaul -ferula association	1 km	19.06.21	C40,0°	C55,3°	16%
1	<i>Testudo horsfieldii</i> Russian tortoise	1 hole	-						
2	<i>Trapelus sanguinolentus</i> Steppe agama	2	2,8						
3	<i>Varanus griseus caspius</i> Caspian Monitor	1	0,06						
PL 6				Sub-sandy hilly plain crossed by ravines and clay- rubbly uplands, Artemisia association	1 km	25.06.21	C24,7°	C22,5°	18%
1	<i>Alsophylax laevis</i> Southern Even-fingered Gecko	7	9,3						
2	Common Wonder Gecko <i>Teratoscincus scincus</i>	20	16,3						
PL 7				Clay hilly plain crossed by ravines, Artemisia-Saxaul- Sazkazgan association	1 km	25.06.21	C21,5°	C19,7°	17%
1	<i>Alsophylax laevis</i> Southern Even-fingered Gecko	4	5,2						
2	<i>Testudo horsfieldii</i> Russian tortoise	14 holes and 2 shells	-						
3	<i>Trapelus sanguinolentus</i> Steppe agama	3	4,3						
PL 8				Clay hilly plain, Artemisia-Tamarix association	1 km	25.06.21	C20,8°	C19,3°	17%
1	<i>Alsophylax laevis</i> Southern Even-fingered Gecko	6	8,1						

2	<i>Trapelus sanguinolentus</i> Steppe agama	3	4,3						
PL 9				Clay plain, Artemisia association	1 km	19.06.21	C36,7°	C42,8°	16%
1	<i>Trapelus sanguinolentus</i> Steppe agama	1	-						
2	<i>Eremias velox</i> Rapid Lizard	1	-						
PL 10				Small-hill sands, Artemisia- Calligonum- Ferula association	1 km	19.06.21	C35,4°	C39,5°	17%
1	<i>Testudo horsfieldii</i> Russian tortoise	Ruine d egg clutch							
2	<i>Trapelus sanguinolentus</i> Steppe agama	2	2,7						
3	Common Wonder Gecko <i>Teratoscincus scincus</i>	trails	-						
PL 11				Fixed hilly sands, Artemisia-ferula association	1 km	20.06.21	C31,2°	C48,2°	16%
1	<i>Trapelus sanguinolentus</i> Steppe agama	1	-						
PL 12				Small-hill sands, Artemisia- Calligonum- Ferula association	1 km	20.06.21	C31,4°	C46,0°	16%
1	<i>Varanus griseus caspius</i> Caspian Monitor	1	0,01						
PL 13				Small-hill sands, with depressions Artemisia- Calligonum- Ferula association	1 km	20.06.21	C31,5°	C43,6°	16%
1	<i>Tenuidactylus caspius</i> Caspian Bent-Toed Gecko	1	-						
2	<i>Trapelus sanguinolentus</i> Steppe agama	3	4,1						
3	<i>Varanus griseus caspius</i> Caspian Monitor	1	0,025						

During the survey of the territory, we recorded 7 reptiles species (11,3% of the total number of reptiles species), of which 3 species (42,8% of the number of species encountered) - Russian tortoise, Caspian Monitor and Southern Even-fingered Gecko are included in the Red Book of the Republic of Uzbekistan, and two (28,6% of the number of species encountered) of them are included in the Red List of the International Union for Conservation of Nature (IUCN Red List).

The highest density of Southern Even-fingered Gecko on the project territory was recorded at PL 6 point and amounted to 9.3 ind/ha (Figure 15).



Figure 15 Southern Even-fingered Gecko on the PL 6 point in Summer 2021 (adult male)

Since Russian tortoise is in a state of aestivation in the summer months, the presence of the latter on the project territory was determined by the remains and traces of the species vital activity (burrows, etc.) (Figure 16).



Figure 16. The burrow of the Russian tortoise at the PL 6 point in Summer 2021

In general, the reptiles' species composition is typical for this geographical area.

Herpetological survey along planned Bash-Karakul OHTL

The field trip to the survey points in the area along planned Bash-Karakul OHTL was carried out from May 5 to 7, 2021. The transects passed through pre-selected survey points and their 1 kilometer radius (Figure 17).

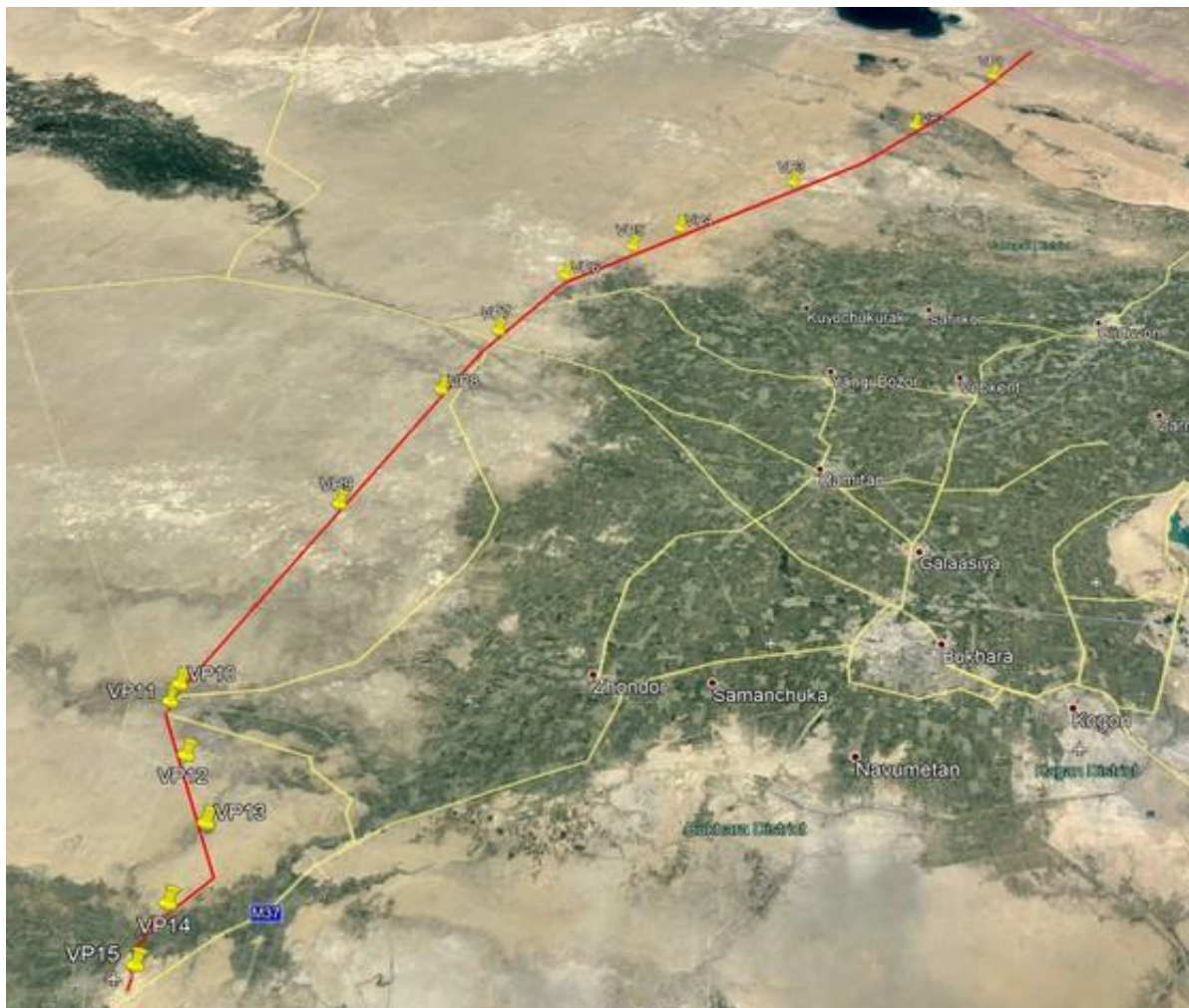


Figure 17 Survey points along planned Bash-Karakul OHTL

As a result of the field trip, 8 species of reptiles were recorded on the project territory, of which 2 species – the Russian tortoise and Caspian Monitor, are rare and threatened species listed in the Red Book of the Republic of Uzbekistan (2019). The most of the encountered reptiles are typical psamobionts. It is worth noting that the main part of the project area passes through agricultural lands, and no potential habitats for the Southern Even-fingered Gecko were identified throughout the project area.

