Initial Environmental and Social Examination Report

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Uzbekistan: Samarkand Solar Power Project
Part 2: Main Report

Prepared by AECOM Limited for the Asian Development Bank.

6.4.2 Ornithological Assessment Overview

The likelihood of the Project site being used as a stopover and/or migration flyway for migrating birds has been investigated. The following sections provide further background information relevant to the assessment of ornithological baseline conditions and the assessment of potential impacts which are generally applicable for solar and power line projects:

- An overview of the potential 'lake effect' of solar panels is provided in Section 6.4.2.1.
- An overview of potential impacts of overhead powerlines on birds is provided in Section 6.4.2.2.
- The relevant key biodiversity areas for birds are detailed in Section 6.4.1.3.
- The details of migration flyways in Uzbekistan are provided in Section 6.4.1.4.
- A summary of the avifauna of Uzbekistan is provided in Section 6.4.1.5.
- A summary of the status of birds of conservation concern which are relevant to the
- Project site is provided in Section 6.4.1.6.

- Subsequent sections of the biodiversity baseline section are structured as follows:
  - The methodologies for the AECOM ecological surveys undertaken.
  - Details of the consultations undertaken.
  - The results of the ecological surveys undertaken by AECOM.

6.4.2.1 Overview of the potential 'Lake Effect' of Solar Panels

A number of unsubstantiated or unverifiable concerns have been raised in relation to the potential of solar PV arrays to mimic waterbodies resulting in bird collisions with the solar panels. The potential ornithological impacts of solar PV installations are poorly understood and there is no coherent guidance worldwide on the potential ecological effects of new and existing solar PV developments.

To date there are no experimental studies in the peer reviewed scientific literature that attempt to quantify the direct impact of PV solar farms on birds purely from an ecological perspective. The attraction of birds to solar PV installations was recognized as a concern by a focus group held to determine the potential hazards of large-scale PV development at airports (Wybo, 2013)[24]. The main attractant for birds recognized by Wybo (2013) was the potential for solar arrays to be used as nesting grounds; however, this claim was not supported with evidence. DeVault *et al.* (2014)[25] examined whether birds were more likely to use habitat at PV installations than nearby airfield grassland. The study stated that birds were rarely observed foraging on or near PV arrays. In terms of collision risk, DeVault *et al*. (2014) observed no obvious evidence for bird casualty caused by solar panels, despite conducting 515 bird surveys at solar PV sites.

Toral and Figuerola (2010)[26] state that the installation of solar farms on land used for rice cultivation would be detrimental to some water bird species. This claim is based on the study's findings that land used to cultivate rice in southwest Spain is used as habitat by some migratory water bird species, rather than any specific impact of solar farms. It is also suggested that the construction of solar farms will result in the loss of wetlands in southern Europe; however, no citation providing evidence of a negative impact of solar farms is presented. It is AECOM's view that the negative impacts reported are a result of changes to habitats and land use rather than the specific impact of any particular technology.

Photovoltaic panels have been shown to reflect polarised light that is attractive to polarotactic aquatic insects, which confuse solar panels with water and attempt to lay eggs on the surface, resulting in mortality and reproductive

[24] Wybo, J.-L. (2013) 'Large-scale photovoltaic systems in airports areas: safety concerns. Renewable and Sustainable Energy Reviews, 21, May, pp. 402–410.
[25] DeVault, T. L. *et al*. Bird use of solar photovoltaic installations at US airports: implications for aviation safety. Landsc. Urban Plan. 122, 122–128 (2014).
[26] Toral, G. M. and Figuerola, J. (2010) 'Unraveling the importance of rice fields for waterbird populations in Europe.' Biodiversity and Conservation. Department of Wetland Ecology, Doñana Biological Station, Avda. Américo Vespucio s/n 41092, P.O. Box 1056, 41080 Seville, Spain, 19(12) pp. 3459–3469.

failure (Horváth *et al.*, 2010[27]; Blahó et al., 2012[28]). Insectivorous predators have been recorded feeding on polarotactic insects attracted to sources of polarised light such as vertical glass windows, horizontal black plastic sheets and dry asphalt roads (Kriska *et al.*, 1998[29]; Bernáth *et al.*, 2008[30]; Horváth *et al.*, 2009[31]). Bernáth *et al.* (2001)[32] describe birds such as Black Kite (*Milvus migrans*), Great White Egret (*Ardea alba*) and Swallow (*Hirundo rustica*) attempting to drink from plastic sheets, hypothesising that this behaviour may be due to an attraction to surfaces reflecting polarised light. The study also describes the mortality of birds at a waste oil lake in Hungary, again attributing this to the direct attraction to polarised light or to insects attracted to polarised light. As solar PV panels are solid, if this hypothesis is correct, there is unlikely to be a significant hazard to perched birds attempting to drink, however Swallows and related birds could be presented with a collision risk as hirundines are known to drink 'on the wing' (Bryant *et al.*, 1984)[33].

In summary, little scientific evidence exists that demonstrates a direct impact of solar PV on birds. It is likely that different avian species are likely to be affected differently by solar developments, dependent on the habitat within and around a solar PV development, the spatial requirements of a given species (e.g. flocking species that require large areas to host the flock) and the foraging behaviour of a given species.

A review was commissioned by Natural England (Harrison et al. 2017[34]) to gather evidence from scientific literature to provide a comprehensive report on current understanding of the potential ecological impacts of solar PV developments. The conclusions reached in the Natural England study has been referred to and the Solar Park was considered in terms of:

- The habitat available prior to the development;
- The habitat that will co-occur with the development; and
- The potential for attraction to polarotactic insect species (i.e. is the development close to a water body).

In the case of the Solar Park site being considered, there are no features nearby that would suggest that the habitat is particularly sensitive or attractive to migrating birds. There are a number of small irrigation ditches close to the site and small stream/wetland areas on the eastern edge that may attract polarotactic insect species and hence attract insectivorous bird species. However, only a limited number and type of species were recorded during site surveys. It is not considered that the Solar Park would result in an increase in species diversity. As a result, no features have been identified that could potentially increase the collision risk of migrating or resident species colliding with the solar panels. As noted in DeVault *et al.* (2014) no obvious evidence was identified of bird casualty caused by solar panels after conducting 515 bird surveys at solar PV sites. Therefore, it is AECOM's opinion that the Solar Park will not result in a 'lake effect' and poses no direct risk to migrating or resident birds. This suggested effect has not been considered further.

6.4.2.2 Overview of Potential Impacts of Overhead Powerlines on Birds

Mortality due to collision is considered to represent one of the most important adverse effects of overhead power lines on birds. Birds collide with power lines because they can be difficult to see, although the degree of collision risk depends on a number of factors. These relate to the species and their behaviour, various environmental factors and the type and design of the power lines. In the 'typical' wire arrangement for steel lattice tower supported high voltage lines it is the relatively thin earth wire (or ground wire) rather than the thicker conductors that is thought to

[27] Horváth, G., Blahó, M., Egri, Á., Kriska, G., Seres, I. and Robertson, B. (2010) 'Reducing the maladaptive attractiveness of solar panels to polarotactic insects.' Conservation Biology, 24(6) pp. 1644–1653.
[28] Blahó, M., Egri, Á., Barta, A., Antoni, G., Kriska, G. and Horváth, G. (2012) 'How can horseflies be captured by solar panels? A new concept of tabanid traps using light polarization and electricity produced by photovoltaics.' Veterinary parasitology, 189(2-4) pp. 353–65.
[29] Kriska, G., Horváth, G. and Andrikovics, S. (1998) 'Why do mayflies lay their eggs en masse on dry asphalt roads? Water-imitating polarized light reflected from asphalt attracts Ephemeroptera.' The Journal of experimental biology, 201(Pt 15) pp. 2273–86.
[30] Bernáth, B., Kriska, G., Suhai, B. and Horváth, G. (2008) 'Wagtails (Aves: Motacillidae) as insect indicators on plastic sheets attracting polarotactic aquatic insects.' Acta Zoologica Academiae Scientiarum Hungaricae. Hungarian Natural History Museum, Budapest, 54(1) pp. 145–155.
[31] Horváth, G., Kriska, G., Malik, P. and Robertson, B. (2009). Polarized light pollution: a new kind of ecological photopollution. Frontiers in Ecology and the Environment. Volume 7, Issue 6. August 2009. pp 317-325
[32] Bernáth, B., Szedenics, G., Molnár, G., Kriska, G. and Horváth, G. (2001) 'Visual ecological impact of a peculiar waste oil lake on the avifauna: dual choice field experiments with waterseeking birdsusing huge shiny black and white plastic sheets.' Arch Nature Conserv Landsc Res, 40 pp. 1–28.
[33] Bryant, D. M., Hails, C. J. and Tatner, P. (1984) 'Reproductive Energetics of Two Tropical Bird Species.' The Auk. American Ornithologists' Union, 101(1) pp. 25–37.
[34] Harrison, C., Lloyd, H. and Field, C. (on behalf of Natural England (2017)). Evidence review of the impact of solar farms on birds, bats and general ecology (NEER012). 1st edition - 9th March 2017

present the greatest collision risk to birds (e.g. Alonso et al. 1994)[35]. Collisions are not thought to be random but are often concentrated in relatively short sections of a power line, where the various influencing factors can interact to create a collision problem or "hotspot" (e.g. Morkill & Anderson 1990[36]; Guyonne et al. 1998[37]).

Scottish Natural Heritage (SNH, 2016)[38] and Birdlife International (Birdlife, International, 2007[39]) have issued guidance regarding the effects of power lines on birds. Within this guidance, large and medium sized birds are highlighted as being the most sensitive (or potentially sensitive) to collision with overhead powerlines: storks, raptors, bustards, cranes, waterfowl and sandgrouse are included. This relatively high susceptibility of these species groups to collision is thought to be due to a number of ecological and biological factors such as: their need to regularly commute between separate roosting and foraging sites often in low light levels; their flocking and migratory behaviour; their large size and relatively poor manoeuvrability in flight; and their monocular vision (which reduces depth perception in comparison to species with binocular vision). The main potential hazards to birds from overhead power lines are (SNH 2016, Drewitt & Langston 2008[40]):

- Displacement of birds by the presence of new infrastructure (pylons, overhead wires), which may occur as both the deterrence of bird activity among and close to the pylons and also as a barrier effect to movement of birds across the Project area in the vicinity of new overhead wires. However, for the element of the Project that relates to replacement of existing overhead wires only, then negative impacts relating to barrier to movement are considered unlikely as birds are likely to have become habituated to the existing overhead wire and pylons;
- Habitat loss, fragmentation and / or degradation resulting from the construction of new infrastructure (including the replacement of existing overhead wires and the elements of the Project which relate to new overhead line options); and
- Increased bird mortality due to collision with new operational overhead line infrastructure, especially if sited close to congregation sites such as wetlands and migration bottlenecks.

6.4.2.3 Key Biodiversity Areas - The Kattakurgan Water Reservoir Important Bird Area

The Kattakurgan Water Reservoir is an Important Bird Area (IBA situated in a natural depression approximately 15km to the south-west of the Project site at its closest point; it is a non-protected area. Tree and shrub plantations (pistachio, oleaster, acacia, maple and others) cover 2,600 ha along the southern, south-eastern and western banks. The reservoir gets its water from the Kara-darya river, which is a right branch of the Zaravshan. river. The reservoir fills in autumn, winter and spring. Water is used for irrigation from May to June. The reservoir freezes for a short time in winter. Emergent vegetation is not developed because of water level fluctuations. The phytoplankton of the reservoir is poor in species composition and numbers. A total of 115 species of birds have been recorded at the site, 61 of them breeding. There are 10 species of birds included in the National Red Book. Of these, 4 species breed: pygmy cormorant (*Phalocrocrax pygmaeus*), common pheasant (*Phasianus colchicus*), Asian houbara (*Chlamydotis macqueeni*), and pin-tailed sandgrouse (*Pterocles alchata*). This site plays an important role in the protection of the Asian houbara and pin-tailed sandgrouse. The site meets several criteria for breeding and migratory species, including globally threatened and biome-restricted species, 1% or more biogeographical population, and congregations of 20,000 of more waterbirds[41]. The following waterfowl species are listed as IBA trigger species: greylag goose (*Anser anser*), common goldeneye (*Bucephala clangula*), smew (*Mergellus albellus*), ruddy shelduck (*Tadorna ferruginea*), great crested grebe (*Podiceps cristatus*), demoiselle crane (*Anthropoides virgo*) and great cormorant (*Phalacrocorax carbo*).

[35] Alonso, J.C., Alonso, J.A., Munoz-Pulido, R. (1994). Mitigation of bird collisions with transmission lines through groundwire marking. Biological Conservation 67: 129-134.
[36] Morkill, A.E. & Anderson, S.H. (1990). Effectiveness of marking powerlines to reduce sandhill crane collisions. Wyoming Cooperative Fish & Wildlife Research Unit Scottish Natural Heritage
[37] Guyonne, F., Janss, E., and Ferrer, M. (1998). Rate of bird collision with power lines: effects of conductor-marking and static wire-marking. Journal of Field Ornithology. 69: 8
[38] Scottish Natural Heritage [SNH] (2016). Assessment and mitigation of impacts of power lines and guyed meteorological masts on birds: Guidance, Version 1 (July 2016). Available at: https://www.nature.scot/guidance-assessment-and-mitigation-impacts-power-lines-and-guyed-meteorological-masts-birds
[39] Birdlife International (2007). Position Statement on Birds and Power Lines On the risks to birds from electricity transmission facilities and how to minimise any such adverse effects - adopted by the BirdLife Birds and Habitats Directive Task Force on 10 May 2007. Website: https://migratorysoaringbirds.birdlife.org/sites/default/files/BHDTF__Position_Power_Lines_and_birds_2007_05_10_.pdf
[40] Drewitt, A.L. and Langston, R.H.W. (2008). Collision Effects of Wind-power generators and Other Obstacles on Birds. Annals of the New York Academy of Sciences 1134(1):233 – 266. DOI: 10.1196/annals.1439.015
[41] BirdLife International (2021) Important Bird Areas factsheet: Kattakurgan Reservoir. Downloaded from http://www.birdlife.org on 15/12/2021.

Consultation with Birdlife International and ornithological experts (IBA Programme since 2008) was undertaken and reported in TYPSA/IFC (2020)[42]; this highlighted that none of the species for which the IBA site was designated use the Project site, with the exception of the potential for Asian houbara bustard.

In terms of non-bird biodiversity features of the IBA, the following fish species are listed in the National Red Book*:* *Barbus capito conocephalus*, *Capaetobrama kuschakewitschi* and *Sabanejewia aurata*. There are 11 species of reptiles, including *Varanus griseus* and *Testudo horsfieldi*. A total of 26 mammalian species have been recorded.