Table 9 List of reptile species inhabiting the project area along planned Bash-Karakul OHTL

№	Species	Species presence acc. to literary sources	Author's earlier personal data	May 2021 field expedition data	Endemism	Nature conservation status		
						UzRDB	UzRDB	UzRDB

Family Bufonidae (toads)								
1	Turan Toad <i>Bufo turanensis</i>	+	+		UZ, TJ, TM			
Family Testudinidae (tortoises)								
1	Russian tortoise <i>Testudo horsfieldii</i>	+	+	+		2 (VU)	VU	II
Family Gekkonidae (geckoes)								
2	Comb-toed Gecko <i>Crossobamon eversmanni</i>	+			UZ, TJ, TM, KZ, IR, AF			
3	Caspian Bent-Toed Gecko <i>Tenuidactylus caspius</i>	+	+				LC	
4	Turkestan thin-toed gecko <i>Tenuidactylus fedtschenkoi</i>	+	+		UZ, TJ, TM, KZ			
5	Common Wonder Gecko <i>Teratoscincus scincus</i>	+	+	+	UZ, TJ, TM, KG, IR, CN			
Family Agamidae (agamas)								
6	Steppe agama <i>Trapelus sanguinolentus</i>	+	+	+				
7	Sunwatcher toad-headed agama <i>Phrynocephalus helioscopus</i>	+						
8	Lichtenstein's Toadhead Agama <i>Phrynocephalus interscapularis</i>	+		+	UZ, TM, KZ			
9	Secret Toadhead Agama <i>Phrynocephalus mystaceus</i>	+						
Family Lacertidae (true lizards)								
10	Rapid Lizard <i>Eremias velox</i>	+	+	+				
11	Sand Racerunner <i>Eremias scripta</i>	+	+	+				
12	Reticulate Racerunner <i>Eremias grammica</i>			+				
Family Varanidae (monitor lizards)								
13	Caspian Monitor <i>Varanus griseus caspius</i>	+	+	+		2 (VU:D)		I
Family Boidae (Boas)								
14	Desert sand boa <i>Eryx miliaris</i>	+				3 (NT)		II
Family Colubridae (colubrid snakes)								
15	Sand racer <i>Psammophis lineolatus</i>	+	+					
16	Spotted whip snake <i>Hemorrhois ravergieri</i>	+	+					
17	Spotted desert racer <i>Platyceps karelinii</i>	+	+					
18	Diadem Snake <i>Spalerosophis diadema</i>	+	+					
Family Viperidae								
19	Saw-scaled Viper, Phoorsa <i>Echis multisquamatus</i>	+	+					

Notes: UzRDB– species/subspecies listed in the Red Data Book of Uzbekistan (2019) (CR – critically endangered; VU – vulnerable; NT – near-threatened); IUCN – species included in the Red List of the International Union for Conservation

of Nature (VU - vulnerable; NT – near-threatened); CITES I, II – species listed in the appendices (I, II) to the Convention on International Trade in Endangered Species of Wild Fauna and Flora; Endemism: AF - Afghanistan, KZ – Kazakhstan; TM – Turkmenistan; KG – Kyrgyzstan; TJ – Tajikistan; UZ – Uzbekistan.

According to processed information, the author's personal data and the field survey results, currently, the project area along planned Bash-Karakul OHTL is inhabited by 1 amphibian species and 19 reptile species belonging to 8 families (Table 9). The total number of amphibian species comprises 33,3% of the total diversity of the amphibian fauna of Uzbekistan, reptiles – 30,6%. Among them, 3 species are included in the Red Book of the Republic of Uzbekistan (2019) (15,8% of the total number of species inhabiting the project area), 1 species is included in the Red List of the International Union for Conservation of Nature (IUCN Red List) (5,2% of total number of species inhabiting the project area) and 3 species – in the Appendices to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (15,8% of the total number of species inhabiting the project area).

Table 10 Primary data and the density of reptiles at the survey points along planned Bash-Karakul OHTL in the spring of 2021

№	Species	Number	Density in/ ha	Biotope	Route length	Date and time	Air temperature	Soil temperature	Humidity %
VP 1				Sandy desert/ Waterbody	1 km	05.05.21	C34,1°	C42,6°	25%
1	<i>Eremias grammica</i> Reticulate Racerunner	1	1						
VP 2				Saline land Alhagi, Harmala, Capparis, Salsola association	1 km	05.05.21	C34,4°	C42,4°	21%
1	<i>Trapelus sanguinolentus</i> Steppe agama	1	1						
2	<i>Eremias grammica</i> Reticulate Racerunner	2	4,9						
3	<i>Varanus griseus caspius</i> Desert Monitor	1	0,1						
VP 3				Fixed sands. Sheep cot.	1 km	05.05.21	C34,8°	C38,3°	19%
1	<i>Trapelus sanguinolentus</i> Steppe agama	4	4,6						
2	<i>Eremias grammica</i> Reticulate Racerunner	2	3,3						

3	<i>Eremias scripta</i> Sand Racerunner	2	6,2						
4	<i>Eremias velox</i> Rapid Racerunner	1	1						
5	<i>Varanus griseus caspius</i> Desert Monitor	1	0,7						
VP 4				Sandy desert. Sheep cot. Vegetation is sparse.	1 km	05.05.21	C33,7°	C37,8°	19%
1	<i>Testudo horsfieldii</i> Central Asian tortoise	2 traces	-						
2	<i>Teratoscincus scincus</i> Common Wonder Gecko	12	12						
3	<i>Phrynocephalus interscapularis</i> Lichtenstein's Toadhead Agama	10	20						
4	<i>Eremias velox</i> Rapid Racerunner	2	3,3						
5	<i>Varanus griseus caspius</i> Desert Monitor	1	0,1						
VP 5				Old quarry with water	1 km	06.05.21	C32,0°	C35,6°	26%
1	<i>Eremias velox</i> Rapid Racerunner	2	3,3						
VP 6				Agricultural zone	1 km	06.05.21	C28,7°	C36,5°	24%
1	<i>Eremias grammica</i> Reticulate Racerunner	2	3,3						
VP 7				Developed zone	1 km	06.05.21	C28,5°	C36,7°	23%
1	<i>Eremias velox</i> Rapid Racerunner	2	3,3						
VP 8				Sandy desert	1 km	06.05.21	C27,8°	C35,3°	22%
0									
VP 9				Sandy desert	1 km	06.05.21	C33,7°	C43,8°	21%
1	<i>Testudo horsfieldii</i> Central Asian tortoise	3 traces	-						
2	<i>Trapelus sanguinolentus</i> Steppe agama	1	1						
3	<i>Phrynocephalus interscapularis</i> Lichtenstein's Toadhead Agama	3	7,2						
4	<i>Eremias scripta</i> Sand Racerunner	1	1						

5	<i>Eremias velox</i> Rapid Racerunner	1	1						
VP 10				Sandy desert/ Waterbody	1 km	06.05.21	C33,4°	C38,5°	28%
0									
VP 11				Sandy desert. Saxaul association	1 km	07.05.21	C31,2°	C45,4°	19%
1	<i>Trapelus sanguinolentus</i> Steppe agama	2	3,3						
2	<i>Eremias grammica</i> Reticulate Racerunner	1	1						
3	<i>Eremias scripta</i> Sand Racerunner	2	4,9						
4	<i>Varanus griseus caspius</i> Desert Monitor	1	0,1						
VP 12				Sandy desert. Artemisia association.	1 km	07.05.21	C31,4°	C43,0°	22%
1	<i>Testudo horsfieldii</i> Central Asian tortoise	1	0,01						
2	<i>Trapelus sanguinolentus</i> Steppe agama	3	2,3						
3	<i>Teratoscincus scincus</i> Common Wonder Gecko	1 egg	-						
4	<i>Eremias scripta</i> Sand Racerunner	1	3,1						
VP 13				Sandy desert Saxaul. Alhagi, Salsola association	1 km	07.05.21	C31,5°	C45,7°	22%
1	<i>Trapelus sanguinolentus</i> Steppe agama	1	1						
2	<i>Eremias scripta</i> Sand Racerunner	2	3,3						
VP 14				Agricultural zone. In the fields of alfalfa and wheat Tamarix association	1 km	07.05.21	C23,7°	C29,1°	26%
1	<i>Trapelus sanguinolentus</i> Steppe agama	1	1						
2	<i>Eremias velox</i> Rapid Racerunner	1	1						
VP 15				Developed zone	1 km	07.05.21	C22,5°	C28,7°	24%
0									

RARE SPECIES OF REPTILES INHABITING THE PROJECT TERRITORIES

Family *TESTUDINIDAE*

Russian tortoise

Testudo horsfieldii (Gray, 1844)



Figure 18 Russian tortoise. Photo by T. V. Abduraupov.

The Russian tortoise is a vulnerable species endemic to Central Asia, whose numbers are decreasing. It is included in the IUCN Red List [VU] and the Red Book of the Republic of Uzbekistan 2(VU) (2019) and listed in Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

This species is endemic to Central Asia, where it inhabits lowlands and foothills (except drifting sands). In addition to Southern Kazakhstan, Turkmenistan, Uzbekistan, Kyrgyzstan and Tajikistan, it is distributed in Northern and Eastern Iran, Afghanistan, North-western China and Northern Pakistan (Ananyeva et al., 1998; Bogdanov, 1960, 1965).

Carapace length is up to 286.4 mm. The carapace is flat, slightly serrated at the rear edge. The indentation on its front edge is not deep. Each of the front paws has four claws. The forearm is covered with six to seven transverse rows of tile-like mails. On the back of the thigh there are several horny tubercles concentrated in one group. The horny mails of the carapace are usually monochromatic, yellowish or brownish-olive, sometimes with wide black spots, more pronounced on the plastron.

It inhabits both sandy and clayey deserts, plains, mountain slopes, depressions and valleys, gorges and mountain steppe up to 1,150 m above sea level (Dal, 1936, 1937). Rarely lives on agricultural lands – on the edges of irrigated and unirrigated fields, in

vegetable gardens and orchards. Avoids places with dense grass cover, as well as areas grazed intensively by livestock.

This is a strictly diurnal species. In hot weather, it can be observed only in the morning and before sunset. In the middle of the day, animals hide from the heat in temporary shelters under shrubs, where they half burrow into the soil, into the holes of rodents or those dug by themselves. During the day, tortoises are capable of covering from 120 m to 2 km. At night they burrow into shallow pits, sometimes remaining on the surface of the ground.

After the winter diapause, tortoises appear on the surface in March—early April, in warm winters and in the south of the range – in February. Mating begins a few days after their emergence. The breeding season is extended from late March to late May. Newly emerged tortoises with a shell 30—50 mm long remain under the ground during the winter and usually appear on the surface next spring.

They grow slowly. Tortoises become mature at the age of 10—13 years, when their carapaces reach 11 cm in length. In natural environment, they can live for at least 30 years.

In June, when ephemeral vegetation dries, the Russian tortoise enters a period of estivation (summer dormancy), for which it digs holes up to 1 m long. In deserts tortoises disappear by the end of May, but in the mountains or on irrigated lands, single individuals may be recorded in June and even July. Much more often, estivation flows into hibernation (winter dormancy).

In certain areas in the southern piedmont plains of Tamdytau and the eastern piedmont plains of Dzhetymtau (Navoi region), the population density averaged 11.7 individuals/ha, with a maximum of up to 15.6 inds./ha; in the pebbly-gravelly-loamy piedmont plain – 12.31 inds./ha (avg. 7.63 ± 5.92 inds./ha); in the rest of the area it was rare. In the rugged rocky areas of low mountains (Aitymtau Mountains) the tortoise occurs mainly along valleys. The highest population density of the species is 4.14 individuals/ha, which was recorded in a gently sloping valley with eroded loamy slopes (Bondarenko, 1994).

In the steppe between Tamdy and Ayakuduk – 29.2 inds./ha were recorded – 26.4♂: 50.5♀: 23.1 juv (Vashetko, Nuridjanov et al., 2010).

The number of tortoises is subject to significant fluctuations (Bogdanov, 1965), which depend on winter and spring meteorological conditions, as well as the abundance of food in biotopes where the animals live. The cultivation of virgin lands, livestock grazing and the use of natural habitats by humans significantly impact the population.

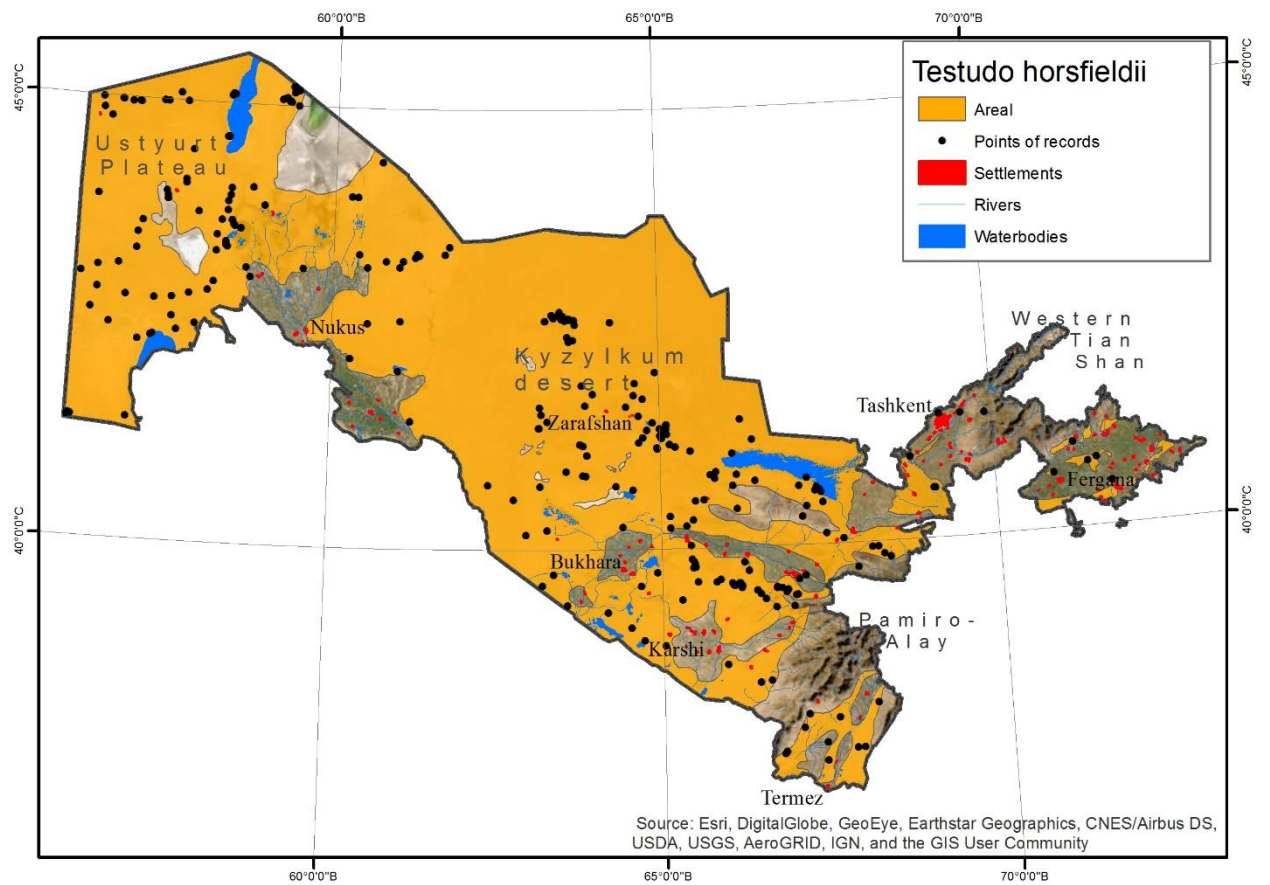


Figure 19 Map of the areal and known locations of the Russian tortoise in various regions of the Republic of Uzbekistan

Family *GEKKONIDAE*

Southern Even-fingered Gecko *Alsophylax laevis* Nikolsky, 1907



Figure 20 Southern Even-fingered Gecko. Photo by T. V. Abduraupov.

This is a vulnerable, declining, sporadically distributed endemic species. Listed in the IUCN Red List [CR] and in the Red Book of the Republic of Uzbekistan 2 (VU: D) (2019). Endemic to Uzbekistan and Turkmenistan.