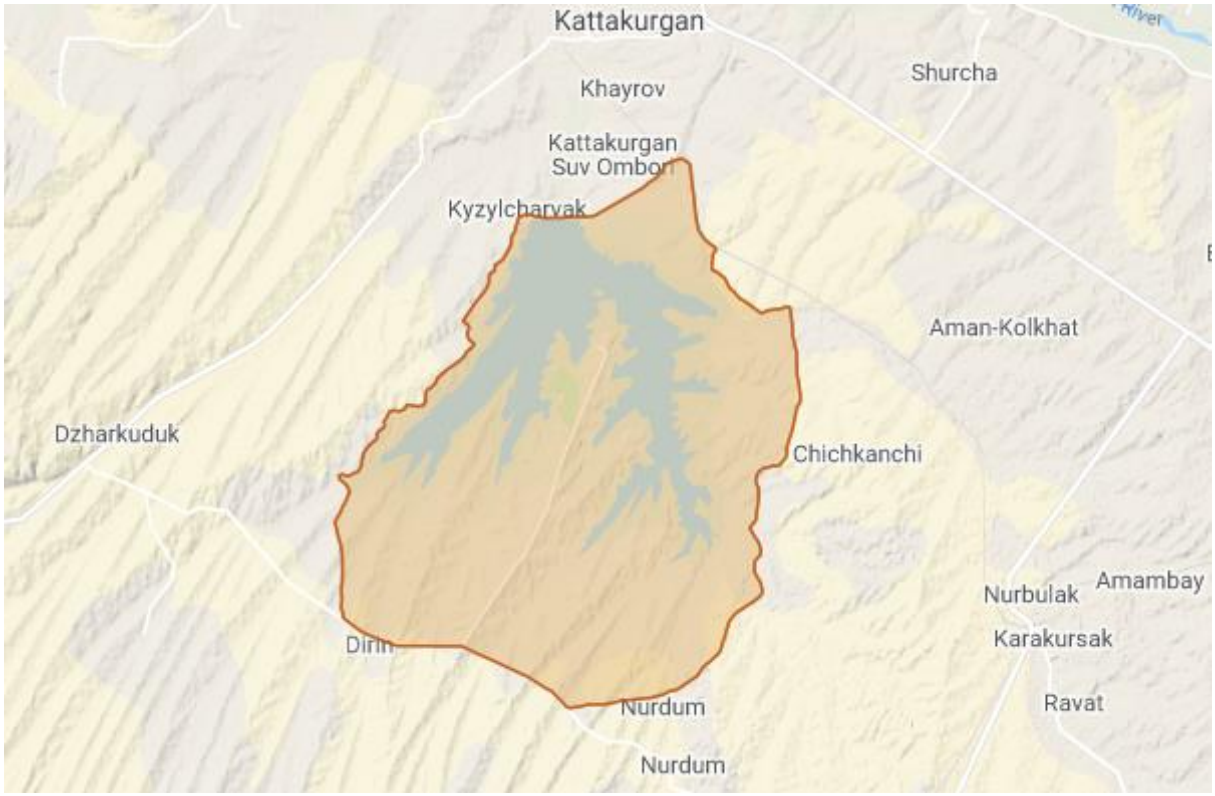

Figure 6-23. Location of the Kattakurgan Reservoir IBA

Source: Birdlife International, 2021

6.4.2.4 Flyways

A number of important flyways cross Uzbekistan with the Solar Farm lying on the Central Asian Flyway (CAF). The CAF covers a large continental area of Eurasia between the Arctic and Indian Oceans and the associated island chains. The Flyway comprises several important migration routes of waterbirds, most of which extend from the northernmost breeding grounds in the Russian Federation (Siberia) to the southernmost non-breeding (wintering) grounds in West and South Asia, the Maldives and the British Indian Ocean Territory. The birds on their annual migration cross the borders of several countries. Notable migratory species potentially using the CAF and flying over the Project area include the White-headed Duck and Sociable Lapwing (see further information under 'Species of Concern' below). Furthermore, the Asian–East African Flyway starts from the northern breeding grounds of water birds in Siberia and leads across Asia to East Africa. The larger African-Eurasian flyway covers a wider range of geographies starting from breeding grounds in Europe and Asia to wintering grounds in Africa.

[42] Environmental and Social Scoping Report – Kattakurgan Solar PV Project. Prepared by TYPSA for IFC. March 2020

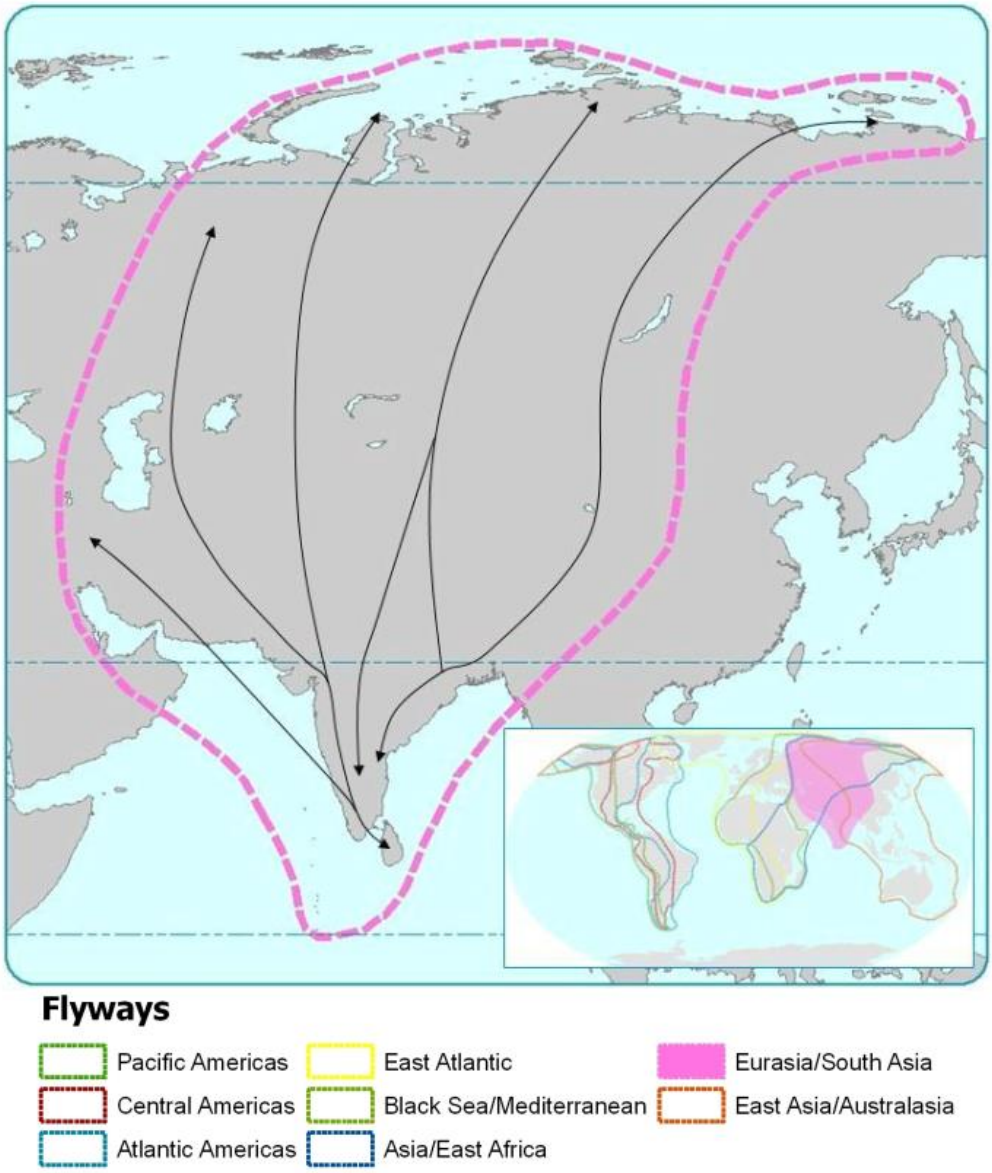

Figure 6-24. Important Flyways Relative to the Project Site

Source: BirdLife International (2020) Central Asian Flyway

Geographically the CAF region covers 30 countries of North, Central and South Asia and Trans-Caucasus (including Uzbekistan).

There is an overlap between the CAF and the area of the Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA), which was concluded in 1995, at The Hague, the Netherlands. Sixteen out of the thirty countries encompassed by the CAF are located in the AEWA Agreement Area (including Uzbekistan).

Uzbekistan's natural and artificial wetlands are important for migrating and overwintering waterfowl (Lanovenko 2006). More than 50 migratory waterbird species have been recorded on Uzbek wetlands, including at least nine which are globally threatened: dalmatian pelican (*Pelecanus crispus*), lesser white-fronted goose (*Anser erythropus*), white-headed duck (*Oxyura leucocephala*), ferruginous duck (*Aythya nyroca*), white-tailed eagle (*Haliaeetus albicilla*), red-breasted goose (*Branta ruficollis*), marbled teal (*Marmaronetta angustirostris*), Pallas's sea eagle (*Haliaeetus leucoryphus*) and pygmy cormorant (*Phalacrocorax pygmaeus*).

Notable migratory species potentially using the flyway in the vicinity of the project area include sociable lapwing (*Vanellus gregarious*) [see further information under 'Species of Concern' below].

The CAF is a broad front are there are no specific features within 20 km of the site which could attract migrating birds. The closest feature is Kattakurgan Reservoir IBA, which is attractive to migrating waterfowl, but the project site does not contain any wetland habitat that may attract such species and no waterfowl were recorded as a result of the baseline surveys (refer to Section 6.4.4: Field Survey Results)

6.4.2.5 Avifauna of Uzbekistan Summary

Uzbekistan has a total of 352 bird species with 19 listed as globally threatened. 297 species are migratory with 55 resident species. The species that are most likely to be present, based on a review of desk- based information, are shown in Table 6-7 below. No species are listed as country endemics.[43]

Of the species below, one avian species categorised as Critically Endangered has been identified (IBAT 7 tool – using a 50 Km buffer) – sociable lapwing. The Tallymerjan area on the Uzbekistan/Turkmenistan border (approx. 140 km south of the project area) has been highlighted as a key stopover site for the eastern flyway, with all birds monitored on the eastern flyway using this site as a stopover site during their migration. It is possible that birds fly over the proposed project site, but it is considered unlikely that the birds could use habitat within the Project site as stopover sites during migration (refer to species account in Species of Concern section below).

Table 6-7. Globally threatened bird species occurring in Uzbekistan

Scientific Name	Common name	Family	IUCN Category
Oxyura leucocephala	White-headed Duck	Anatidae (Ducks, Geese, Swans)	EN
Anser erythropus	Lesser White-fronted Goose	Anatidae (Ducks, Geese, Swans)	VU
Melanitta fusca	Velvet Scoter	Anatidae (Ducks, Geese, Swans)	VU
Marmaronetta angustirostris	Marbled Teal	Anatidae (Ducks, Geese, Swans)	VU
Aythya ferina	Common Pochard	Anatidae (Ducks, Geese, Swans)	VU
Podiceps auritus	Horned Grebe	Podicipedidae (Grebes)	VU
Columba eversmanni	Yellow-eyed Pigeon	Columbidae (Pigeons, Doves)	VU
Streptopelia turtur	European Turtle-dove	Columbidae (Pigeons, Doves)	VU
Leucogeranus leucogeranus	Siberian Crane	Gruidae (Cranes)	CR
Otis tarda	Great Bustard	Otididae (Bustards)	VU
Chlamydotis macqueenii	Asian Houbara	Otididae (Bustards)	VU
Vanellus gregarius	Sociable Lapwing	Charadriidae (Plovers)	CR
Numenius tenuirostris	Slender-billed Curlew	Scolopacidae (Sandpipers, Snipes, Phalaropes)	CR
Neophron percnopterus	Egyptian Vulture	Accipitridae (Hawks, Eagles)	EN
Clanga clanga	Greater Spotted Eagle	Accipitridae (Hawks, Eagles)	VU
Aquila nipalensis	Steppe Eagle	Accipitridae (Hawks, Eagles)	EN
Aquila heliaca	Eastern Imperial Eagle	Accipitridae (Hawks, Eagles)	VU
Haliaeetus leucoryphus	Pallas's Fish-eagle	Accipitridae (Hawks, Eagles)	EN
Falco cherrug	Saker Falcon	Falconidae (Falcons, Caracaras)	EN

Further assessment was undertaken to determine the species of concern most likely to be present close to the Project site. These are listed in below.

6.4.2.6 Bird Species of Concern Relevant to the Project Site

The following bird species were identified by the IBAT screening undertaken by TYPSA.[44].

[43] BirdLife International (2020) Country profile: Uzbekistan. Available from http://www.birdlife.org/datazone/country/uzbekistan. Checked: 2020-02-03
[44] See footnote 21

Sociable lapwing – *Vanellus gregarious*

The sociable lapwing is a strikingly patterned plover species listed as Critically Endangered (CR) by the IUCN and Vulnerable (VU: R) on the Red Data Book of Uzbekistan.

It is listed as CR due to recent dramatic declines in population size across its range, with an estimated 5,600 pairs remaining globally. It is thought that illegal hunting during migration and on wintering grounds may now be the species primary threat, although the reasons for its recent decline are poorly understood (Birdlife International, 2018).

The species breeds in Northern Kazakhstan during the summer months and a large percentage of the population flies in a south-west direction to spend the winter in Syria and Sudan between September and March. A recently discovered migratory population however migrate to the east to winter in Pakistan, crossing Afghanistan, Turkmenistan and Uzbekistan on their journey, and resting at stopover sites along their route (Birdlife International, 2018). Further information is provided in Donald *et al* (2021)[45] which confirms the two migration flyways from the breeding grounds in Kazakhstan; '*a longer western route (c. 5200 km) west through southern Russia, then south through the Caucasus to wintering areas in Saudi Arabia and eastern Sudan, and a shorter eastern route (c. 2800 km) south through Turkmenistan and Uzbekistan to wintering areas in Pakistan and north-western India. The migration strategy is characterised by infrequent long-distance movements followed by often lengthy stopovers in a small number of staging areas that are used consistently across years, and by high individual and low between-individual consistency in spatial and temporal patterns of movement*'. A single autumn stopover area and a single spring stopover area was identified along the migration route which is geographically relevant to the Project site ie. the aforementioned eastern route. Donald *et al* (2021) suggest that birds are highly faithful to passage and wintering sites. During migration and on the wintering grounds, the species appears to be strongly associated with areas of agriculture, particularly along rivers. In October 2015 the world's largest aggregation in recent years was discovered at a site known as Tallymarzhan (also Tallymerjen), which straddles the border between eastern Turkmenistan and south-western Uzbekistan. This site is located to the south of Qarshi within the Qashqadaryo Region; this region is located to the south of Samarqand Region and is therefore remote from the Project site. Additionally, mapped distribution of sight and specimen records shown in Donald *et al* (2020), for the last 50 years (1971-2020), do not correspond to the region where the Project site is located. Although information in Donald et al (2021) does not suggest that the Project site is located on a stopover staging area for this species, the tracking data maps do suggest that tracked birds may overfly the region where the Project site is located.

Consultation undertaken by AECOM and the Samarkand Regional Ecology Department, during a meeting on 26th November 2021, confirmed that the Project site and surrounding locality was unlikely to be a stopover site for sociable lapwing during spring and autumn passage. This assessment is supported by information in the Kattakurgan IBA factsheet [46], which does not list this species as a biodiversity feature of the IBA which is located in the vicinity of the Project site area. It is possible that sociable lapwing may fly over the proposed Project site during spring and autumn passage and therefore surveys for this species of high conservation concern were undertaken during the autumn 2022 passage period; this is consistent with advice provided during consultation with ADB.

The CHA (Turnstone Ecology, 2022: Appendix D) did not assess this species as a trigger for Critical Habitat but meets the criteria for inclusion as a Priority Biodiversity Feature when assessed against the PBF guidelines as set out in EBRD PR6 GN. This species was not recorded during any of the baseline surveys which have been undertaken for the project.

White-headed Duck – *Oxyura leucocephala*

Listed as endangered by the IUCN, this duck species is known to occur in Uzbekistan in winter. It usually occurs within larger wetland systems where there are semi-permanent freshwater, brackish or eutrophic lakes with a fringe of emergent vegetation (BirdLife International, 2019). High threats include the drainage of appropriate

[45] Donald P.F., Kamp J., Green R.E, Urazaliyev R., Koshkin M. and Sheldon R.D. Migration strategy, site fidelity and population size of the globally threatened Sociable Lapwing Vanellus gregarious. Journal of Ornithology (2021) 162:349–367 https://doi.org/10.1007/s10336-020-01844-y

[46] BirdLife International (2022) Important Bird Areas factsheet: Kattakurgan Reservoir. Downloaded from http://www.birdlife.org on 11/04/2022.

habitat and hybridisation with the north American ruddy duck. White-headed duck is not listed as an IBA trigger species for the Kattakurgan Water Reservoir KBA.

The CHA (Turnstone Ecology, 2022: Appendix D) did not assess this species as a trigger for Critical Habitat but meets the criteria for inclusion as a Priority Biodiversity Feature when assessed against the PBF guidelines as set out in EBRD PR6 GN. The project AoI does not support habitat suitable for this species however transit through AoI is possible. White-headed duck was not recorded on any of the baseline surveys and it is considered that any transitory movements are highly unlikely to be of numbers which are significant.

Saker Falcon - *Falco cherrug*

The saker falcon is listed as Endangered (EN) on the IUCN Red List due to electrocution from power lines, overexploitation for the falcon trade and habitat degradation. The estimated global population of the species is now between 12,200 and 29,600 individuals across its large range, with resident and breeding populations occurring in Uzbekistan. A specialist in hunting in open terrain landscapes such as semi-desert, steppe habitat and agricultural areas, it mainly hunts terrestrial rodents (BirdLife International, 2019). The species is also listed as Near-threatened (NT) on the Red Data Book of Uzbekistan.

There is suitable foraging habitat within the Project site for this species and therefore there is the possibility that this species may occur within the Project site, although there is no reasonable likelihood that the proposed site regularly supports significant populations for this species considering the relatively small size of the cultivated and fallow land present within the site and immediate surrounds in terms of similar habitat which is ubiquitous throughout the region.