Length of the body with the head: male – up to 31 mm, female – up to 33 mm (Figure 14). The head and body are slightly flattened from top to bottom. There are 16—20 scales across the forehead between the centers of the eyes. The upper side of the body is yellowish with a grey tint, with four indistinct, dark transverse, sometimes interrupting stripes on the back; similar stripes can be seen on the upper surface of the limbs and tail; in immature individuals the stripes are more contrasting. A wide dark longitudinal stripe extends from the tip of the muzzle across the eyes as far as the nape. There is a transverse stripe on the back of the head.

The Southern Even-fingered Gecko occurs on takyr with sparse vegetation, where completely barren and flat areas alternate with areas where short saltwort, clusters of wormwood and camel thorn and weak meadow grass plants grow.

In the 1970s, there were from 0.3 (Ayakagytna depression) to 1,600 individuals (Kuldzhuktau sky island) recorded on 1 hectare in local populations; by now it has disappeared from many known habitats, while in others the number has sharply decreased (Bogdanov, 1992).

Southern Even-fingered Gecko is active from March to October at night, while during the day it hides in cracks in the ground, in its burrow or the hole of an insect or some other lizard. Mating takes place in March—April. In one season (from May to August) females produce 1–2 clutches each consisting of 1–2 eggs. The first young under 1 year of age

are observed from mid-July; they become mature after wintering. It feeds on small insects and arachnids.

O. P. Bogdanov (1992) recorded Southern Even-fingered Gecko in the central part of Kyzylkum, near the Kuldzhuktau residual mountains and along the escarpments of the Ayakagytna depression. We recorded this species in small numbers at the foot of the Lau-Lau elevation: during a 3-hour night transect we encountered only 2 individuals. We also found one individual near a railway, at the Moilisay station not far from Uchkuduk.

Quite numerous mosaic populations were observed by us near the settlements of Dzhankeldy and Kalaata in the southern foothill part of the Kuldzhuktau outlier. In this part of the range, the number of Southern Even-fingered Gecko reaches up to 12-16 ind/ha. Also, almost the same populations exist north-east of the Kuldzhuktau outlier, near the Karakata depression – 9-10 ind/ha. According to our data, the number of Southern Even-fingered Geckos on the slopes of the Ayak-Agitma depression is quite low – 1.3 ind/ha.

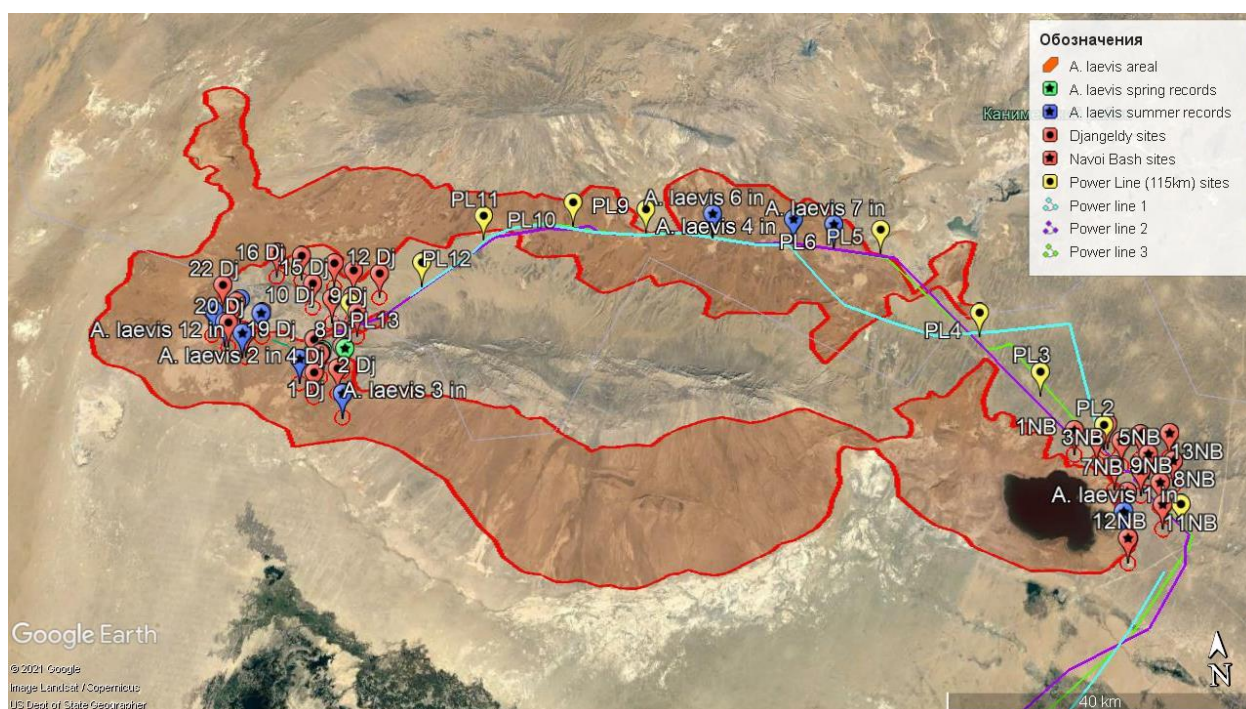


Figure 21 Map of the areal and known locations of the Southern Even-fingered Gecko on the project territories

Family *VARANIDAE*

Caspian Monitor

Varanus griseus caspius (Eichwald, 1831)



Figure 22 Caspian Monitor. Photo by T. V. Abduraupov.

Rare species. UzRDB (2019): 2 (VU:D).

The largest lizard in Uzbekistan and neighboring countries. The length of the body with the head is up to 520 mm. The upper side of the body is greyish-brown, yellowish-brown or reddish-brown, with numerous dark dots and specks. On the upper side of the neck there are two or three longitudinal brown stripes, and on the back and tail there are several transverse stripes of the same colour. In youngsters, the stripes are very pronounced, they are black or almost black.

After hibernation, the first individuals appear relatively late – in early to mid-April. Active all day throughout April. In May, they are active in the morning and evening hours. They go into hibernation in September-October. Often the Caspian Monitor has an estivation in summer, which gradually turns into winter hibernation. They begin estivating in late June—early July.

It inhabits mainly fixed and semi-fixed sands, clay and stony-gravelly soils, visits solonchaks. Sometimes it is found in the foothills of sky islands up to 1,000 m above sea level. M. Andrushko (1953) recorded the species in the central part of Kyzylkum. T. Z. Zakhidov (1938) reports that the Caspian Monitor often occurs in the northern part of the Kenimeh desert.

According to an oral report of the surveyor of the Houbara Bustard Breeding Center in the Bukhara region, Dr. John Burnside, Caspian Monitor is quite often found around the remnants of Kuldzhuktau, especially in the vicinity of the villages of Dzhankeldy and

Kalaata. We have also repeatedly observed it in the area of the Kuldzhuktau, Bukantau and Auminzatau residual mountains, as well as in the vicinity of Ayak-Agitma Lake in 2012, 2014 and 2019.

Family *BOIDAE*

Desert sand boa

Eryx miliaris (Pallas, 1773)



Figure 23 Desert sand boa. Photo by T. V. Abduraupov.

Desert sand boa is a near-threatened, sporadically distributed subspecies, included in the Red Data Book of the Republic of Uzbekistan (2019) with the status 3(NT); also included in Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

A medium-size snake. Females reach 720 mm in length, males are somewhat smaller – 550-580 mm. Tail length – 50-70 mm. The tail is short and blunt.

It lives mainly in sand deserts, where it prefers drifting and semi-fixed dunes, as well as more or less loose soils in deserts and semi-deserts with wormwood-saltwort communities and saltwort populations. It is less common on takyr with patches of vegetation near sands and on relatively hard loess and clay soils, near ruins, on the slopes of gullies and at the borders of irrigated lands. Often occurs near colonies of Gerbils, whose burrows it uses to shelter. It is able to plunge into the sand quickly, head first, and "swim" under its surface, leaving a characteristic trail in the form of a serpentine bulge. The upward-looking eyes allow the Desert sand boa to examine the surface without raising its head above the sand.

Active from April to October. In the hot season, it leads a nocturnal and crepuscular lifestyle. It uses the holes of rodents as a refuge, therefore it often settles in colonies of Gerbils. The breeding season is in late March. In June-July, the female gives birth to 4—10 babies up to 12—14 cm long. It feeds on lizards, rodents and small birds.

M. N. Bogdanov (1882) encountered this species in the sands of the Kyzylkum desert. A. M. Andrushko (1953) recorded it in the central part of the desert, and T. Z. Zakhidov

(1938) – in the Kenimeh desert. Kh. S. Salikhbayev caught this snake in the Shafrikan forestry enterprise (leskhoz) near Barat-Kuduk (Bogdanov 1960).

In the 1950s, up to 20 individuals from the local population were recorded on a three-hour transect in Bukhara region (Shafrikan leskhoz).

In 2014 and 2016 our team recorded the Desert sand boa in the central part of the Kyzylkum desert, in the Yamankum sands, where it inhabits semi-fixed dunes. The average density of this species during the period of the highest activity in the Yamankum sands is 0.3–0.4 ind/ha. The average density of the Desert sand boa during the period of the highest activity in this area is 0.2-0.3 ind/ha. We have repeatedly observed it near the Ayak-Agitma depression and near the settlements of Kalaata and Dzhankeldy.

Currently, the population is rapidly decreasing due to increased poaching (the species is used in traditional medicine), high export and cultivation of lands.

SUMMARY TABLES

Table 11 List of reptile species found on the Dzankeldy WF project area

	NAME OF SPECIES		IUCN /RDB STATUS	TOTAL NO. OBSERVED	
	LATIN	ENGLISH		SPRING	SUMMER
1	<i>Testudo horsfieldii</i>	Russian tortoise	VU/ 2 (VU)	17	-
2	<i>Alsophylax laevis</i>	Southern Even-fingered Gecko	CR/2(VU:D)	7	47
3	<i>Tenuidactylus caspius</i>	Caspian thin-toed gecko	LC/-	2	6
4	<i>Tenuidactylus fedtschenkoi</i>	Turkestan thin-toed gecko	LC/-	2	3
5	<i>Trapelus sanguinolentus</i>	Steppe Agama	-/-	18	3
6	<i>Phrynocephalus helioscopus</i>	Sunwatcher toad-headed agama	-/-	1	2
7	<i>Phrynocephalus reticulatus</i>	Reticulated toad-headed agama	LC/-	11	4
8	<i>Eremias intermedia</i>	Aralo-Caspian racerunner	LC/-	12	-
9	<i>Eremias lineolata</i>	Striped racerunner	LC/-	1	-
10	<i>Eremias velox</i>	Rapid racerunner	-/-	3	1
11	<i>Eryx miliaris</i>	Desert sand boa	-/3(NT)	1	
12	<i>Hemorrhois ravergieri</i>	Spotted whip snake	-/-	-	1

Table 12 List of reptile species found on the Bash WF project area

	NAME OF SPECIES		IUCN /RDB STATUS	TOTAL NO. OBSERVED	
	LATIN	ENGLISH		SPRING	SUMMER
1	<i>Testudo horsfieldii</i>	Russian tortoise	VU/ 2 (VU)	35	-
2	<i>Alsophylax laevis</i>	Southern Even-fingered Gecko	CR/2(VU:D)	-	1
3	<i>Trapelus sanguinolentus</i>	Steppe Agama	-/-	8	-
4	<i>Phrynocephalus helioscopus</i>	Sunwatcher toad-headed agama	-/-	2	-
5	<i>Eremias velox</i>	Rapid racerunner	-/-	14	-
6	<i>Varanus griseus</i>	Caspian Monitor	-/2(VU:D)	1	-
7	<i>Eryx miliaris</i>	Desert sand boa	-/3(NT)	1	-
8	<i>Psammophis lineolatus</i>	Sand racer	-/-	1	-

Table 13 List of reptile species found on the project area along planned Dzhankeldy-Bash OHTL

	NAME OF SPECIES		IUCN /RDB STATUS	TOTAL No. OBSERVED
	LATIN	ENGLISH		
1	<i>Testudo horsfieldii</i>	Russian tortoise	VU/ 2 (VU)	19 holes
2	<i>Alsophylax laevis</i>	Southern Even-fingered Gecko	CR/2(VU:D)	17
3	<i>Tenuidactylus caspius</i>	Caspian thin-toed gecko	LC/-	1
4	<i>Teratoscincus scincus</i>	Common Wonder Gecko	-/-	20
5	<i>Trapelus sanguinolentus</i>	Steppe Agama	-/-	22
6	<i>Eremias velox</i>	Rapid racerunner	-/-	5
7	<i>Varanus griseus</i>	Caspian Monitor	-/2(VU:D)	3

Table 14 List of reptile species found on the project area along planned Bash-Karakul OHTL

	NAME OF SPECIES		IUCN /RDB STATUS	TOTAL No. OBSERVED
	LATIN	ENGLISH		
1	<i>Testudo horsfieldii</i>	Russian tortoise	VU/ 2 (VU)	5 traces, 1 in.
2	<i>Teratoscincus scincus</i>	Common Wonder Gecko	-/-	12
3	<i>Trapelus sanguinolentus</i>	Steppe Agama	-/-	13
4	<i>Phrynocephalus interscapularis</i>	Lichtenstein's Toadhead Agama	-/-	13
5	<i>Eremias grammica</i>	Reticulate racerunner	LC/-	8
6	<i>Eremias scripta</i>	Sand racerunner	LC/-	6
7	<i>Eremias velox</i>	Rapid racerunner	-/-	9
8	<i>Varanus griseus</i>	Caspian Monitor	-/2(VU:D)	4

CONSTRUCTION-RELATED THREATS

1. The development of natural habitats for many species of reptiles (including rare ones) may cause the population loss, especially populations of narrow-area endemics, such as Southern Even-fingered Gecko;
2. Animals (insects, amphibians, reptiles, birds, mammals) can get into the pit and trenches dug for the construction purposes, which can lead to their injury and death. These trenches are especially dangerous for the Russian tortoise;
3. Changing the existing relief will lead to partial loss of the habitats for animals inhabiting the project area;
4. If the construction work is begun in the winter season, part of the population of reptiles (including rare ones) being in hibernation in the ground may die;
5. Linear structures connected to the construction site will also pose threat to the life of most reptiles, especially Russian tortoise and Caspian Monitor.

RECOMMENDATIONS

Safety and environmental protection must be priorities in any activity, for which it is necessary, after assessing potential threats, in this case to biodiversity, to make efforts to carry out activities aimed at minimizing potential damage. In this regard, we recommend the following actions:

1. Seasonality of work. The construction work must take into consideration the reptiles' activity features. That is, it is advisable that all construction work should be carried out at a time when all reptiles came out of hibernation (winter dormancy). In this period, reptiles do not have permanent burrows and can leave the construction site in advance. If the works begins in the hibernation period, underground wintering chambers can be damaged and then the reptile is doomed to death.
2. Construction works must be carried out strictly within the territory designated for the purpose.
3. All trenches must be levelled (filled with earth) after the termination of the construction; trenches should not be used as barriers to protect the territory, so that animals should not be captured there.
4. When the construction stage is over, it is necessary to monitor regularly populations of terrestrial animals in the existing research sites within the project territory.
5. The so-called 'closed zones' (protected with a fence) must be organized in the territory of the objects, where no activity should be allowed. This territory should be representative from the point of view of the biotope and the presence of a protected species. It would serve both a buffer zone of the object and, at the same time, a kind of protected area where animals can live undisturbed.
6. Creation/support of a reptile's nursery, with the function of rehabilitation and breeding of rare species, such as Southern Even-fingered Gecko and Russian tortoise. After the construction work, it is possible to resettle these animals back to

the reclaimed areas from the nursery. This nursery could help in preserving rare narrow-area endemic reptile species.

7. It is necessary to conduct large-scale work to study the current state of populations and the boundaries of the areal of the Southern Even-fingered Gecko throughout Uzbekistan.
8. The Russian tortoises must be removed from the construction site to nearby areas with similar biotopes. Moreover, after the removal, the construction site must be enclosed in a solid corrugated metal fence to prevent the tortoises' possible returning to the construction site.