The CHA (Turnstone, 2022: Appendix D) did not assess this species as a trigger for Critical Habitat but meets the criteria for inclusion as a Priority Biodiversity Feature when assessed against the PBF guidelines as set out in EBRD PR6 GN. This species was not recorded during any of the baseline surveys which have been undertaken for the project.

Steppe Eagle - *Aquila nipalensis*

This species is widespread and occurs in Uzbekistan during its migration between breeding grounds further north and wintering grounds in Africa and on the Indian subcontinent. It is found predominantly in steppe and semi-desert habitats, feeding mainly on small mammals. It has been severely affected by the conversion of steppe habitat to agricultural lands and is adversely affected by power line and wind energy infrastructure. It is listed as Endangered (EN) by the IUCN and Vulnerable (VU:D) on the Red Data Book of Uzbekistan.

The CHA (Turnstone, 2022: Appendix D) did not assess this species as a trigger for Critical Habitat but meets the criteria for inclusion as a Priority Biodiversity Feature when assessed against the PBF guidelines as set out in EBRD PR6 GN. A single migrating steppe eagle was recorded at the Project site during the AECOM survey visit undertaken in September 2021.

Pallas's Fish Eagle - *Halieetus leucoryphus*

The project area is within the native non-breeding range of this species displayed on the IUCN red list. The species is closely linked to wetland, reservoirs and lake habitats and nests in trees near these water bodies.

The eagle is listed as Endangered largely due to the continued loss and disturbance of wetland and breeding sites across its range, and there are now thought to be between 1000-2499 mature individuals globally. Pallas's fish eagle is not listed as an IBA trigger species for the Kattakurgan Water Reservoir KBA.

The CHA (Turnstone, 2022: Appendix D) did not assess this species as a trigger for Critical Habitat but meets the criteria for inclusion as a Priority Biodiversity Feature when assessed against the PBF guidelines as set out in EBRD PR6 GN. This species was not recorded during any of the baseline surveys which have been undertaken for the project.

Egyptian Vulture - *Neophron percnopterus*

The project location is within the native breeding range of the Egyptian vulture. Across its large range it faces a variety of threats from lead poisoning, direct or secondary poisoning, electrocution from power lines, collision with wind turbines and reduced food availability due to habitat change and is listed as Endangered (EN) on the IUCN Red List and Vulnerable (VU) on the Red Data Book of Uzbekistan. An Egyptian vulture was recorded at the Project site during the site visit by TYPSA in autumn 2020.

The CHA (Turnstone Ecology, 2022: Appendix D) did not assess this species as a trigger for Critical Habitat but meets the criteria for inclusion as a Priority Biodiversity Feature when assessed against the PBF guidelines as set out in EBRD PR6 GN.

Asian Houbara - *Chlamydotis macqueenii*

Consultation undertaken by AECOM with the Samarkand Regional Ecology Department during a meeting on 26th November 2021 confirmed that the project site is unlikely to support populations of Asian Houbara.

Asian Houbara Bustard was not recorded during the September 2021 and 'November 2021 surveys. A specific breeding survey for this species was undertaken in April 2022 (refer to 6.4.2.4) within the Solar PV site. No Asian houbara were recorded during the AECOM surveys; therefore the likelihood that breeding populations are present within the Project AoI is negligible.

The CHA (Turnstone, 2022: Appendix D) did not assess this species as a trigger for Critical Habitat but meets the criteria for inclusion as a Priority Biodiversity Feature when assessed against the PBF guidelines as set out in EBRD PR6 GN. This species was not recorded during any of the baseline surveys which have been undertaken for the project.

Little Bustard - *Tetrax tetrax*

The main threats are habitat loss, degradation and fragmentation, lack of food availability and nest failure due to modern agricultural practices.

The CHA (Turnstone Ecology, 2022: Appendix D) did not assess this species as a trigger for Critical Habitat but meets the criteria for inclusion as a Priority Biodiversity Feature when assessed against the PBF guidelines as set out in EBRD PR6 GN. This species was recorded during surveys undertaken by TYPSA in 2021 (a single bird).

Great Bustard - *Otis tarda*

This species has suffered rapid global population reductions across most of its range owing to the loss, degradation and fragmentation of its habitat, hunting pressure and also collision with powerlines. Great bustard therefore qualifies as IUCN Vulnerable (VU) [Birdlife International, 2022]. The species is also assigned Critically Endangered (CR) status under the Red Data Book of Uzbekistan.

This species is a native non-breeding (winter visitor) to the Samarkand region of Uzbekistan. The migration movements for this species can be triggered by cold weather conditions which are more likely to occur in the Russian/Kazakhstan native breeding range between December-March.

Further details of the known ranges and wintering grounds within the Samarkand region (and Jizzakh region) in relation to the project site are shown in Appendix D (Critical Habitat Assessment, Turnstone Ecology [2022]) which have been informed by the assessment for great bustard undertaken by TYPSA/IFC in the winter of 2020/21 and reported in TYPSA/IFC (2021). The Project AoI is to the south-west of a known core wintering area in the Jizzakh region (Nuratau Range) and is located to the north-east of the a known core wintering area in Samarkand region (Steppe of Karnabchul). The Project AoI therefore does not overlap with the core wintering areas of great bustard detailed in the aforementioned CHA. As detailed in the CHA, the Project AoI does not support suitable terrestrial habitat for over-wintering or staging Great Bustard and no birds were recorded within the AoI during the winter surveys undertaken in the winter 2020-21 (Typsa/IFC 2021). The species was not recorded during winter baseline surveys undertaken by AECOM. It is therefore considered that the Project AoI in unlikely to be of critical importance for wintering Great Bustard within Uzbekistan. This position is echoed in the 2021 Typsa/IFC (2021) report which clearly states 'the Project site is likely to be situated outside the area of Critical Habitat'. However, the airspace of the Project AoI, including route of the OHL is likely to be used by birds moving between wintering grounds as well as migrating between wintering and breeding habitats. The CHA has

determined that the EAAA used for the assessment is likely to support significant numbers of the Central Asian population and the thresholds for Critical Habitat are met for Criterion 1.

Great Bustards are known to be highly susceptible to collision with overhead lines and the project is in an area with a significant proportion of the Central Asian population of this species. Between 10 to 15 collisions would affect 1% of the Central Asian population which would be highly significant given the species' relatively low, and declining, population

Great bustards are known to be highly susceptible to collision with overhead lines and the project is in an area with a significant proportion of the Central Asian population of this species. Between 10 to 15 collisions would affect 1% of the Central Asian population which would be highly significant given the species' relatively low, and declining, population.

In summary, Critical Habitat has therefore been triggered for great bustard.

6.4.3 Site Survey Methodology

The ecological baseline (habitat identification, floral survey, terrestrial fauna and avifauna survey) was established by local biodiversity specialists on September 2021[47] and by AECOM ecologists/local biodiversity specialist[48] during site surveys on 26th, 27th and 28th November 2021 (referred to as the 'September 2021' and 'November 2021' surveys herein). These surveys included:

- Walkover transect surveys for birds, reptiles, mammals and rare and endemic species of plants within the Solar PV site;
- Walkover transect survey for habitat assessment categorization within the Solar PV site;
- Drive-over and point count surveys for the aforementioned ecological features along the OHL (from the on-site substation to the existing Ishtihan substation) and also in areas adjacent to the proposed Project site.

The Solar PV site footprint (being relatively small) was surveyed on foot with a series of transects running from east to west and north to south directions. The area was traversed in a regular pattern in order to reduce the chances of missing any important biotic features.

Additional baseline surveys were undertaken in April and September 2022 (for Asian houbara and sociable lapwing respectively); refer to sections 6.4.2.4 & 6.2.4.5 below.

6.4.3.1 Habitat and Flora Survey

The aims of the September 2021 habitat and flora survey, which was undertaken by local botanical specialists, are as follows:

- Determine the habitat type and plant species present at and around the proposed Project site and highlight any IUCN threatened species and/or species listed in the Red Data Book of Uzbekistan. The vegetation was sampled by the local botanical specialists along a transect route using 10mx10m quadrats, using the Drude method[49] for assigning vegetation cover and describing the vegetation type formations.
- Identify any exotic (non-native) or potentially invasive flora species.
- Identify the potential direct or indirect impacts, whether they are beneficial, adverse or neutral, on the current vegetation communities or protected species as a result of the construction and operation of the proposed Project.
- Identify feasible mitigation strategies as counter measures for the potential impacts.

[47] Fazlullo Agzamov, Research Specialist on Biodiversity, Research Institute of Ecology and Environmental Protection, Tashkent City Department of the State Committee on Ecology and Environment Protection and Abdusalom Normatov, Senior Researcher, Forestry Scientific Research Institute, Tashkent

[48] Fazlullo Agzamov, Research Specialist on Biodiversity, Research Institute of Ecology and Environmental Protection, Tashkent City Department of the State Committee on Ecology and Environment Protection

[49] The Drude method is a description of vegetation in terms of its floristic composition and is generally accepted in terms of geobotany in Uzbekistan

Plant species were identified, and distributions were checked using relevant literature. The conservation status of each of the plant species documented was researched using the IUCN data bases. This was cross checked against the Uzbekistan Red Data Book to determine the presence of species of national conservation importance. The September 2021 survey was undertaken within the optimal survey season (April-September) for undertaking habitat surveys.

The site was appraised by an experienced botanist/ habitat surveyor from AECOM and a local biodiversity specialist during the November 2021 field survey visit; the habitats and species present could be identified with confidence. Sufficient information was obtained during the September 2021 visit to allow ground-truthing of habitats and flora during the November visit.

The September and November 2021 surveys did not coincide with the optimum period for surveying those spring ephemeral species which are perennials (eg. *Liliaceae* and *Iridaceae*); these have bulbs, corms or tubers which enter a period of dormancy until sprouting in early spring. Nevertheless, the aboveground parts can still be detected and identified at the end of the growing season in late summer/early autumn. Also, the dead above ground parts of spring ephemeral species which are annuals (eg. *Papaveraceae*, *Chenopodiaceae*, *Compositae*, *Fabaceae*) could be detected and identified during the September 2021 visit. Therefore, the timing of the surveys is not considered to be a limitation in terms of this botanical and habitat appraisal.

6.4.3.2 Terrestrial Fauna Survey

The aims of the faunal study were to:

- Carry out field work to identify the terrestrial fauna that may reside or range within the region of the proposed Project.
- Provide detailed lists of the mammal, reptile, and amphibian fauna in the region.
- Provide the IUCN Red Data rating and protected status in Uzbekistan for each of the fauna species determined to be present or potentially occurring at the Project site.
- Identification of any direct or indirect impacts, whether they are beneficial, adverse or neutral, on the current terrestrial biodiversity and provide relevant mitigation measures.

Considering that the activity patterns of many terrestrial species are hugely variable (i.e. many are nocturnal), it is possible that certain small species (particularly small mammals, reptiles and amphibians) could have been overlooked during the daily site surveys.

6.4.3.3 Avifauna Survey

The aims of the September 2021 and November 2021 avifauna surveys were to:

- Carry out field work to identify the micro-habitats within the proposed Project's footprint and identify the avifauna that may reside or frequent the area.
- Provide a detailed list of avifauna that occur in the region.
- Provide the IUCN rating for each of the fauna species determined to be present and protected status in Uzbekistan for each of the avifauna species determined to be present or potentially occurring at the Project site.
- Identify direct or indirect impacts to the local avifauna that could be the result of the construction and operation of the proposed Project.
- Determine relevant mitigation measures.

There are numerous factors that could influence the presence of avian species within the region such as season, weather conditions, and food availability. In order to account for this the bird distributions were researched to formulate an index similar to that used for terrestrial fauna species. In addition, the breeding and migratory habits were researched using Bird Life International databases to derive the species lists. Birds that could potentially frequent the proposed Project site have been classified according to their migratory, breeding and resident statuses. This scale uses the following terms:

Residence status:

- **Resident**: These birds reside and breed within the local areas on a more or less permanent basis though may move within their distribution zone
- **Non-breeding migrant:** These birds do not breed in this area however may be found in the region during certain periods/ seasons as they either use this area as a temporary or seasonal home range. This includes Eurasian wintering migrants.
- **Breeding migrant:** These birds frequent the region specifically to breed and raise their young, however following the breeding season will move on to other areas.

6.4.3.4 Asian Houbara Breeding Survey

Following consultation with the Asian Development Bank (ADB), a species-specific survey for Asian Houbara (*Chlamydotis macqueenii*) was undertaken by local biodiversity specialists[50] on 11th-13th April 2022.

The aim of the Asian Houbara breeding survey was to detect communal display areas (leks) in areas of suitable breeding habitat within the project area following the methodology detailed in Sutherland et al, 1996[51]. The dates of the survey in early/mid-April coincide with the optimal period for lekking activity. The aim was to confirm presence/absence of breeding populations of Asian Houbara within the Solar PV site. This species 'inhabits open, arid and sparsely vegetated steppe and semi-desert; it favours scattered shrubby vegetation, typically comprising xerophytic or halophytic plants (Birdlife International, 2022[52]). The intensive agricultural areas which support the proposed OHL do not represent suitable breeding habitat for this species and therefore element of the project was scoped out of the survey.

In terms of the survey methodology, watches from vantage points were made in the early morning from elevated points using high powered optical equipment (telescopes mounted on a tripod (as well as binoculars)). The surveys coincided with the recommended timeframes as advised by ADB (ie. early mornings in April). The location of the vantage points sought to avoid any disturbance to any lekking birds that may have been present. A desk-based survey reconnaissance (using aerial photography and topographical [contour] mapping) was undertaken by the survey team, with the purpose of determining potential vantage point, access arrangements and survey logistics.

The latitude and longitude co-ordinates for any lek sites used by Asian Houbara, and all other records/observations of this species, were recorded on a survey form and registered on a corresponding map.

Other bird species which were recorded incidentally during the April 2022 Asian Houbara survey were also recorded as part of this survey; this included breeding and migrating (spring passage) species. The following information was recorded for these records: species, number, behaviour and flight direction (if relevant).

6.4.3.5 Sociable Lapwing _Autumn Passage Survey

Following consultation with the Asian Development Bank (ADB), a species-specific survey for sociable lapwing (*Vanellus gregarious*) was undertaken by local biodiversity specialists in September 2022. **Further detailed method will be added on receipt of the GBI ecology summary report.**

6.4.3.6 Central Asian Tortoise Survey

Following consultation with the Samarkand Regional Ecology Department/Goscomecology surveys for Central Asia Tortoise (*Testudo horsfieldii*) were undertaken by AECOM between 27th-29th April 2022. The field survey was carried out by a local reptile specialist R.A. Nazarov in April 2022; the findings are reported in Nazarov, R.A. (May 2022)[53]. A purpose of the surveys was to confirm presence/absence and an estimation of population density within the Project site, to inform the ecological baseline, impact assessment and mitigation for this assessment and to accord with the requirements of Samarkand Regional Ecology Department/Goscomecology with respect to permitting for translocation of tortoises. The surveys also aimed to record any other reptile species encountered during the tortoise surveys; to inform the ecological baseline, impact assessment and mitigation with respect to all reptile species present or potentially present within the Project Site.

[50] Team leader - Fazlullo Agzamov, Research Specialist on Biodiversity, Research Institute of Ecology and Environmental Protection, Tashkent City Department of the State Committee on Ecology and Environment Protection
[51] Sutherland, W.J (1996). Ecological Census Techniques: A Handbook. Cambridge University Press
[52] BirdLife International (2022) Species factsheet: Chlamydotis macqueenii. Downloaded from http://www.birdlife.org on 28/03/2022. Recommended citation for factsheets for more than one species: BirdLife International (2022) IUCN Red List for birds. Downloaded from http://www.birdlife.org on 28/03/2022.
[53] Nazarov, R.A. (May 2022). A Herpetological Assessment of Current State of Territory of Samarkand Solar PV (Samarkand Region, Uzbekistan), with the focus on the condition of the population of Asian tortoise (*Testudo horsfiledii*).

The surveys were undertaken in April and therefore within the active season for Central Asian tortoise when they are more commonly active above ground and therefore easier to detect.

The survey involved the surveyor walking a 12.4km line transect within the Solar PV site and the OHL route during the daytime and also on a single occasion during the night-time; observations of tortoises, tortoise burrows and tortoise signs were recorded within distance bands so that population densities could be calculated.

6.4.4 Consultations

The following organisations were consulted as part of the biodiversity assessment:

- Samarkand Regional Ecology Department (included the respective Heads from the Regional Department of Ecology, Biodiversity Division, Expertise Division and Air Protection Division) [26th November 2021].