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Entomological survey report

Report Title	<u>Entomological survey</u>
Scope	INVERTEBRATES
Areas Covered	DZHANKELDY WF / DZHANKELDY TO BASH OHTL
Seasons Covered	SPRING 2021 / SUMMER 2021
Notes	

Entomological survey

DZHANKELDY WIND FARM PROJECT:

CLIENT: 5 CAPITALS

Date: June 2021

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Introduction

Studies of the regional entomofauna were launched in the second half of the 19th century by researchers and travelers A. P. Fedchenko and O. A. Fedchenko, who made large collections of plants and insects in the Kyzylkum desert. Descriptions of a number of new species and information on the distribution of representatives of the Kyzylkum entomofauna can be found in A. P. Fedchenko's Trip to Turkestan series (1871—1873).

The studied area of Dzhankeldy WF is located in the south-west of the Kyzylkum desert, Bukhara Province.

In 1923-1931, the entomofauna of Bukhara Province was studied by V. V. Yakhontov.

In 1934-1937, entomologists V. N. Nevsky and A. A. Bekuzin from the Central Asian State University organised a zoological expedition to the Kanimeh steppe (south-eastern part of Kyzylkum). The data they collected was used by V. P. Nevsky to write his work Entomofauna of the Kanimeh Desert («Энтомофауна Кенимехской пустыни») (1953). The author described 250 insect species and their associations with specific biotopes and plants.

M. P. Sosnina (1958) and B. V. Korniyenko (1962, 1963, 1967, 1971) provide information on the insects of the Karnabchul clayey desert adjoining South-Western Kyzylkum. The deepest research was made by Yu. V. Sinadsky (1959, 1963, 1964, 1968), who studied insects damaging Central Asian desert forests, including those in Kyzylkum. His works summarise data on insects' species composition, ecology and biology.

In 1962-1963, a team of researchers from the Severtsov Institute of the Evolutionary Morphology and Ecology of Animals, Academy of Sciences of the USSR, headed by Academician M. S. Gilyarov, studied the zoology of soils in the Ayakguzhumdy area. The findings were published in articles by B. M. Mamayev (1966), F. N. Pravdin (1965), M. S. Gilyarov and B. M. Mamayev (1964, 1967).

In 1965-1966, a team of entomologists from the Institute of Zoology, Academy of Sciences of the USSR, worked in the Kyzylkum desert and gathered large amounts of data on various groups of insects. Since 1966, M. I. Falkovich was studying the ecology and economic significance of lepidopterans in the territory of the Kyzylkum desert station. He identified over 600 insect species, studied trophic links in about 250 and described a number of new species in the families Coleophoridae, Scythridae and Geometridae (1969, 1970, 1972). I. L. Sukhareva (1972) published materials on the owl moths of Kyzylkum.

The most comprehensive work covering the insect fauna of the region is Entomofauna of South-Western Kyzylkum (A. G. Davletshina et al. 1979). In 1962—1964 the authors made research into the part of the desert between the Shafirkan village and Jingildy in the west, the Mingbulak depression in the north and Tamdybulak in the east. The route ran along the sky islands of Kuljuktau, Auminzatau, the southern portion of Bukantau, Tamdytau, and the Mingbulak, Karakata and Ayakagitma depressions.

In 1974—1975, in the north and north-east of the western portion of the Kyzylkum desert the survey covered the villages of Ayakagytma and Jingildy, Karakata depression, the towns of Zeravshan and Tamdybulak, in the south – Alat District of Bukhara Province and the Karakul Reserve, which is the southernmost point of the South-Western Kyzylkum.

According to the authors, this territory was inhabited by 1,100 species from 16 genera and 108 families, 3 of which are included in the Red Data Book of Uzbekistan:

Hypermnestra helios Nickerl, 1846 (NT), *Satanas gigas* Eversmann, 1855 (VU: R), *Reduvius fedtschenkianus* Oshanin, 1871 (VU: R).

The collection of papers Insects as Components of the Saxaul Forest Biocoenosis (Mamayev et al., 1975) on insects' species composition, ecology and their biocoenotic relations with plants was a great contribution to the study of the entomofauna of desert forest biocoenoses. The work reveals insects' evolution and distribution patterns in man-planted saxaul woods.

G. M. Dlussky made big research into the ants of the desert in 1960—1970, which resulted in the monograph *Ants of the Desert* (Dlussky 1981).

The entomofauna of specific desert plants was studied in subsequent years – saxaul (Nurmuratov, 1971), *Calligonum* (Yelyubayev, 1974), sagebrush (Moiseyeva, 1965, Korniyenko, 1967), sand acacia (Soitova, 1974) and other.

In April 2014, May 2015 and September 2017, 3 joint Russian-Uzbek expeditions were organised as part of an international cooperation agreement between the Karshi and Nizhny Novgorod State Universities to inventory the entomofauna of certain regions of Uzbekistan. The results of the first expedition, including the itinerary with the coordinates of locations where the material was collected, were published in a special issue of the 'Эверсманния' (Eversmannia) magazine (Anufriyev, Rahimov, 2015 and other). The same issue contains an article describing 24 ant species (Mokrousov, Zryanin, 2015).

In 2017, A. G. Blummer described a new species in the Kyzylkum desert – *Uranembia rivkusi* Blummer.

However, in general, desert entomocoenoses are not studied properly. There are no comprehensive, generalising works on or full lists of Central Asian desert insects.

Based on the desktop study 11 insect species listed in the Red Data Book of Uzbekistan were identified as possible on the studied territory and adjacent areas.

Order – Heteroptera

1. *Reduvius fedtschenkianus* Oshanin, 1871 (VU:R)

Order – Hymenoptera

Family – Sphecidae

2. *Fedtschenkia indigotea* Radoszkowski, 1886 (EN)
3. *Chlorion regae* F.Smith, 1873 (VU:R)
4. *Prionyx macula lugens* Kohl, 1890 (VU:R)
5. *Prionyx nigropenctinatus* (Taschenberg, 1869) (VU:R)
6. *Eremochares mirabilis* (Gussakovskij, 1928) (VU:R)

Family – Crabronidae

7. *Larra transcaspica* F.morawitz, 1894 (VU:R)
8. *Laphyragogus kohlii* (Bingham, 1896) (VU:R)

Order – Lepidoptera

Family – Noctuidae

9. *Catocala remissa* Staudinger, 1891 (VU:D)

Family – Papilionidae

10. *Hypermnestra helios* Nickerl, 1846 (NT)

Order – Diptera

Family – Asilidae

11. *Satanas gigas* Eversmann, 1855 (VU:R)

Methods and collection of material

Transect and area surveys were used in this study. Transects were employed for noticeable and easily identifiable large-size species, such as mantis, various beetles, butterflies and dragonflies, as well as their nests (wasps, ants). Transects were 1 km long and 2 m wide. One of the varieties of transect – current recording method – was used in complex topographies. In this case, the 1-kilometre-long line was divided into two 500-metre or five 200-metre sections, depending on the terrain. As they moved along a transect, researchers recorded in their notebooks every insect that could be identified right on the spot. In addition, insects along the transects were caught using a net. All transects were recorded with the help of GPSs.

Since often it is impossible to identify reliably the species of an insect without examining it with a microscope or magnifying glass, the insects were caught with the help of special traps for identification.

After the expedition, the material that could not be identified in the field was identified at the entomology laboratory at the Institute of Zoology, Academy of Sciences of Uzbekistan, with the help of a binocular digital microscope.

Physiographical characteristics of the survey areas

The studied area is located in the south-west of the Kyzylkum desert. The desert is a unique physiographical region spreading over the interfluvial area between the Amudarya and Syrdarya in Uzbekistan. In the north-west it is bordered by the Aralkum desert and Aral Sea, in the north-east by the Syrdarya river, in the east by the spurs of the Tien Shan and Pamir-Alai and in the south-west by the Amudarya.

The study area encompasses the low sky islands of Kuljuktau in the west and south and Ayakagytm depression as far as to the Bashagytm spring in the east. The territory is a flatland with fixed and semi-fixed sands and piedmont plains covered with gypsum deserts. Sand ridges and hillocks are fixed with vegetation. Depressions between the ridges are occupied by takyr.

Accumulative temperatures in the growing season are quite high in the area, while relative humidity in the daytime in July is never above 20%, usually ranging within 15-16%. About 45% of annual precipitation falls in spring.

Because of low precipitation, very dry air and high temperatures in summer, the soil dries up somewhat earlier than in more humid regions of Uzbekistan. Nevertheless, due to a lower wilting point, the drought on sandy and sandy-loamy soils affects vegetation less than in loamy and clayey areas.