6.4.5 Field Survey Results

6.4.5.1 Introduction

The results of the ecological field surveys undertaken by AECOM, as detailed in Section 4.1.3, are provided below. The results of consultation with statutory stakeholders and as a result of formal and informal liaisons with the local community are also included, where relevant.

A full species list for the fauna and flora recorded during the field surveys is provided in Appendix A.

6.4.5.2 Habitats

The vegetation of Uzbekistan is divided into four main ecosystems (Belolipov *et a*l, 2013)[54]; the proposed Project site is located in the adyr zone (lowlands and foothills).

The September 2021 and November 2021 surveys confirmed that the Solar PV site is a mosaic of historic (within the last 20 years) and more recent (within last 5 years) cultivated land, with ridge and furrow patterns indicative of ploughing ubiquitous throughout. Camelthorn (*Alhagi pseudoalhagi*) is a ubiquitous feature of the vegetation (abundant) and spiny cocklebur (*Xanthium spinosum*), a noxious weed, is locally abundant; the latter species is an introduced invasive species (refer to Sennikov *et al*, 2020[55]). Isirik (*Peganum harmala*), a native noxious weed, is widespread and is locally abundant. Other ruderal and weed flora components which typify this agro-ecosystem are *Papaver pavonium*, *Tribulus terrestris*, and *Sphaerophysa salsula*, with *Cynodon dactylon* and *Hordium leporinum* grasses achieving local abundance. A full species list is shown in Appendix A.

The agro-ecosystem (a mosaic of historic and more recent [within last 5 years] cultivated land) and the associated weed flora assemblage which prevails within the Solar PV site is Modified Habitat as defined in PS6. The OHTL route crosses intensively cultivated and irrigated farmland habitat, with cropped fields including cotton cultivation: it is Modified Habitat as defined in PS6 (refer to Figure 6-25).

In terms of the assessment against the PBF guidelines as set out in EBRD PR6 GN (refer to Appendix D), no habitat types or ecosystems were present or identified as being potentially present, that would be considered as priority habitats as such Criterion 1: Threatened Habitat has not been triggered. No higher or lower plant species were recorded which would be considered as Priority Biodiversity Features under PBF Criterion 2 (Vulnerable species).

[54] Belolipov, I.V., Zavrov, D.E. and Eisenman, S.W. (2013). The Geography, Climate and Vegetation of Uzbekistan. *Medicinal Plants of Central Asia; Uzbekistan and Kyrgystan, pp.5-7*

[55] Sennikov A N, Tojibaev K S, Beshko N Y, Esanov H K, Wong L J, Pagad S (2020). Global Register of Introduced and Invasive Species - Uzbekistan. Version 1.5. Invasive Species Specialist Group ISSG. Checklist dataset https://doi.org/10.15468/m5vdwk accessed via GBIF.org on 2022-04-07.

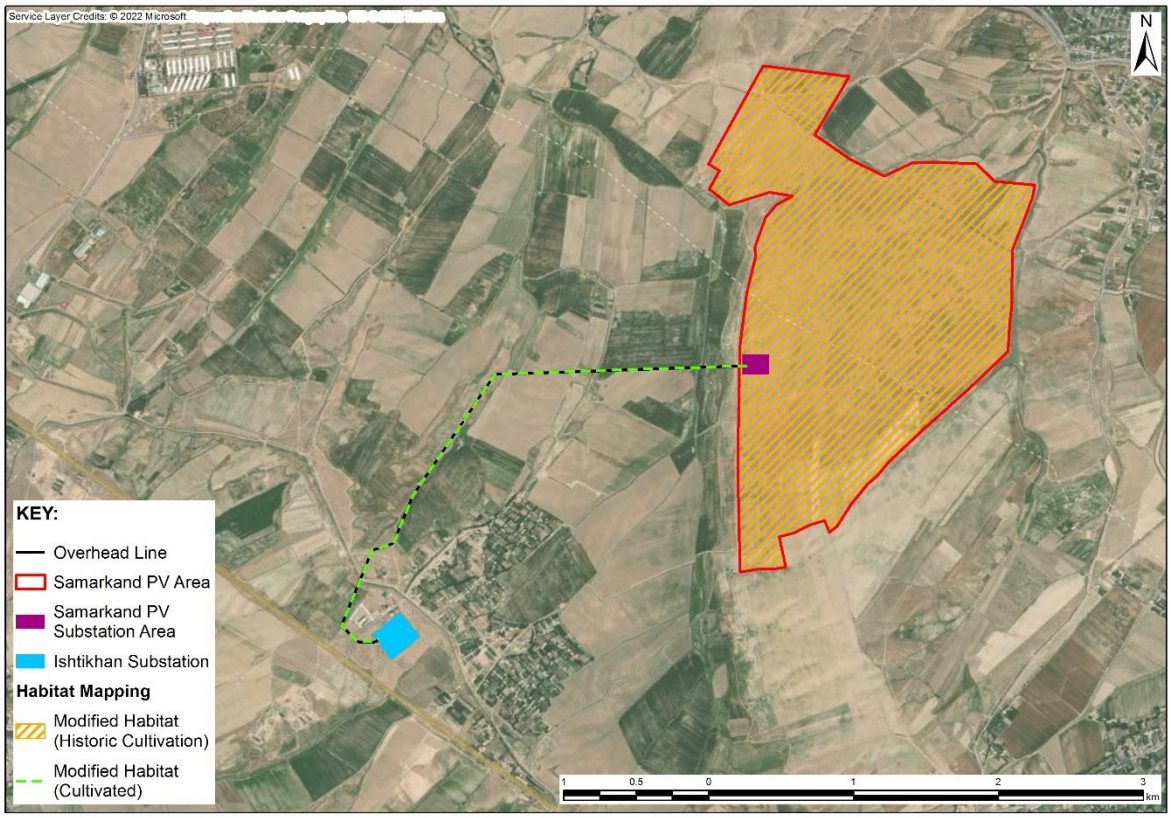

Figure 6-25. Habitats Relevant to Project Site

Figure 6-26. Fallow cultivated land in southern part of Solar PV site with remnant cereal crop and frequent Camelthorn

Source: Stephen Dixon (2021) - Site visit photos November 2021.

Figure 6-27. The prevailing agro-landscape (ridge and furrow) with associated ruderal weed flora assemblage within the Solar PV site

Source: Fazlullo Agzamov (2021) - Site visit photos September 2021.

Figure 6-28. Northern part of the Solar PV site, historic ridge and furrow and crop planting holes

Source: Stephen Dixon (2021) - Site visit photos November 2021.

Figure 6-29. Spiny cocklebur, an introduced invasive species, is locally abundant within the historic cultivated land.

Source: Stephen Dixon (2021) - Site visit photos November 2021.

6.4.5.3 Survey Results for Breeding and Non-breeding (migratory and wintering) birds – Solar PV Site

There are several Eurasian migrants that winter in Uzbekistan or migrate through the country as part of the African-Eurasian flyway on route to neighbouring countries. Data has shown that there have been successive declines in populations of many Afro-Palaearctic migrant birds (BirdLife International, 2018). Other species may not breed in Uzbekistan but may migrate to overwinter from breeding areas in northern Eurasia.

A summary of the bird species recorded within the Solar PV site during the AECOM surveys which coincided with the autumn and spring migration period (ie. the September 2021 and April 2022 surveys respectively) and the wintering surveys (ie. the November 2021 survey) are shown in Table 6.8 below.

A single species of conservation concern and PBF species was observed during the September 2021 field survey visit: steppe eagle (*Aquila nipalensis*) [IUCN Endangered]. A single overflying bird on autumn passage was recorded. A single species, white-tailed eagle (*Haliaeetus albicilla*), is included within the Red Data Book of Uzbekistan (VU); an individual was recorded overflying the Solar PV site during the November 2021 visit.

The Asian houbara survey undertaken in April 2022 confirmed the likely absence of breeding populations for this species within the Project site. The sociable lapwing survey undertaken in September 2022 confirmed the likely absence of this species within the project site, however there is potential for possible movements over site during spring and autumn migration.

Migratory and resident species recorded during the April 2022 field survey, which may also breed within the proposed project area include: black-bellied sandgrouse (*Syrrhaptes orientalis*), crested lark (*Galerida cristata*) and isabelline wheatear (*Oenanthe isabelline*). None of the breeding bird species recorded are of global conservation concern (refer to Table 6-8) and non are included in the Red Data Book of Uzbekistan.

Table 6-8. Summary of the Bird Species Recorded During the AECOM Surveys within the Solar PV site (refer to footnotes)

Common Name	Latin Name	IUCN threatened[1]?	URDB Listed[2]?	PBF (EBRD PR6 GN)	Peak Count			
					Visit 1: Sept 2021	Visit 2: Nov 2021	Visit 3: April 2022[3]	Comments
Black-bellied Sandgrouse	*Syrrhaptes orientalis*	x	x	x	4	-	6	Resident species
Feral Pigeon	*Columba livia forma domestica*	x	x	x	165	-	14	Resident species
Oriental Turtle Dove	*Streptopelia orientalis* SL	x	x	x	68	-	-	Non-breeding (migratory) species
Eurasian Collared Dove	*Streptopelia decaocto*	x	x	x	14	-	-	Resident species
Laughing Dove	*Spilopelia senegalensis*	x	x	x	2	-	-	Resident species
Steppe Eagle	*Aquila nipalensis*	✓ EN	✓VU:D	✓	1	-	-	Non-breeding (migratory) species which is included in the Red Book of Red Data Book of Uzbekistan (VU)
White-tailed Eagle	Haliaeetus albicilla	x	✓VU	x	-	1	-	Winter visitor
Western Marsh Harrier	*Circus aeruginosus*	x	x	x	5	1	2	Resident species
Hen Harrier	*Circus cyaneus*	x	x	x	1	3	1	Winter visitor
Montagu's Harrier	*Circus pygargus*	x	x	x	-	-	2	Summer breeding and migratory species
Eurasian Sparrowhawk	*Accipiter nisus*	x	x	x	-	-	2	Resident species

Shikra	*Accipiter badius*				-	-	1	Summer breeding and migratory species
Long-legged Buzzard	*Buteo rufinus*	x	x	x	2	-	-	Summer breeding and migratory species
Peregrine Falcon	*Falco peregrinus*	x	x	x	-	1	-	Winter visitor
Common Kestrel	*Falco tinnunculus*	x	x	x	3	3+	-	Resident species
Hobby		x	x	x	2	-		Summer breeding and migratory species
Little Owl	*Athene noctua*	x	x	x	1	1	-	Resident species
Common Swift	*Apus apus*	x	x	x	-	-	4	Summer breeding and migratory species
Blue-cheeked Bee-eater	*Merops persicus*	x	x	x	33	-	-	Summer breeding and migratory species
European Bee-eater	*Merops apiaster*	x	x	x	18	-	-	Summer breeding and migratory species
Hoopoe	*Upopa epops*	x	x	x	1	-	1	Resident species
Northern Raven	*Corvus corax*	x	x	x	5	-	-	Resident species
Rook	*Corvus frugilegus*	x	x	x	52	100+	25	Resident species
Magpie	*Pica pica*	x	x	x	11	-	-	Resident species
Eurasian Skylark	*Alauda arvensis*	x	x	x	47	30+	-	Non-breeding (wintering) species.
Crested Lark	*Galerida cristata*	x	x	x	36	40+	42	Resident species
Asian Short-toed Lark	*Alaudala cheleensis*	x	x	x	16	-	-	Summer breeding and migratory species

White-winged Lark	*Alauda leucoptera*	x	x	x	-	90	-	Winter visitor
Calandra Lark	*Melanocorypha calandra*	x	x	x	-	100+	-	Resident species
Sand Martin	*Riparia riparia*	x	x	x	47	-	-	Summer breeding and migratory species
Eurasian Barn Swallow	*Hirundo rustica*	x	x	x	80	-	8	Summer breeding and migratory species
Common Myna	*Acridotheres tristis*	x	x	x	35	-	-	Resident species. Recorded at the farm to the south of the site boundary.
Starling	*Sturnus vulgaris*	x	x	x	34	-	-	Resident species
Common Rock Thrush	*Monticola saxatilis*	x	x	x	-	-	1	Summer breeding and migratory species
Northern Wheatear	*Oenanthe oenanthe*	x	x	x	18	-	-	Summer breeding and migratory species
Isabelline Wheatear	*Oenanthe isabellina*	x	x	x	-	-	9	Summer breeding and migratory species
Desert Wheatear	*Oenanthe deserti*	x	x	x	6	-	-	Summer breeding and migratory species
Pied Wheatear	*Oenanthe pleschanka*	x	x	x	4	-	3	Summer breeding and migratory species
Siberian stonechat	*Saxicola maurus*	x	x	x	-	-	17	Summer breeding and migratory species
Tree Pipit	*Anthus trivalis*	x	x	x	-	-	30	Migratory species

White Wagtail	*Motacilla (alba) alba*	x	x	x	3	-	-	Summer breeding and migratory species
Masked Wagtail	*Motacilla (alba) personata*	x	x	x	5	-	-	Summer breeding and migratory species
Tree Sparrow	*Passer montanus*	x	x	x	12	-	-	Resident species
Spanish Sparrow	*Passer hispaniolensis*	x	x	x	49	-	-	Resident species
Brambling	*Fringilla montifringilla*	x	x	x	-	-	-	Winter visitor
Linnet	*Linaria cannabina*	x	x	x	-	5+	-	Resident species
Corn Bunting	*Emberiza calandra*	x	x	x	-	5+	5	Resident species

Footnotes

[1] Globally threatened species (IUCN web site): CR – critical endangered, EN – endangered, VU – vulnerable

[2] Uzbekistan Red Data Book (2019): CR – critically endangered, EN – endangered, VU – vulnerable, NT – near threatened species

[3]Species recorded incidentally during the Asian Houbara surveys undertaken in April 2022

6.4.5.4 Survey Results for Non-breeding birds – OHL

The following bird species were recorded during a reconnaissance of the OHL on 27th November 2021: northern lapwing (*Vanellus vanellus*), white stork (*Ciconia ciconia*), grey heron (*Ardea cinerea*), white-tailed eagle (*Haliaeetus albicilla*), hen harrier (*Circus cyaneus*), common buzzard (*Buteo buteo*), common kestrel (*Falco tinnunculus*), merlin (*Falco columbarius*), little owl (*Athene noctua*), feral pigeon (*Columba livia* forma *domestica*), great grey shrike (*Lanius excubitor*), hooded crow (*Corvus cornix*), rook (*Corvus frugilegus*), magpie (*Pica pica*), skylark (*Alauda arvensis*), crested lark (*Galerida cristata*), calandra lark (*Melanocorypha calandra*), meadow pipit (*Anthus pratensis*), common myna (*Acridotheres tristis*), starling (*Sturnus vulgaris*), white wagtail (*Motacilla [alba] alba*), tree sparrow (*Passer montanus*), common chaffinch *(Fringilla coelebs*), brambling (*Fringilla montifringilla*), desert finch (*Rhodospiza obsoleta*), reed bunting (*Emberiza schoeniclus*) and corn bunting (*Emberiza calandra*). None of these species are IUCN 'threatened' species. A single species, white-tailed eagle, is included within the Red Data Book of Uzbekistan (VU).

The sociable lapwing survey undertaken in September 2022 confirmed the likely absence of this species within the project site, however there is potential for possible movements over site during spring and autumn migration.

Figure 6-30. White-tailed Eagle (Immature)

Source: Fazlullo Agzamov (2021) - Site visit photos November 2021.

Figure 6-31. Little Owl

Source: Fazlullo Agzamov (2021) - Site visit photos November 2021.

Figure 6-32. Crested Lark

Source: Fazlullo Agzamov (2021) - Site visit photos September 2021.

Figure 6-33. Hen Harrier

Source: Fazlullo Agzamov (2021) - Site visit photos November 2021.

6.4.5.5 Flora

No IUCN threatened plant species were recorded and none are listed in the Red Data Book (RDB) of Uzbekistan. The key species that were identified during the AECOM surveys are detailed in Section 6.4.2.1 (Habitats) above. A full species list is provided in Appendix A.

6.4.5.6 Terrestrial Mammals

A single mammal species was observed during the AECOM field surveys: Tolai Hare (*Lepus tolai*) [IUCN Least Concern]; an individual was recorded during the November 2021 visit (within the Solar PV site). The following mammal species were confirmed to be present within the Solar PV site from observations of indicative signs (eg. tracks, droppings, burrows, feeding signs, carcasses); none of which are IUCN threatened species or included within the Red Data Book [RDB] of Uzbekistan):

- Zaisan mole vole (Ellobius tancrei) [IUCN Least Concern] – active burrows/digging by this species were observed;
- Long-eared hedgehog (Hemiechinus auritus) [IUCN Least Concern] –a hedgehog skin was observed; and
- Eurasian pygmy shrew (Soricidae minutus) [IUCN Least Concern] – bones found in a found in a kestrel pellet;
- Red fox (Vulpes vulpes) [IUCN Least Concern] – scats (droppings) observed.

During the September 2021 field visit anecdotal reports provided during an interview with the local residents confirmed the presence of Red Fox.

- There were no records of IUCN threatened mammal/Red Data Book of Uzbekistan species as a result of the AECOM site surveys, consultation with the Samarkand Regional Ecology Department or interviews with local

residents, including Marbled Polecat (*Vormela peregusna*), Steppe Polecat (*Mustela eversmanii*) and Goitered Gazelle (*Gazella subgutturosa*). Therefore, these species are considered absent and are considered no further in this assessment.

6.4.5.7 Bats

Common pipistrelle (*Pipistrellus pipistrellus*) [IUCN Least Concern] was recorded foraging/commuting within the proposed Solar Site during the September 2021 visit. There is no habitat suitable for roosting within the Solar PV site and it is considered likely that bats are utilizing the farm buildings adjacent to the Solar PV site for roosting.

6.4.5.8 Reptiles

AECOM 2021 Surveys and Consultation

The Samarkand Regional Ecology Department advised that the following IUCN threatened species has the potential to occur within the Project Area: Central Asian tortoise (*Testudo horsfieldii*). Tatar sand boa (*Eryx tataricus*) [Uzbekistan Red Data Book species] was also highlighted as being potentially present.

No reptile species were recorded during the September 2021 field survey, which coincided with the end of the reptile active season, prior to winter hibernation. The November 2021 survey visit was undertaken outside the main active season for reptiles, hence no reptiles were recorded during this visit.

Burrows which have the potential to support reptiles (for example lizards, snakes, tortoises) were observed in localised areas during both 2021 AECOM field survey visits.

During the consultation meetings with the local community, it was established that tortoises had been intensively harvested within the Solar PV site within the past 20 years and that it is likely that the current density of the tortoise population within the site is low, with only a small population remaining. However, at the time of the 2021 AECOM surveys, it was not possible to confirm the status of the population in the absence of any baseline data gathered for the spring period, which is the optimal time for tortoise survey.

AECOM 2022 Reptile Surveys

The following narrative includes a summary of the surveys undertaken between 27th-29th April 2022 for Central Asian Tortoise and reported in Nazarov (2022).

Central Asian Tortoise

Listed as Vulnerable by the IUCN, the species is threatened by habitat loss (e.g. due to agricultural development) and long-term collection for the pet trade. This species is widely distributed in Uzbekistan; it is mapped in the Zarafshan area and is widespread in the semi-desert of the central Kyzylkum (Showler, 2018). Central Asian Tortoise is a Red Data Book of Uzbekistan listed species. The potential presence of this species within the Solar PV site was confirmed by consultation with the Samarkand Regional Ecology Department and also by Nazarov (2022).

A total of five Central Asian Tortoises were recorded during the April 2022 surveys (three adult females and two adult males), in the northern part of the Soar PV site. Tortoise burrows were recorded in the north-eastern part of the Solar PV site. The locations of the tortoises and tortoise burrows are shown in Figure 6.33 below. All records of tortoises refer to the Solar PV site; localised areas where the ground is sloped were favoured as these areas provide suitable areas for burrowing (ie. gullies and local depressions).

Nazarov (2022) concludes that the population size in the Project site is very low and does not exceed 0.1 individuals/hectare. Tortoises recorded during the survey showed evidence of damaged carapaces due to agricultural activity (eg. ploughing).

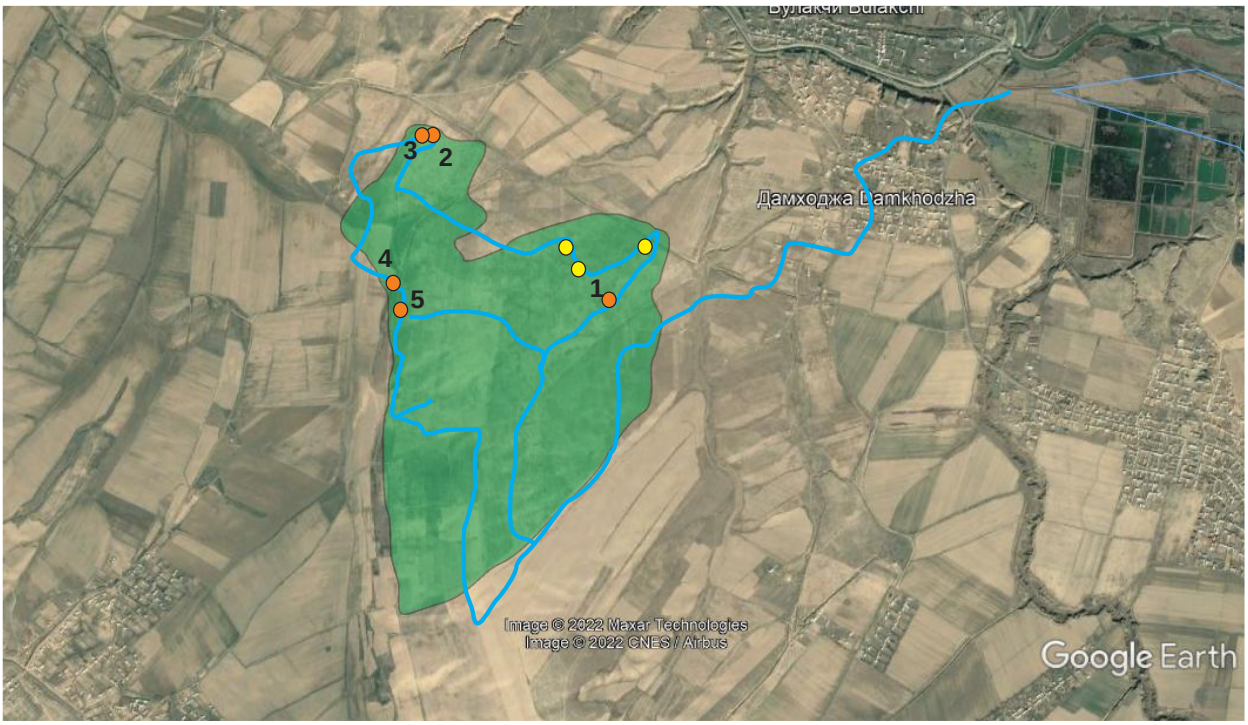

Figure 6-34. Central Asian Tortoise Survey Results (April 2022) - orange circles indicate the location of the tortoises recorded; yellow circles indicate the location of tortoise burrows. The transect route is shown by the blue line.

Bondarenko *et al* (2017)[56] suggest that the areas with the highest densities of Central Asian tortoise within the Republic of Uzbekistan support populations of >10 animals per hectare; this exceeds the estimated density within the Project site (i.e. 0.1 individuals/hectare). Therefore, the results of the April 2022 field surveys suggest that the population density of tortoises within the proposed project site is low. There is insufficient secondary data to determine the population within Samarkand Region, however considering the relatively small population of tortoises within the proposed Project Site and when applying the 1% rule for national assessments in the UK (and with consideration of the relatively small size of the modified [cultivated] habitat within the Study Area compared to the ubiquity of similar habitat within the wider region), there is no reasonable likelihood that the Project area is of regional value for Central Asian Tortoise (i.e. supporting more than 1% of the Samarkand regional population). Nevertheless, this species is listed as IUCN VU and small populations are confirmed to be present within the Project area; it is also listed on the Red Data Book of Uzbekistan.

Central Asian Tortoise was the only IUCN Vulnerable reptile species recorded within the Project AoI.

The occurrence of Central Asian tortoise does not trigger critical habitat in terms of IFC Performance Standard 6 (PS6); refer to Turnstone Ecology CHA: Appendix D. However, Central Asian tortoise is included as a Priority Biodiversity Feature when assessed against the PDF guidelines as set out in EBRD PR6 GN.

[56] Bondarenko D. A., Peregontsev E. A. (2017) *Distribution of the Central Asian Tortoise (Agrionemys horsfieldii) In Uzbekistan (Range, Regional and Landscape Distribution, Population Densities*). Current Studies in Herpetology, 2017, vol. 17, iss. , pp. 124-?.

Figure 6-35. Central Asian Tortoise foraging within a gully within the Solar PV site

Source: R.A. Nazarov (2022) - Site visit photos April 2022.

Figure 6-36. Damaged carapace, probably due to ploughing activities

Source: R.A. Nazarov (2022) - Site visit photos April 2022.

Tatar Sand Boa (Eryx tataricus)

This Uzbekistan Red Data Book species was not recorded during the April 2022 surveys, however, there are anecdotal records of this species within the Project site derived from informal discussions with local residents during the survey work. Therefore, this species is scoped into the impact assessment due to its potential presence with the Project site. The potential occurrence of tatar sand boa does not trigger critical habitat in terms of IFC Performance Standard 6 (PS6); refer to Turnstone Ecology CHA: Appendix D. However, the species is included as a Priority Biodiversity Feature when assessed against the PBF guidelines as set out in EBRD PR6 GN.

Other reptiles

No other reptile species were recorded during the April 2022 surveys, however species which have the potential to occur within the Project site are shown in Table 6.9 below. None of these species are of international or national conservation concern or are included as PBF species when assessed against the EBRD PR6 GN (refer to Appendix D). .

Table 6-9. Summary of Reptile Species Within the Project Area (Nazarov 2022) [refer to footnotes]

FAMILY and Species names	English Name	Global Threat Status (IUCN)	National Threat Status (URDB)	Confirmed to be Present Within the Project Site	Potentially Present Within the Project Site[2]
ANGUIDAE					
Pseudopus apodus	European Glass Lizard	LC	Not listed	No	Yes
BOIDAE					
Eryx tataricus[1]	Tartar Sand Boa	LC	3 (NT)	No (anecdotal records only)	Yes
COLUBRIDAE					
Hemorrhois ravergieri	Spotted Whip Snake	LC	Not listed	No	Yes
LACERTIDAE					
Eremias arguta uzbekistanica	Steppe-Runner	LC	Not listed	No	Yes
Gekkonidae					
Tenuidactylus fedtschenkoi	Turkestan Thin-toed gecko	LC	Not listed	No	Yes
Mediodactylus russowii	Transcaspian Bent-Toed Gecko	LC	Not listed	No	Yes
TESTUDINIDAE					
Testudo horsfieldii[1]	Central Asian Tortoise	VU	2 (VU)	Yes (April 2022 field survey confirmed presence)	N/A

Footnote
[1] Species meeting the criteria for inclusion as a Priority Biodiversity Feature when assessed against the PBF guidelines as set out in EBRD PR6 GN
[2] Based on known geographical ranges for each species and the respective habitat requirements, in relation to the habitat types/extent within the Project site

6.4.5.9 Amphibians

The arid and modified (cultivated) habitats within the proposed Solar PV site are unsuitable for amphibians. Amphibians are therefore considered absent and are not considered further within this assessment.

6.4.6 Ecosystem Services

Under IFC's Performance Standard 6, ecosystem services are the benefits that people, including businesses, derive from ecosystems. Based on the framework used for the Millennium Ecosystem Assessment (2003) ecosystem services are organized into four types:

- Provisioning services, which are the products people obtain from ecosystems (for example these may include food, freshwater, timber, fibres, medicinal plants);
- Regulating services, which are the benefits people obtain from the regulation of ecosystem processes (for example, regulating services can be surface water purification, carbon storage and sequestration, climate regulation, protection from natural hazards);
- Cultural services, which are the nonmaterial benefits people obtain from ecosystems (for example, these could be natural areas that are sacred sites and areas of importance for recreation and aesthetic enjoyment)
- Supporting services, which are the natural processes that maintain the other services (such as soil formation, nutrient cycling, primary production).

The following is preliminary baseline ecosystem services review for the project area:

- Provisioning Services provided by the project site include grazing by pastoral farmers and their livestock herds. Carrion eating birds remove carcasses from the field. During interviews with locals, they told that livestock corpses are removed by vultures, and this prevents the spread of diseases if they decompose in the landscape. The area also provides pathways that are used by communities and farmers to cross the area.

More information about grazing and herding is discussed in section 6.7.6 and in the LRP. Impacts on herding and pasture land are assessed in section 7.1.9 and 7.2.9 and therefore a separate assessment on ecosystem services is not required.

- Regulating Services include access to ground water (well water for irrigation) and the natural streambed channels and gullies that convey runoff and floods during the spring rainfall events.
- Cultural Services include the burial ground located to the northeast of the project boundaries.
- Supporting Services provided by the project area are few. The project site has been previously used for agriculture and this has affected natural run-off and streamflow patterns by concentrating and redirecting flows into channels and irrigation canals. Rainfall events in the spring may provide supporting services such as sediment transport, nutrient cycling and primary production in the catchment that contributes run-off to the Zarafshan River located 2–3 km to the north.

6.5 Archaeology and Cultural Heritage

6.5.1 Overview

The project site is located on a terrace south of the Podvodyaschiy Canal, on the left bank of the Zarafshan Valley in Samarkand Region, Kattakurgan District. The Solar Array site has been subject to previous ploughing, and no archaeological or cultural heritage sites are currently known from within the Project footprint. The Transmission Line crosses a low-lying landscape characterised by extensive irrigation channels, canals and agriculture.

Although the Zarafshan Valley was a key communication corridor across central Eurasia and irrigated many ancient and historic oasis settlements, there is little evidence for any ancient cultivation or settlement within or in the immediate vicinity of the Project.

This Preliminary ESIA presents the cultural heritage legislation and policy context and baseline information regarding the Site and study area based on desk-based research including the State Register of Tangible Cultural Heritage Properties and a review of historic CORONA and recent Google Earth satellite imagery.

6.5.2 Approach to Assessment

6.5.2.1 Scope

The scope of the archaeology and cultural heritage baseline studies follows the definition set out in EBRD and IFC cultural heritage policy and guidance.

EBRD PR8 defines cultural heritage "as a group of resources inherited from the past which people identify, independently of ownership, as a reflection and expression of their evolving values, beliefs, knowledge and traditions. It encompasses tangible (physical) and intangible cultural heritage, which is recognised at the local, regional or national level, or within the international community. Its scope includes:

- Physical cultural heritage refers to movable or immovable objects, sites, groups of structures as well as cultural or sacred spaces associated therewith, and natural features and landscapes that have archaeological, paleontological, historical, architectural, religious, aesthetic or other cultural significance.
- Intangible cultural heritage refers to practices, representations, expressions, knowledge and skills that communities, groups and, in some cases, individuals recognise as part of their cultural heritage and which are transmitted from generation to generation." (EBRD 2019).
- IFC Performance Standard 8: Cultural Heritage (IFC 2012) aims to protect cultural heritage from the adverse impacts of project activities and support its preservation. Its scope includes:
- Tangible cultural heritage with archaeological, paleontological, historical, cultural, artistic, and religious values.
- Unique natural features or tangible objects that embody cultural values, such as sacred groves, sacred trees and rocks.
- Intangible forms of culture proposed to be used for commercial purposes, such as cultural knowledge, innovations, and practices of communities embodying traditional lifestyles.
- Critical Cultural Heritage, internationally recognised or legally protected cultural heritage areas, including proposed World Heritage Sites. Heritage of communities who use, or have used within living memory the cultural heritage for long-standing cultural purposes.

The baseline study considers palaeontological sites and archaeological and cultural heritage sites ranging in date from the prehistoric to the modern period, and considers both tangible and intangible heritage.

6.5.2.2 Study Area

The methodology for the archaeology and cultural heritage baseline assessment was based on identifying the Project Area of Influence (PAI), conducting a desk-top literature review and assessing the sensitivities of potential archaeological and cultural heritage sites.

The PAI is defined as a 50m buffer around the Solar Project including the solar PV plant, new substation, common facilities and a 200m buffer around the Transmission Line ROW centre line.

The Study Area for cultural heritage considers known heritage assets in the wider area in order to provide context and to understand the archaeological potential of the Project location. It includes:

- The Project location plus a 500m buffer area around it, in order to identify assets in the immediate vicinity of the Project that may be vulnerable to the physical impact of project activities.
- Designated heritage assets (World Heritage properties, elements inscribed on the Representative List of the Intangible Cultural Heritage of Humanity, cultural heritage listed on the State Register, historical and cultural reserves, museum reserves) within 5km of the Project location, to provide context and assess Project impacts on their setting and visual amenity.
- Visually prominent, designated heritage assets between 5km and 15km from the Project location, depending on backdrop, visual contrast and viewing geometry in relation to the solar PV plant, Transmission Line and cleared ROW, to provide context and assess Project impacts on their setting and visual amenity.