Vegetation

The vegetation in the studied area is highly diverse. One of the typical plants is the semi-shrub sagebrush *Artemisia*. Sagebrush associations occupy large areas of the gypsum desert on the piedmont plains of the Kuljuktau area. The sand cover is favourable for the distribution of bindweed, *Astragalus* and saltwort (*Salsola arbuscula*, *Salsola orientalis*) associations. Sandy areas feature *Aristida*, *Calligonum*, *Ammodendron*, *Haloxylon persicum*, *Carex physodes*, *Astragalus*, *Ephedra* and similar plants. *Tamarix*, *Haloxylon persicum* and *Salsola* associations develop on the bottoms of depressions near bodies of water (wells).

Intense overgrazing in the desert leads to strong changes in the numbers and composition of natural biocoenoses. *Peganum harmala* develops actively on heavily overgrazed areas.

Results

The entomological survey was conducted from 15 to 17 April on the project territory of Dzhankeldy WF and from 7 to 9 May 2021 along OHTL from Dzhankeldy WF to Bash WF, by A. G. Akhmedov, a researcher from the Entomology laboratory at the Institute of Zoology, Academy of Sciences of the Republic of Uzbekistan.

All the recorded insect species have the status of 'not listed'.

22 locations were surveyed on the project territory of Dzhankeldy WF (Figure 1). The results of the survey are presented in the Table 1.

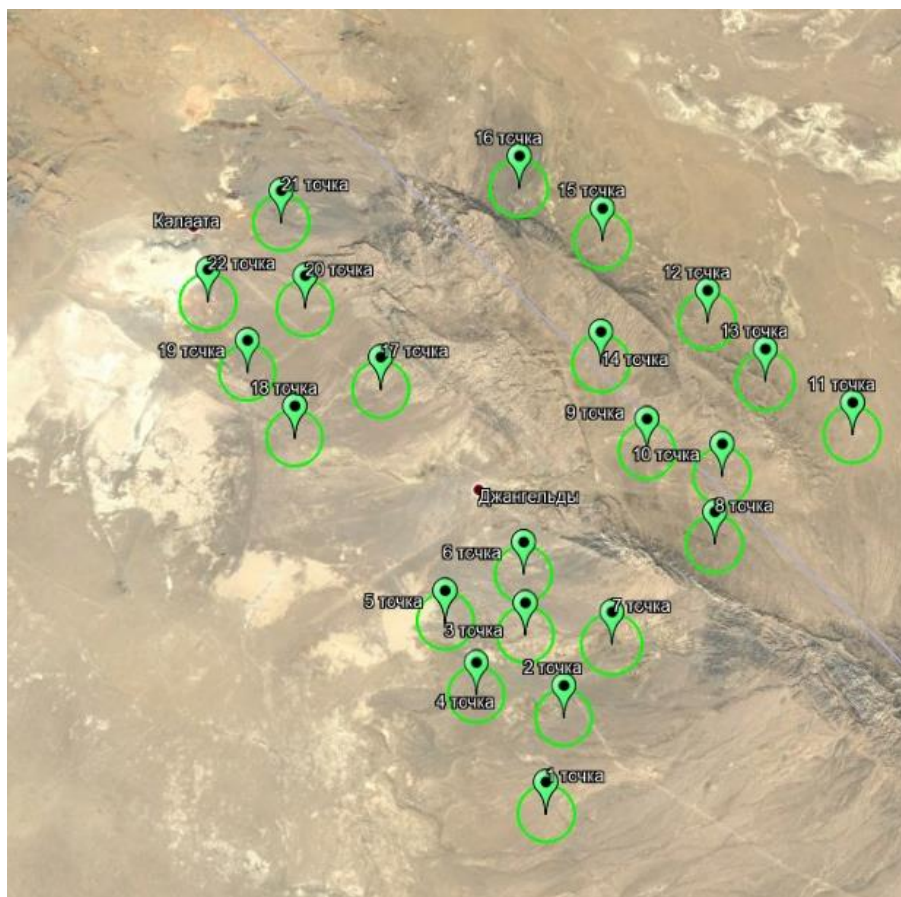


Figure 1 Studied locations on the project territory of Dzhankeldy WF

Table 1 Results of the entomological survey on the project territory of Dzhankeldy WF

No. of monitoring location	Coordinates	Biotope	Recorded species
Location 1	40°45'52.40"N63°24'31.57"E	Gravelly-clayey plain	Messor variabilis Lycosa sp. Sarcophaga sp. Neoplocaederus scapularis Plagiolepis pallescens Zophosis punctate Halictus sp. Scolopendra cingulate

Location 2	40°47'43.10"C 63°24'0.68"B	Gravelly-clayey plain	Lycosa sp. Adesmia sp. Anacanthotermes turkestanicus Halictus sp.
Location 3	40°48'54.02"C 63°22'17.99"B	Gravelly-clayey area	Halictus sp. Lucilia sp. Neoplocaederus scapularis Messor variabilis Messor aralocaspicus Lepisiota semenovi Cardiocondyla uljanini Plagiolepis pallescens
Location 4	40°47'28.69"C 63°21'44.07"B	Gravelly-clayey plain	Messor aralocaspicus Anacanthotermes turkestanicus Adesmia sp. Zophosis punctate Sarcophaga sp. Lucilia sp.
Location 5	40°48'31.22"C 63°20'17.88"B	Fixed sands	Orthochirus scrobiculosus Scolopendra cingulate Camponotus xerxes
Location 6	40°49'57.92"C 63°21'40.02"B	Gravelly-clayey plain	Plagiolepis pallescens Messor aralocaspicus Sarcophaga sp.
Location 7	40°49'22.81"C 63°24'25.27"B	Gravelly-clayey plain	Nighttime records Camponotus xerxes Hyles sp. Messor variabilis
Location 8	40°51'54.69"C 63°25'51.38"B	Gravelly-clayey elevations	Camponotus turkestanus Lycosa sp. Scolopendra cingulate Sarcophaga sp.
Location 9	40°53'3.51"C 63°23'21.60"B	Sand hillocks	Camponotus xerxes Halictus sp. Anthophora sp. Scolopendra cingulate
Location 10	40°53'10.19"C 63°25'22.01"B	Gravelly-clayey foothills	Camponotus fedchenkoi Messor variabilis Cardiocondyla uljanini Plagiolepis pallescens Lepisiota semenovi Tapinoma erraticum Scolopendra cingulate

Location 11	40°54'51.73"C 63°28'1.43"B	Gravelly-clayey plain	Tapinoma erraticum Messor aralocaspius Anacanthotermes turkestanicus
Location 12	40°55'46.84"C 63°23'31.75"B	Sandy-gravelly area	Adesmia sp. Plagiolepis pallescens Messor aralocaspius Messor variabilis Lucilia sp. Lycosa sp.
Location 13	40°55'10.10"C 63°25'27.33"B	Loamy plain	Messor aralocaspius Scolopendra cingulate
Location 14	40°54'15.72"C 63°21'25.97"B	Foothills	Sarathropus depressus
Location 15	40°56'27.38"C 63°20'15.91"B	Gravelly-clayey plain	Messor aralocaspius Cardiocondyla uljanini Plagiolepis pallescens Tapinoma erraticum Adesmia sp.
Location 16	40°56'46.42"C 63°17'48.08"B	Gravelly-clayey plain	Messor variabilis Lycosa sp. Neoplocaederus scapularis Adesmia sp.
Location 17	40°52'11.19"C 63°16'30.64"B	Gravelly-clayey plain	Bombus sp. Halictus sp. Anthophora sp. Messor aralocaspius Zophosis punctate
Location 18	40°50'41.05"C 63°14'58.05"B	Gravelly-clayey plain	Lycosa sp. Sarcophaga sp.
Location 19	40°51'29.85"C 63°13'12.74"B	Gravelly-clayey plain	Anacanthotermes turkestanicus Halictus sp. Plagiolepis pallescens Cataglyphis cinnamomeus Monomorium kusnezovi Camponotus turkestanicus
Location 20	40°53'4.35"C 63°13'56.35"B	Gravelly-clayey plain	Adesmia sp. Neoplocaederus scapularis Lycosa sp.