6.5.3 Desktop Study Methodology

The aim of the desktop study is to determine, as far as is reasonably possible from existing records, the nature, extent and significance of the archaeology and cultural heritage within the Study Area. The desktop study describes the historical development of the Study Area and the wider area, placing it in context in order to predict its archaeological and cultural heritage potential; anticipate the type, date, and character of remains; and broadly

indicate areas with higher archaeological potential based on factors such as geology, topography, past and present land use, known archaeological remains and vegetation cover.

Sources consulted include:

- The National List of Tangible Cultural Heritage Properties (State Register of Monuments) for Samarkand Region – Kattakurgan District and for the adjoining Pastdargom District to the east and Ishtikhon District to the north57;
- Historical and modern topographic mapping, including U.S. Army Map Service Series N50258 and US Defense Mapping Agency Series 1501 Air mapping59 and Soviet Civilian and Military Topographic Mapping60;
- CORONA satellite imagery dated from 196461 and Google Earth Pro satellite imagery dated from 1985 to 2021; and
- Relevant regional and period archaeological and landscape studies, dissertations and readily available historical articles.

6.5.4 Archaeological Field Evaluation (State Expertise)

If required during the OVOS approval process, the Site would be subject to formal State Historical-Cultural Expertise of the Site by the Scientific Methodology Council under the Main Scientific Production Administration for Protection and Use of the Cultural Heritage Items of the Ministry of Culture of the Republic of Uzbekistan. No request for archaeological information was received therefore no further investigation was required.

6.5.5 Archaeology and Cultural Heritage Baseline Conditions

6.5.5.1 Tangible Cultural Heritage

Archaeological Sites

The Project site has not been subject to archaeological field survey (State Expertise). The wider area has not been subject to systematic or recent archaeological field research.

This Preliminary report therefore presents the results of desk-based research together with a site visit by the AECOM team in September 2021. Understanding of baseline conditions could change as a result of State Expertise.

A review of satellite imagery dating from 2014 to 2021 (GoogleEarth Pro) has identified a range of erosional ravines and paleochannel courses in the Solar Array area, visible on imagery taken in different years and seasons. In the vicinity of the Transmission Line, an overlapping sequence of irrigation canals and field systems is visible.

CORONA satellite imagery[62] was also reviewed (1109-1024Aft, 1964–1970). The combination of Soviet mapping, historical and recent satellite mapping is a proven tool for remote site prospection in topographically similar areas of Uzbekistan[63].

[57] Cabinet of Ministers Resolution No. 846 "On the Approval of the National List of Tangible Cultural Heritage Properties" (October 4, 2019). Available at: https://lex.uz/docs/-4543266 Accessed 26 October 2021.
[58] 1952 Samarkand, Sheet NJ 42-1. Scale: 1:250,000. Western Siberia Series N502, U.S. Army Map Service. Available at: https://maps.lib.utexas.edu/maps/ams/western_siberia/txu-oclc-6559336-nj42-1.jpg
[59] 1977 Samarkand, Uzbekistan, Sheet NJ 42-1. Scale 1:250,000. US Defense Mapping Agency Hydrographic/Topographic Centre, Washington. Series 1501 Air. Edition 2. Available at: https://maps.lib.utexas.edu/maps/jog/russia/txu-oclc-224096234-nj42-01.jpg
[60] 1984 Samarkand, Kattakurgan. Sheet J42-001. Scale: 1:100 000. Soviet military topographic map. Available at: MapStor.com
[61] Corona imagery: 1011-1039F126-127 (08 Oct 1964); 1043-1103Fore089 (17 Aug 1967); 1109-1024Aft (06 Mar 1970). Available at: https://corona.cast.uark.edu/
[62] CORONA satellite imagery. 1109-1024Aft, 1964-1970. Available at: https://corona.cast.uark.edu/
[63] Rondelli, B., Stride, S. & Garcia-Granero, J.J. (2013) Soviet military maps and archaeological survey in the Samarkand region. Journal of Cultural Heritage 14, 270 – 276. DOI: https://doi.org/10.1016/j.culher.2012.06.006; Angas, J., Uribe, P., Bea, M., Farjas, M., Arino, E., Martinez-Ferreras, V. & Gurt, J.M. (2021) Potential of CORONA satellite imagery for 3D reconstruction of archaeological landscapes [Ancient Termez]. 3rd Congress in Geomatics Engineering, Valencia. DOI: https://dx.doi.org/10.4995/CiGeo2021.2021.12703

- The Doab (two waters) area between the Karadarya and Akdarya, in the Middle Zarafshan Valley has formed the largest oasis in the whole of Central Asia at least since the middle of the first millennium BCE. However, the Middle Zarafshan Valley has been subject to extensive development projects during the Soviet period, particularly between the 1960s and 1980s. The levelling of the plain, the creation of artificial terraces and the construction of new canals have destroyed or seriously affected many archaeological remains, permanently modifying the entire landscape. Extensive cotton and tobacco cultivation continue to cause the loss of archaeological data[64]. Many surviving monuments have been diminished by ploughing, resulting in a spread of findspots around them. This extensive agricultural development means that proportionally fewer remains are known from the Zarafshan Valley than other areas. This is important given the extensive medieval historical accounts of the sophisticated Sogdian oasis settlements once present along the valley[65].

A review of the known archaeology and history of the wider Project area indicates that there is low potential for the presence of Palaeolithic, Mesolithic and Neolithic material. Throughout the later prehistoric, antique and medieval periods, it is likely that the Solar Array area was an upland area on the south bank of the Karadarya River. To the north of the Karadarya river was an extensive zone of low-lying irrigated oasis agriculture, centred on the historic city of Ishtikhon; to the west were the ancient settlements of Košāniya and the Sogdian city of Rabinzhan, now Kattakurgan.

Any terrestrial archaeological remains within the Project Area are likely to comprise:

- In situ surface finds scatters or features identified on bare ground.
- Surface scatters identified in areas of disturbed ground or in up-cast spoil from groundworks. If there are extensive erosion channels then these may also reveal surface scatters weathering-out/eroding from buried deposits.
- Landscapes of historic irrigation and cultivation, e.g. west of Tower 1 [39°51'47.50"N 66°26'11.11"E]; between Towers 5 and 7 [39°51'33.45"N 66°25'27.80"E]; near Tower 15 [39°51'2.65"N 66°24'30.50"E] and mound north of Tower 18 [39°50'46.41"N 66°24'26.75"E].
- Buried or partially buried remains associated with historical upland grazing and more recent irrigated large-scale arable agriculture.
- Buried features, which may have Medium depth and complexity.

The visibility of archaeological sites may be hampered by burial under accumulated material dredged from irrigation canals and spread out over the adjacent ground surface, particularly in the vicinity of the Transmission Line. This may be between 5m and 10m deep in places[66].

6.5.5.2 Natural Features and Tangible Objects with Cultural Values

Desk-based assessment and socio-economic field survey and interviews have not identified any unique natural features or tangible objects that embody cultural values, such as sacred plants, rocks and watercourses, within the site or in its area of impact.

6.5.5.3 Tourism

The Samarkand Region is in the process of developing tourism to attract local and foreign tourists. This includes developing cultural tourism, ecotourism, agriculture, health/curative mineral springs and pilgrimage tourism.

[64] Rondelli, B & Mantellini, S (2004) Methods and Perspectives for Ancient Settlement Studies in the Middle Zeravshan Valley. The Silk Road Foundation Newsletter Vol 2 No. 3, December 2004

- [65] Askarov, K.K (1995) Rural settlements in the southern regions of Samarkand Sogd in the early Middle Ages (typology of settlement systems). Thesis, Academy of Sciences of the Republic of Uzbekistan Institute of History, Tashkent http://cheloveknauka.com/selskie-poseleniya-yuzhnyh-rayonov-samarkandskogo-sogda-v-rannem-srednevekovie-tipologiya-sistem-rasseleniya#ixzz7BqJ56U4X
- [66] Rakhmonovna, F.O. (2012) Natural and archaeological monuments of the Zarafshan valley and the problem of their protection. Dissertation. Available at: https://otherreferats.allbest.ru/geography/00948324_0.html

No specific cultural heritage sites with high tourism potential or priority restoration sites are noted in Kattakurgan District[67]. The Kattakurgan Reservoir is visited and used for recreation. There are plans to further develop visitor facilities at the Khoja Hasan Andoqi shrine and spring[68] in the north of the district.

6.5.5.4 Intangible Cultural Heritage

Intangible cultural heritage is defined as the practices, representations, expressions, as well as the knowledge and skills (including instruments, objects, artefacts, cultural spaces), that communities, groups and, in some cases, individuals recognised as part of their cultural heritage. It is sometimes called living cultural heritage and includes oral traditions and expressions, including language; performing arts; social practices, rituals and festive events; knowledge and practices concerning nature and the universe; and traditional craftsmanship (UNESCO, 2003).

UNESCO Representative List of Intangible Cultural Heritage and Memory of the World Register

Uzbekistan's entries on the UNESCO Representative List of the Intangible Cultural Heritage (ICH) of Humanity comprise the art of miniature, Khorazm Dance; silk and textile production; Navruz (New Year) ceremonies; Palov rice dish traditions; Askiya, the art of wit; Katta Ashula traditional song; the shamanistic beliefs, Zoroastrian, Buddhist and Islamic traditions of the Boysun District; and the classical music tradition of Shashmaqom[69]. Additional elements proposed for inclusion on the representative list of ICH include the art of baxshichilik epic poetry and song; pottery; embroidery; carving and carpet making.

- Uzbekistan's entries in the Memory of the World Register comprise the Archives of the Chancellery of Khiva Khans, the Holy Koran Mushaf of Othman and the Collection of the Al-Biruni Institute of Oriental Studies[70]. Elements proposed for inclusion on the UNESCO Memory of the World Register include al-Khwarizmi's *Brief Commentary on Astronomy*; Archives of the Bukhara Emirate; state foundation documents; cinematography of Khudoibergan Devonov and documents on evacuation to Uzbekistan during the Second World War.

It is not assessed that the continuation and transmission of any entries or proposed entries on the Representative List or the Memory of the World Programme would be impacted by the Project.

Local intangible cultural heritage activities

Uzbek local crafts related to intangible heritage include silk production and weaving, rug and carpet-making and motifs; ceramics and varnished miniatures; wood-carving; metal chasing and embossing; silk and gold embroidery and tapestry; the Uzbek language; and culinary traditions. The Kattakurgan District specialise in the making of gold jewellery [71].

- Religious practices in Uzbekistan are reported to comprise Muslim 96% (mostly Sunni of the Hanafi school), Russian Orthodox 2.5%, other 1.8% includes small communities of Catholics, Protestants, Buddhists, Baha'is, Hare Krishnas, and atheists[72]. Uzbekistan has experienced a resurgence in religious practice since the 1980s, with increased activities of religious schools, neighbourhood mosques and religious orders which are controlled by the Muslim Board of Uzbekistan (the Muftiate). The surrounding area has a number of Islamic centres with their *maktabs* (primary schools) and *madrasahs* (seminaries) organised and supported by Muslim religious educators and their followers.

[67] Resolution of the Cabinet of Ministers No. 100 on Additional Measures to Develop Domestic and Pilgrimage Tourism. Appendix 1: Cultural heritage sites with high tourism potential, which are planned to create conditions for visitors. Available at: https://lex.uz/ru/acts/-5315060
[68] Tokhliyev, I (2018) The role of tourism in the economy or ways to take advantage of opportunities to develop pilgrimage tourism in the regions. [Turizmning iqtisodiyotdagi o'rni yoxud hududlarda ziyorat turizmini rivojlantirish imkoniyatlaridan foydalanish yo'llari]. Zarnews. Available at: https://zarnews.uz/uz/post/turizmning-iqtisodiyotdagi-o-rni-yoxud-hududlarda-ziyorat-turizmini-rivojlantirish-imkoniyatlaridan-foydalanish-yo-llari
[69] UNESCO Lists of Intangible Cultural Heritage and the Register of good safeguarding practices. Available at: https://ich.unesco.org/en/lists
[70] UNESCO Memory of the World Register: Uzbekistan. Available at: http://www.unesco.org/new/en/communication-and-information/memory-of-the-world/register/access-by-region-and-country/uz/
[71] Resolution of the President of the Republic of Uzbekistan. Decision No. PQ-4539 of 28 November 2019. On Additional Measures for Further Development of Crafts and Support of Craftsmen. Available at: https://lex.uz/ru/docs/-4622088
[72] USDoS (2020) Uzbekistan 2020 International Religious Freedom Report. United States Department of State, Office of International Religious Freedom. Available at: https://www.state.gov/wp-content/uploads/2021/05/240282-uzbekistan-2020-international-religious-freedom-report.pdf

Intangible cultural heritage activities in the Project site and immediate Study Area are assessed as being of local or regional significance. There are no associations with particular innovations, technical or scientific developments.

6.5.5.5 Critical Cultural Heritage

Critical Cultural Heritage is defined as internationally recognised or legally protected cultural heritage areas, including proposed World Heritage Sites, or the heritage of communities who use, or have used within living memory the cultural heritage (IFC, 2012).

The Project site itself does not contain any internationally recognised or legally protected cultural heritage areas.

The Silk Roads, a Tentative List World Heritage Site within Uzbekistan (Ref. 5500), broadly follows the course of the Zarafshan Valley.

Community Use of Cultural Heritage

Approximately 600m north of the northern boundary of the Solar Array area are a cemetery and prayer room, south of the village of Upka [39°53'4.20"N 66°27'0.88"E]. According to the scoping report, it has been used for over 100 years, and residents of Damhodja, Bulokcha, Upka and Erkin Nafas makhallas are buried there. A further cemetery is located about 1.5km from the southern boundary of the project site between Suyunjon and Partaabad Makhallas[73].

According to information gathered during a field visit for the scoping report, the nearest mosque is 10km from Damhodja makhalla towards Melihuja makhalla, another mosque is 7km from Damhodja makhalla towards Ishtikhan substation.

Interviews with land users and local communities indicated one sacred site in the vicinity of the Project, the 19th-20th century Khoji Abdurahmon Mausoleum (State Register Architectural Monument No. 691) which is located along the M37 highway, c.10km west of the Project. This mausoleum is visited by local communities during religious holidays.

Potential Significance of Archaeological Remains

No internationally recognised or legally protected cultural heritage areas have been identified within the Study Area. The Study Area has low potential to contain significant, stratigraphically intact archaeological remains. There is potential for surface remains in the form of findspot scatters and for remains to be well preserved below levels of intensive farming / land re-modelling within alluvial and colluvial deposits. Any remains present may have been impacted by agricultural ploughing, irrigation works and physical, climatic and chemical weathering. It is anticipated that any superficial or buried archaeological sites within the Project area are likely to be classed according to IFC criteria as 'replicable cultural heritage' (IFC, 2012), and can be mitigated by appropriate archaeological investigation, recording and dissemination.

Internationally Recognised Cultural Heritage Areas

World Heritage properties

Uzbekistan has four cultural properties inscribed on the World Heritage List, the Historic Centre of Bukhara, the Historic Centre of Shakhrisyabz, Itchan Kala and Samarkand – Crossroad of Cultures[74]. The nearest World Heritage Property is:

- Samarkand – Crossroad of Cultures (Ref: 603rev), described as a crossroad and melting pot of the world's cultures. Founded in the 7th century BCE as ancient Afrasiab, Samarkand had its most significant development in the Timurid period from the 14th to the 15th centuries. The High monuments include the Registan Mosque and madrasas, Bibi-Khanum Mosque, the Shakhi-Zinda compound and the Gur-Emir ensemble, as well as Ulugh-Beg's Observatory[75].

[73] TYPSA (2020). Uzbekistan Scaling Solar Round 2. Environmental and Social Scoping Report – Kattakurgan Solar PV Project. Report for International Finance Corporation (IFC/WB). Document No. SP6349-RP-EN-KK-ESScop-D02, p.
[74] Uzbekistan Properties inscribed on the UNESCO World Heritage List. Available at: https://whc.unesco.org/en/statesparties/uz
[75] Samarkand – Crossroad of Cultures. Available at: https://whc.unesco.org/en/list/603

The historic city of Samarkand, located in a large oasis in the valley of the Zarafshan River, is located approximately 50km east of the Project, which would not impact upon it due to the intervening distance.

Tentative List World Heritage Sites

A Tentative List is an inventory of those cultural and natural properties which each State Party intends to consider for nomination to the World Heritage List. Those in proximity to the Project comprise:

- Arab-Ata Mausoleum, Samarkand Region (Ref. 5290). Built on top of a tepa, this brick mausoleum in the village of Tim dates to the 10th century CE. It is located c.55km southwest of the Project[76].
- Silk Roads Sites in Uzbekistan (Ref. 5500)[77]. Uzbekistan's Silk Roads facilitated trade in silk and materials such as precious metals and stones, ceramics, perfumes, ornamental woods, and spices in return for cotton and wool textiles, glass, wine, amber, carpets and horses. This trade was sustained by a system of caravanserais, commercial settlements, trade cities and forts, spreading ideas, scientific and technological developments. This is reflected in surviving monuments, sites and cultural landscapes. Although the route broadly followed the Zarafshan Valley, no properties forming part of the Silk Roads Sites in Uzbekistan within Samarkand Region are included in this tentative listing.
- Silk Roads: Zarafshan-Karakum Corridor (Uzbekistan) (Ref. 6497)[78]. The "Silk Roads: Zarafshan-Karakum Corridor" is located along the Zarafshan river, its wider hydrological basin and the Karakum desert. The corridor consists of 31 component parts, but none are located in Kattakurgan District or in the vicinity of the Project.
- The Project will not impact upon these Tentative List sites. The landscape in the vicinity of the Project is already characterised by modern intensive farming and other power infrastructure near Ishtikhon substation. Potential harmful impacts from the Project on these Tentative List properties are therefore scoped out.

Legally Protected Cultural Heritage Areas

No State Register sites have been identified within, or in the vicinity of the Project.

6.5.6 Archaeology and Cultural Heritage Receptors and Receptor Sensitivity

Ground in low-lying areas is likely to have been disturbed by the excavation of ditches and canals, ground levelling and ploughing. Any surviving archaeological deposits may be buried under thick anthropogenic deposits. Surface findspots may be present where disturbed by ploughing or erosion, unknown buried remains may be present within natural deposits (alluvium, colluvium) and beneath made ground

The archaeological sites known from the wider area are considered to be typical of the region. Some have been designated according to local, national or international standards in terms of their outstanding aesthetic, artistic, documentary, environmental, historic, scientific, social, or spiritual value. The assessment of the scientific value of any archaeological sites may change following the site visit, State Expertise and any intrusive investigation and recording work.

Intangible cultural heritage activities are assessed as being of local significance and no particular elements are designated or registered, and consultation has not indicated any associations with particular innovations, technical or scientific developments, movements or specific individuals of regional or national significance.

6.5.7 Sensitivity Criteria

Receptor sensitivity is the degree to which a particular receptor is more or less susceptible to a given impact. Receptor sensitivity takes into consideration the receptor's resilience and value.

[76] UNESCO World Heritage Centre – Tentative Lists. Arab-Ata Mausoleum. Available at: https://whc.unesco.org/en/tentativelists/5290/
[77] UNESCO World Heritage Centre – Tentative Lists. Silk Roads Sites in Uzbekistan. Available at: https://whc.unesco.org/en/tentativelists/5500/
[78] UNESCO World Heritage Centre – Tentative Lists. Silk Roads: Zarafshan-Karakum Corridor (Uzbekistan). Available at: https://whc.unesco.org/en/tentativelists/6497/

Receptor resilience or vulnerability describes the ability of the receptor to withstand adverse impacts. It takes into consideration activity-impact-receptor pathways, as well as environmental characteristics that might make it more or less resilient to change. As such, a receptor can be considered as existing within a spectrum of 'vulnerable' to 'resilient', with the former more likely to experience significant impacts as a result of a given change.

Receptor value takes into consideration its quality and its importance as represented, for example, by its conservation status, its cultural importance and/ or its economic value. The evaluation of receptor sensitivity employs a qualitative scale of negligible, low, medium, and high for each of the sensitivity characteristics, resilience and value.

In the absence of any national or international consensus on archaeological impact assessment methods for non-designated resources, the criteria used to determine receptor sensitivity, magnitude, nature and significance of impacts on cultural heritage are based on the International Commission on Monuments and Sites (ICOMOS) 2011 Guidance on Heritage Impact Assessments for Cultural World Heritage Properties (appendices 3A and 3B)[79]. It is acknowledged that it contains much reference to World Heritage, but the assessment tools contained in its appendices are applicable to all cultural heritage assets.

None of the sites or objects have been previously recorded or designated, so there are no assigned national designation rankings to apply. The sensitivity of an archaeological or cultural heritage receptor also reflects how vulnerable or robust a site, monument, artefact, assemblage or complex is to damage or destruction by a number of factors, including:

- Natural conditions, such as erosion, flooding, wave movement and chemical deterioration.
- Environmental conditions, such as faunal and floral impacts.
- Human conditions, such as vandalism or interference, recreational use, vehicular damage.
- Project-related conditions, including construction and operational impacts.

The assessment of heritage value with regard to research agendas is important in establishing the significance and value of archaeological remains. The value of archaeological remains and sensitivity of archaeological sites, monuments and artefact find-spots is judged upon the extent of survival, their current condition, rarity, representativeness, the importance of the period to which the remains date, fragility, connection to other monuments (group value), potential to contribute to knowledge, understanding and appreciation, potential for future research, the values assigned by local experts and the extent of documentation enhancing the monuments' value.

Table 6-10 presents the sensitivity criteria specific to the archaeology and cultural heritage study.

Table 6-10 Archaeology and cultural heritage sensitivity criteria

Sensitivity	Criteria
High	Sites of acknowledged international importance inscribed as World Heritage Sites. Individual attributes that convey Outstanding Universal Value. Nationally-designated archaeological monuments, sites, buildings or historic landscapes protected by national laws. Undesignated sites, structures or historic landscapes of demonstrable national value. Assets that can contribute significantly to acknowledged national or international research objectives, whether designated or not. Well or extremely well preserved historic landscapes with considerable or exceptional coherence, time-depth, or other critical factors. Intangible Cultural Heritage inscribed on national registers, or associated with movements or individuals of national or global significance.
Medium	Designated or undesignated sites, landscapes or seascapes that can contribute significantly to regional research objectives.

[79] ICOMOS 2011 [under review] Guidance on heritage impact assessments for Cultural World Heritage Properties. International Council on Monuments and Sites. Paris. Available at: http://openarchive.icomos.org/266 /

	Designated or historic buildings that have exceptional qualities or historical associations, with important historic integrity and contributing significantly to historic character. Designated or undesignated historic landscapes or seascapes of regional value, which would warrant designation. Intangible cultural heritage areas in local registers, or associated with movements or individuals of local importance.
Low	Designated or undesignated assets of local importance. Assets compromised by poor preservation and/ or poor survival of contextual associations, or with little or no surviving archaeological interest. Assets with potential to contribute to local research objectives. Historic buildings of modest quality in their fabric or historical associations, or buildings or urban landscapes of no architectural or historical merit; buildings of an intrusive character. Undesignated historic landscapes or seascapes with importance to local interest groups, whose value is limited by poor preservation and/ or poor survival of contextual associations. Landscapes or seascapes of little or no significant historical interest. Intangible cultural heritage activities of local significance, or associated with individuals of local importance. Poor survival of physical areas in which activities occur or are associated. Areas with few intangible cultural heritage associations or vestiges surviving.
Negligible	Assets with little or no surviving archaeological interest. Buildings or urban landscapes of no architectural or historical merit; buildings of an intrusive character. Areas with few intangible cultural heritage associations or vestiges surviving.
Unknown	The importance of the resource cannot be ascertained.

Source: ICOMOS, 2011

6.5.8 Receptor Sensitivity

Table 6-11 presents the level of sensitivity for each receptor identified.

Table 6-11 Assessed sensitivity of archaeology and cultural heritage receptors

Receptor	Sensitivity
Tangible cultural heritage Any archaeological sites identified by the State Expertise	Presently unknown, anticipated to be low
Natural features/ tangible objects with cultural values None identified	High
Intangible cultural heritage Cultural knowledge, living traditions & religious practices e.g. activities and transmission of practices related to shrines, cemeteries, healing springs, farming practices; local crafts. These are considered to be resilient to the Project effects.	Medium
Critical Cultural Heritage None identified	High

No archaeological remains have been identified within the project site or Transmission Line. It is anticipated that past ploughing and irrigation works may have truncated the upper levels of deposits. For this reason, these receptors are assessed as being of low (local) importance.

The sensitivity of any currently unknown archaeological remains that may survive within the Project Area cannot be accurately determined at the time of writing. Their sensitivity would be derived from their potential to contribute to our scientific understanding of past human activities and environments. However, based on the likely level of

preservation of remains and the condition of remains from the wider area, it is assessed that their sensitivity would be low.

Local intangible heritage practices including farming, herding and crafts. These have strong administrative support and are considered to be resilient to the development. It is not assessed that the Project will impact upon the fabric, use or transmission of practices associated with shrines or cemetery sites.

No internationally recognised or legally protected cultural heritage areas have been identified. It is anticipated that any superficial or buried archaeological sites within the Project area are likely to be classed according to IFC criteria as 'replicable cultural heritage' (IFC, 2012), and can be mitigated by appropriate archaeological investigation, recording and dissemination.

6.6 Waste Management

An appropriate landfill site will be identified by the EPC contractor that receive municipal, construction and hazardous waste. AECOM have not identified an appropriate licensed company for recycling of wastes. The EPC Contractor will provide this information as part of detailed design.

6.7 Socio-economic Conditions

6.7.1 Introduction and Methodology

Social impacts are defined as *"the consequences to human populations of any public or private actions that alter the ways in which people live, work, play, relate to one another, organize to meet their needs, and generally cope as members of society*" (ICGPSA, 1994). To understand the full extent of any social impacts arising from the Project, directly or indirectly, a detailed socio-economic baseline is required to appreciate current socio-economic conditions and therefore accurately assess the significance of any anticipated impacts, positive or negative. The baseline also helps to determine what mitigation measures (which aim to reduce the significance of negative impacts and enhance the significance of positive impacts) can be feasibly implemented within the Project's socio-economic context.

Additional baseline data was gathered during the impact assessment phase to compile a more comprehensive description of social conditions of the communities within the Projects' Area of Influence (AoI). In order to provide socio-economic context, statistics and other summary information will also be provided for Uzbekistan as a whole.

Further work has been completed including a Land Acquisition Audit (LAA) and Livelihood Restoration Plan (LRP). In support of those studies, detailed socio-economic surveys have been undertaken and are included in the LRP Socio-economic Area of Influence.

The Social Study Area, or AoI, focused on the Project Site and surrounding areas, as defined in Section 2.7. For the purpose of characterising other potential direct and indirect socio-economic impacts to surrounding communities, in accordance with IFC guidance (see Section 3.5.1), the Study Area will also extend to 2 km from the perimeter of the Project Site to encompass nearby communities who may feasibly be impacted by the project's construction, operation and decommissioning activities. These communities have been identified in Figure 6-37.

Although the focus of the baseline study is the Project site and surrounding communities, some national and regional level baseline information may also be included to provide a wider socio-economic context.

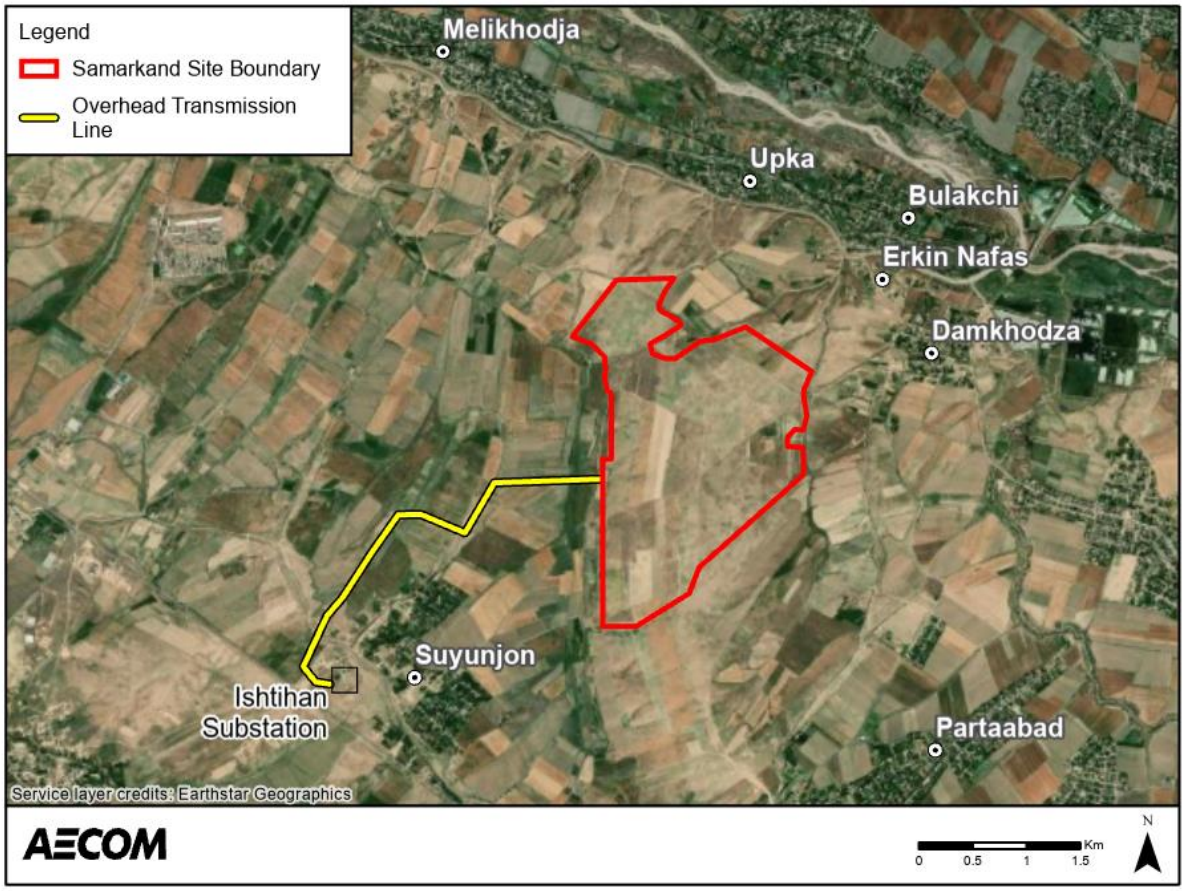

Figure 6-37. Makhallas within 2 km of the Project Site Boundary

6.7.2 National and Regional Development Context

The Republic of Uzbekistan is a landlocked country in Central Asia and was formerly a part of the Union of Soviet Socialist Republic until it declared independence in September 1991. The country occupies a total of 448,900 square kilometres and shares borders with five other countries: Afghanistan, Kazakhstan, Kyrgyzstan, Tajikistan, and Turkmenistan.

As of 2020, the estimated total population was 34,232,050, just under 50% of whom live in rural areas (WBD, 2021). Uzbeks account for 83.8% of the population, while other ethnic groups such as the Tajiks, Kazakhs, Russians, Karakalpak, Tartars comprise the remaining 16.2% (CIA, 2021). Uzbek is the only official and most widely spoken language in the country, spoken natively by approximately 85% of the population. Russian has widespread use as an inter-ethnic communication language and as a language of governance. Other ethnic languages spoken in the country are Tajik, Kazakh, Tatar, Kyrgyz. and others. In terms of religious faith, 88% percent of the population are Muslim (primarily Sunni), 9% are Eastern Orthodox Christians and 3% are of other faiths (CIA, 2021).

Economically, Uzbekistan is a High producer and exporter of cotton and, with a large capacity for power-generation from the Soviet era and an abundant supply of natural gas, the country has become the largest electricity producer in Central Asia. Having a large supply of liquid assets at its disposal has resulted in high economic growth and low public debt (Brookings Institute, 2019). However, the country's GDP per capita remains relatively low, at USD 7,378 compared to other economies in the region such as Kazakhstan (USD 26,728), Turkmenistan (USD 16,195), and Azerbaijan (USD 14,452).

The Republic of Uzbekistan consists of the Republic of Karakalpakstan, 12 regions, 120 cities, 113 towns, 164 districts, and 11,844 rural settlements. The population is densest in the southern and eastern regions of the country

near the capital, Tashkent. Whereas, the population to the northern and western regions, around the Republic of Karakalpakstan is sparser (Bektemirov & Rahimov, 2001).