Location 21	40°54'24.07"C 63°12'32.17"B	Sandy-gravelly area	Sarcophaga sp. Lycosa sp. Messor variabilis Anacanthotermes turkestanicus-термит Adesmia sp. Scolopendra cingulate Halictus sp. Anthophora sp.
Location 22	40°52'27.53"C 63°11'35.24"B	Gravelly plain	Adesmia sp. Lucilia sp. Scolopendra cingulate Messor aralocaspius Tuponia pallida Adelungia sp.

11 locations were surveyed along planned OHTL from Dzhanekedy WF to Bash WF (Figure 2). The results of the survey are presented in the Table 2.

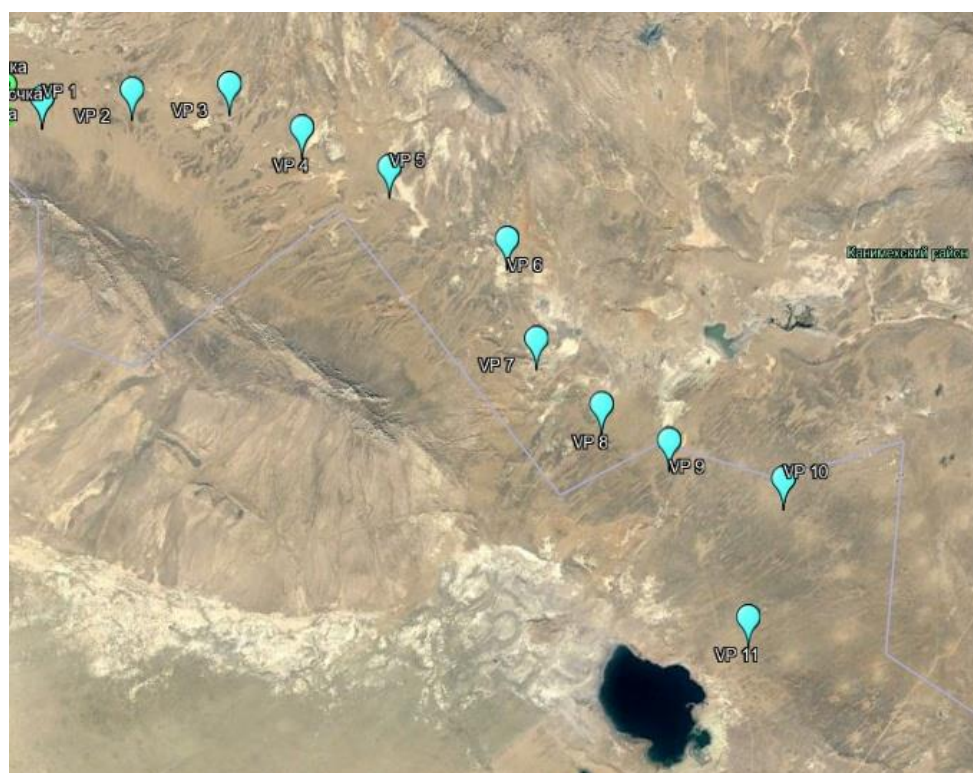


Figure 2 Studied locations along planned OHTL from Dzhanekedy WF to Bash WF

Table 2 Results of the entomological survey along the projected power line from Dzhanekedy WF to Bash WF

No. of monitoring location	Coordinates	Biotope	Recorded species
Location 1	40°54'59.18"C 63°31'7.06"B	Dunes, loose sands	Cataglyphis pallidula Sarcophaga sp.
Location 2	40°57'28.26"C 63°37'21.21"B	Fixed sands	Theone costipennis Lycosa sp. Nabis ferus Messor aralocaspius Cataglyphis oxiana

			<i>Cataglyphis cinnamomea</i> <i>Megamecus variegatus</i> <i>Anthaxia anatolica</i> <i>Anacanthotermes turkestanicus</i>
Location 3	40°59'56.75"C 63°44'13.51"B	Sands	<i>Cataglyphis pallidula</i> <i>Plagiolepis pallescens</i> <i>Messor variabilis</i> <i>Cucullia boryphora</i> <i>Tentyria</i> sp. <i>Halictus</i> sp. <i>Bembex</i> sp. <i>Theone costipennis</i> <i>Lycosa</i> sp. <i>Nabis ferus</i> <i>Anacanthotermes turkestanicus</i>
Location 4	40°59'11.95"C 63°50'44.76"B	Fixed sands	<i>Anthaxia anatolica</i> <i>Neoplocaederus scapularis</i> <i>Zophosis punctate</i> <i>Machozetus lehmanni</i>
Location 5	40°59'0.79"C 63°58'13.03"B	Fixed sands	<i>Lycosa</i> sp. <i>Sarcophaga</i> sp. <i>Anacanthotermes turkestanicus</i>
Location 6	40°57'41.99"C 64° 8'49.14"B	Fixed sands	<i>Chioneosoma Porosum</i> <i>Tricomymex</i> sp. <i>Cataglyphis oxiana</i> <i>Tetramorium schneideri</i> <i>Neuroleon</i> sp. <i>Lycosa</i> sp.
Location 7	40°52'53.95"C 64°13'51.22"B	Fixed sands	<i>Julodis variolaris</i> <i>Clytra</i> sp. <i>Messor variabilis</i> <i>Cataglyphis cinnamomea</i> <i>Lycosa</i> sp.
Location 8	40°50'45.36"C 64°20'28.15"B	Fixed sands	Bombyliidae (3 species) <i>Cataglyphis oxiana</i> <i>Anacanthotermes turkestanicus</i>
Location 9	40°50'16.41"C 64°26'23.39"B	Fixed sands	<i>Sarathropus depressus</i> <i>Anacanthotermes turkestanicus</i> <i>Lycosa</i> sp. <i>Menecleon</i> sp.
Location 10	40°50'40.94"C 64°35'45.76"B	Fixed sands	<i>Menecleon</i> sp. <i>Lycosa</i> sp. <i>Zophosis punctate</i>
Location 11	40°42'20.01"C	Sands	<i>Trichomyrmex</i> sp.

	64°37'13.16"B		Cataglyphis pallidula Anthaxia anatolica Neoplocaederus scapularis Lixus hirticollis Anacanthotermes turkestanicus Adesmia sp. Zophosis punctate
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Conclusions and recommendations

The recorded entomofauna was typical for this area. The most common species in all biotopes were darkling beetles and ants, as well as *Anacanthotermes turkestanicus*. The highest insect diversity was recorded on flowering plants (Ferula, Astragalus, Ammodendron). There were numerous records of various dipterans and hymenopterans, which were impossible to identify in the field. One of the most interesting finds was a bumble-bee from the genus *Bombus*. Other common arthropods included tarantula and *Scolopendra cingulata*. In April, when nighttime temperatures were low and winds quite strong, the insect species diversity was low. No insects were caught by light traps. During the second survey in early May the weather was warmer and the species diversity at night was somewhat higher. Recorded insects included antlions, bugs and numerous unidentifiable small butterflies. At one location not included in the survey area, mass migration of Trichoptera was recorded when we were camping. It is also quite possible that various butterflies (Lepidoptera) migrate through the construction site. No species listed in the Red Book of Uzbekistan or IUCN Red List were found.

In general, we do not see any potential threat to the entomofauna on the construction site, but, nevertheless, we recommend that the construction work have as little impact on the site as possible.

Table 3 Summary table for Dzhankeldy WF

	INVERTEBRATES	
	TAXONOMIC ORDER	NO. OF SPECIES
1	Hymenoptera	15
2	Coleoptera	3
3	Diptera	2
4	Blattodea	1
5	Hemiptera	2
6	Araeae	1
7	Scorpiones	1
8	Scolopendromorpha	1
9	Lepidoptera	1

Table 4 Summary table for Dzhankeldy-Bash OHTL

	INVERTEBRATES	
	TAXONOMIC ORDER	NO. OF SPECIES
1	Hymenoptera	10
2	Coleoptera	13
3	Diptera	4
4	Blattodea	1
5	Hemiptera	1
6	Araeae	1
7	Scorpiones	1
8	Scolopendromorpha	1

9	Neuroptera	1
10	Trichoptera	1
11	Lepidoptera	1

Appendix 1



Orthochirus scrobiculosus



Coccinella septempunctata



Neoplocaederus scapularis



Crematogaster subdentata



Lycosa sp.



At one of the survey locations



Bombyliidae (species 1)



Bombyliidae (species 2)



Julodis variolaris

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