The system of public administration in Uzbekistan is comprised of two tiers, central and local. Local governments are subdivided into regional, district and city administrations. In addition, community self-governments also operate locally, although they are not part of the central public administration system (Bektemirov & Rahimov, 2001).

6.7.3 Local Governance and Institutional Structure

The project site is located within the Samarkand Region of Uzbekistan which has an estimated population of 3.6 million people and encompasses 14 administrative districts. The regional capital is the City of Samarqand, this is the second-largest centre for economic activity after the country's capital, Tashkent. The project site sits within the Kattakurgan District, with an estimated population of 272,320 people and a total area of 139,000 km^2 (SRG, 2021).

The solar Project is located near the communities listed in Table 6-12 below.

Table 6-12. Nearest Settlements to the Project

Settlement	Distance from the Project Site (km)	Number of Residents	Comments
Melikhodja	1.6	1,701 *(M= 858, F= 843)*	Small village located northwest of the project site. Falls under the Melikhodja mahalla Approximately 100 sheep from the Melikhodja village are thought to be grazed on the project site
Erkin Nafas*	0.87	719 *(M=353, F= 361)*	Erkin Nafas, Upka and Damhoda, grouped together by the district administration for the purpose of population estimates, are located to the northeast of the project site. These settlements are three relatively small rural villages. All three of these villages fall under the Shurak mahalla
Bulakchi	1.2	718 (M=349, F= 369)	Also located to the north east of the project site, Bulakchi is a rural village. 29 households from Bulokchi collectively own approximately 300 sheep which graze on the project land. Each household takes it in turn to herd the sheep. There is also a herd of cows (approximately 100 animals) and two smaller herds of sheep (approximately 20 animals) from Bulokchi village which use the project area as grazing land.
Suyunjon	1.35	1,177 (M= 597, F= 580)	Southwest of the project site Suyunjon is a small village which contains an electrical substation where the OTL from the project site will send the energy to be fed into the national grid. Falls under the Melikhodja mahalla Suyunjon community members get their water from a well on a farmer's land that will be affected by the OTL route Suyunjon community members are also allowed to graze their livestock on this farmers land (for an agreed price) after the harvest is collected.

Settlement	Distance from the Project Site (km)	Number of Residents	Comments
			It is estimated that there are between 2,000-3,000 sheep belonging to community households in the Suyunjon village.
Partaabad	1.8	-	The village of Partaabad in located southeast of the project site and falls within the Pastdargom District (other settlements in the AoI are in the Kattakurgan District). Falls under the Bagishamol mahalla of Pasdargom District.

Source: District Administration. Key: (*) including Upka and Damkhodza, (M) Male Population, (F) Female Population.

6.7.3.1 Formal Governance Structures

At both the regional (or *oblast*) and district (or *raion*) levels local governance is divided into:

A. Local state administration, which acts as an administrative body, the heads of which are appointed by the central government and are subject to formal approval by the corresponding local councils. The president appoints regional governors, who in turn appoint district and city/town governors that come under regional subordination. The district and city governors are accountable to the regional governor, who in turn is accountable to the president; and,

B. Elected local council, which acts as a legislative body, the representatives of which are appointed/elected for a period of five years. These administration levels represent the executive and regulatory bodies of the state at the regional and district levels, implementing the policies of central government in the provinces.

At the sub-district level there are Makhalla Committees which act as governance institutions in towns and rural areas. Makhalla Committees are salaried state officials and as such are answerable to the local state administrators as they are fully dependent on their funding (Urinboyev, 2018). Article 105 of the Constitution of the Republic of Uzbekistan recognises Makhallas as self-governing bodies whose role is to govern at the local level and oversee activities which include, but are not limited to:

- Development of infrastructure.
- Administering social welfare programs (e.g. provision of social aid to low-income families).
- Ensuring security and order.

There are the seven Makhallas situated within 2 km of the project site boundary, these are: Melikhodja, Erkin Nafas, Upka, Bulakchi, Damkhodzha, Partaabad[80], and Suyunjon.

6.7.3.2 Informal Governance Structures

In addition to the formal Makhalla Committees, informal/social Makhallas often operate in parallel. The key difference between these institutions being that the leaders of the informal Makhallas are volunteers and are elected by local residents, hence they are regarded as community-led, self-governing institutions. However, no informal/social Makhallas have been identified in the Project AoI.

6.7.4 Demographic Profile

The Makhallas identified in Section 6.7.3 correspond to the seven settlements located within a radius of 2 km of the project site boundary. The populations of these settlements (except for Partaabad) is shown in Table 6-12. Based on satellite images and extrapolating population figures to the seemingly populated land, it has been estimated that the overall population of all seven settlements could be within the range of 5,000-6,000 inhabitants.

[80] This village crosses into the Pastdargom District

In 2020, the population of Kattakurgan District as a whole was estimated to be 272, 320 which is split quite evenly between men (51%) and women (49%). The District shows an expansive pattern, with a high birth rate in comparison to the mortality rate, as shown in Table 6-13. This trend is reflected at the local level in all the settlements within 2 km of the project site boundary.

Kattakurgan District also shows a negative migrant balance, with more people moving out of the district than moving in. This is also true of two of the project-affected settlements, Meylihuja and Erkin Nafas, for Bulakchi the number of people moving into and out of the area was the same, and for Suyunjon, more people moved into this area than those who moved out.

Generally, more women are migrating in and out of identified areas. This is reflective of a general global trend of increased female migration referred to the 'feminisation of migration'. The OECD indicate that there may be any number of reasons women are becoming increasingly mobile, but most migrate for economic reasons to participate in both formal and informal, legal and illegal work (OECD, 2000).

Table 6-13. Demographic data for Kattakurgan District and the affected settlements (2020)

Area	Born			Died			Immigration			Emigration		
	T	M	F	T	M	F	T	M	F	T	M	F
Meylihuja	46	26	20	4	3	1	0	0	0	17	6	11
Erkin Nafas*	12	8	4	3	1	2	2	0	2	4	2	2
Bulakchi	19	9	10	2	1	1	3	1	2	3	2	1
Suyunjon	25	13	12	4	3	1	6	1	5	4	2	2
Partaabad	-	-	-	-	-	-	-	-	-	-	-	-
Kattakurgan District	7182	3773	3409	1001	568	433	312	87	225	1166	435	731

Source: State Committee of Statistics. Key: (T) Total Population, (M) Male Population, (F) Female Population, (*) including Upka and Damkhodza.

Although detailed ethnicity information for Kattakurgan, which covers the Project AoI is not available, Generally, ethnic groups living in Uzbekistan have equal access to all social and other services, including health, education, and water and sanitation. None of the groups are socially excluded either from a legal standpoint or in terms of their actual situation. Further, none of the ethnic groups maintain cultural or social characteristics separate from the mainstream Uzbekistan society that would classify them as ethnic minorities. Therefore, based on the information obtained during the site visit and stakeholder engagement, there it is understood that there are no indigenous people living in the region that meet ADB criteria:

i. self-identification as members of a distinct indigenous cultural group and recognition of this identity by others.

ii. collective attachment to geographically distinct habitats or ancestral territories in the project area and to the natural resources in these habitats and territories.

iii. customary cultural, economic, social, or political institutions that are separate from those of the dominant society and culture; and

iv. a distinct language, often different from the official language of the country or region.

6.7.5 Land Regulations and Use

6.7.5.1 Land Tenure

The legal foundation for all land tenure in Uzbekistan is contained in three key documents:

- The Constitution (1992, Article 55)
- Civil Code (1997, Head 8, Head 13, and Head 17)
- The Land Code (1998, Head 4)

Exclusive state ownership of land was first incorporated in the 1992 Constitution; hence land is the only productive asset that cannot be privately owned in Uzbekistan. The Land Code stipulates that land is a state-owned national treasure to be used in a rational manner and it is protected by the state as a base of life, activities and welfare of the population (Land Code of the Republic of Uzbekistan, 1998). However, lifelong inheritable land tenure is available to Uzbek citizens but only in the following cases:

- Dehkan farms (individual or family farms)
- Individual homestead construction and household operation
- Collective orchards and vineyards

Furthermore, land plots can be provided to legal and physical entities for a continuous, long-term, or temporary tenure and use. This is usually for agricultural or forest land, as per Head 4, Article 20 of the Land Code (1998). Land plots are usually leased to citizens and legal entities by mayors (or *hokims*) of districts, towns, and cities. However, if any foreign element is involved, the central Government of Uzbekistan must be the leasing entity, as per Head 4, Article 24 of the Land Code (1998).

Users pay for the use of the land in the form of land tax. Under Head 4, Article 24 (1998) of the Land Code it is not permitted to sublease the leased land plot as a whole or even part of it. This provision further stipulates that leased land plots cannot be sold and purchased, cannot serve as collateral, and cannot be donated or exchanged. A specific form of subleasing, “intrafarm leasing”, is permitted only to worker families within a *shirkat* (former collective farms).

For private farms land is usually leased for approximately 30 years but can range between a minimum of 10 years and a maximum of 50 years. Farms are subject to some state interventions (e.g. quotes for the production of cotton and wheat) but for the most part they are governed by local authorities (or *hokimiyat*). Hokimiyat may cancel leases for various transgressions, usually if the leaseholder fails to comply with the contract terms (e.g. the cropping plan).

Most land around the project site is organized under the Dehkan modality. Dehkan farms are rural household producers operating on small household plots received on lifetime inheritable tenure rights. Dehkan farms are numerous and are considered to be very important as they satisfy basic needs of the large rural population including food, employment, income. Dehkan farms tend to specialize in vegetables, fruit, meat, milk, eggs and other animal related products. Dehkans often work for private farmers – for cash or on the basis of a sharecropping agreement (dehkans receive a percentage of the yield) (Melnikovová & Havrland, 2016).

6.7.5.2 Residential Properties

The closest residential properties to the site are the residence associated with Area 1 on the west of the site. This property is approximately 225m from the site boundary. On the east side the closest property is associated with the scattered properties south of Damkhodzha and is 470m from the eastern edge of the site.

6.7.5.3 Current Land Use in Project Area

There are 5 distinct areas within and adjacent to the project site that are being used for both sanctioned and unsanctioned farming activities, see Figure 6-41. The status of key affected areas, as of the site visit conducted in September 2021, is as follows:

- *Area 1:* a registered farm in a long-term lease contract with the district government, which sits adjacent to the project site’s north-western boundary. As part of the government optimisation process, the farmer was given 10 hectares (ha) of land. In 2020 he returned 7 ha of the land for the Project voluntarily, as he was not

using it and did not make any improvement on the land. He believed that the 3 ha of land were enough for him and his household. The farmer has a house outside of the project area on the remaining 3 ha and one in the village. The farmer has been growing peas and fruits, herding 50 sheep and has a well next his property. The leaseholder is currently an employee of Masdar.

- *Area 2:* is a registered farm of 12ha in a lease contract with the Khokimiyat of Kattakurgan for the last 4 years. This farmland is adjacent to the project's north-eastern boundary. The farm is leased and used by five siblings (three brothers and two sisters) and their children – two siblings have relocated to Russia, while the remaining siblings are still using the land near the project to keep livestock (four cows) and grow crops such as watermelons and melons, tomatoes, potatoes, sesame on 1 ha and winter wheat. The siblings were originally offered a replacement plot of land but this land was not appropriately serviced (i.e. no power line for pump, no well for water) and the siblings refused the replacement land. They reached an informal agreement with the Khokimiyat to obtain monetary compensation instead, which never materialised. As a result, the siblings made considerable investment in their land, including building a well and an overnight shelter, before it was acquired for the project – incurring into considerable debt.
- *Area 3:* a registered farm of 60 ha used to grow crops (grain, barley, wheat) and for livestock grazing. The historic leaseholders are an elderly couple with married children and grandchildren. The couple base their income from the remittance from two of their children currently abroad and from state pension. The whole 60ha was acquired by the project and the historic leaseholder was allocated replacement land of 20 ha by the Khokimiyat. The historic leaseholders practice rain-fed agriculture, including peas and wheat – the yield depends on the weather conditions. During the site visit, the leaseholder stated that only half of his current land (10 ha) is adequate, and the other 10 ha are unsatisfactory. Although he had livestock grazing in the land acquired by the project as well as agricultural equipment and a container, the replacement land is small and not suitable for grazing sheep and the farmer never received support with the removal and transfer of the agricultural equipment and a container.
- *Area 4:* is a registered farm of 67 ha which was used for agriculture (15ha) and herding livestock (52 ha). The farmer made substantial improvement on the land including a water well, electricity supply and a shelter. They planted a lot of crops from 2016 until 2020, such as wheat, different vegetables, grapes and fruit trees. The historical leaseholder was allocated 10.5 ha – 8.5 ha are used for cultivation of watermelon, melon, and wheat, and the remaining 2 ha are allocated for livestock herding as they recently bought 10 sheep. The new allocated land does not have regular access to water with the farmer relaying on collecting water from a nearby-channel using electric pumps but the electricity gets cut off on a regular basis and struggling to achieve the level of yields she had prior to the project acquiring land. The farmers receive state pension as additional income.
- *Area 5:* a registered farm of approximately 57 ha and the project acquired 35 ha. The leaseholder current farm is 15 ha, which are used for agriculture (10 ha) and for pasture (5 ha) – the farmer grown rainfed wheat and have 25 sheep. The farmer has disabilities, both him and his wife obtain state pension.

Figure 6-38. Recent farmed areas associated with Farm 5

Figure 6-39. Ruined Farm 5 house

Figure 6-40. Inside of ruined Farm 5 house

Figure 6-41. Areas to be affected by the Project

To the northeast of the project site there is a cemetery and a small prayer room (shaded red in Figure 6-42) which has been used by the residents of Damhodja, Bulokcha, Upka, and Erkin Nafas makhallas for over 100 years.

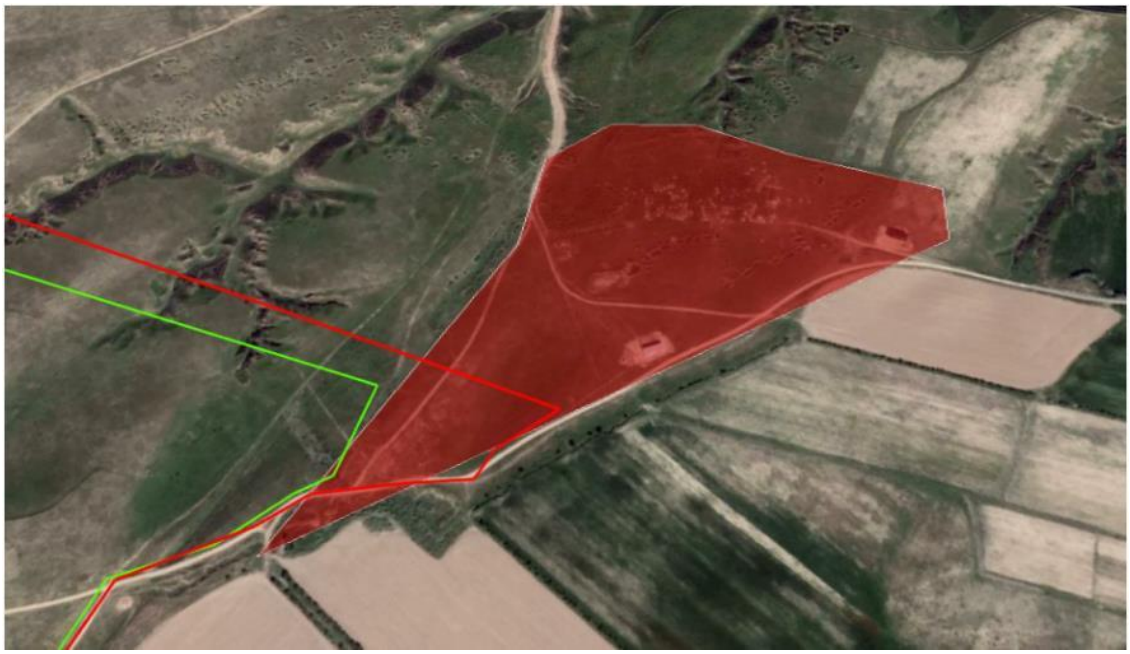

Figure 6-42. Location of the cemetery and small prayer room (shaded red), initial site boundary (red line), and revised site boundary (green line)

There is also an irrigation/drainage channel which passes through the northern end of the project site, as shown in Figure 6-43. According to the TYPSA Scoping Report (TYPSA, 2020b), the irrigation channel is in a state of decay and is currently used as a drainage canal for dirty water from irrigation of fields located upstream. Local farmers indicated that their cattle sometimes drink from the drainage channel without any consequences.

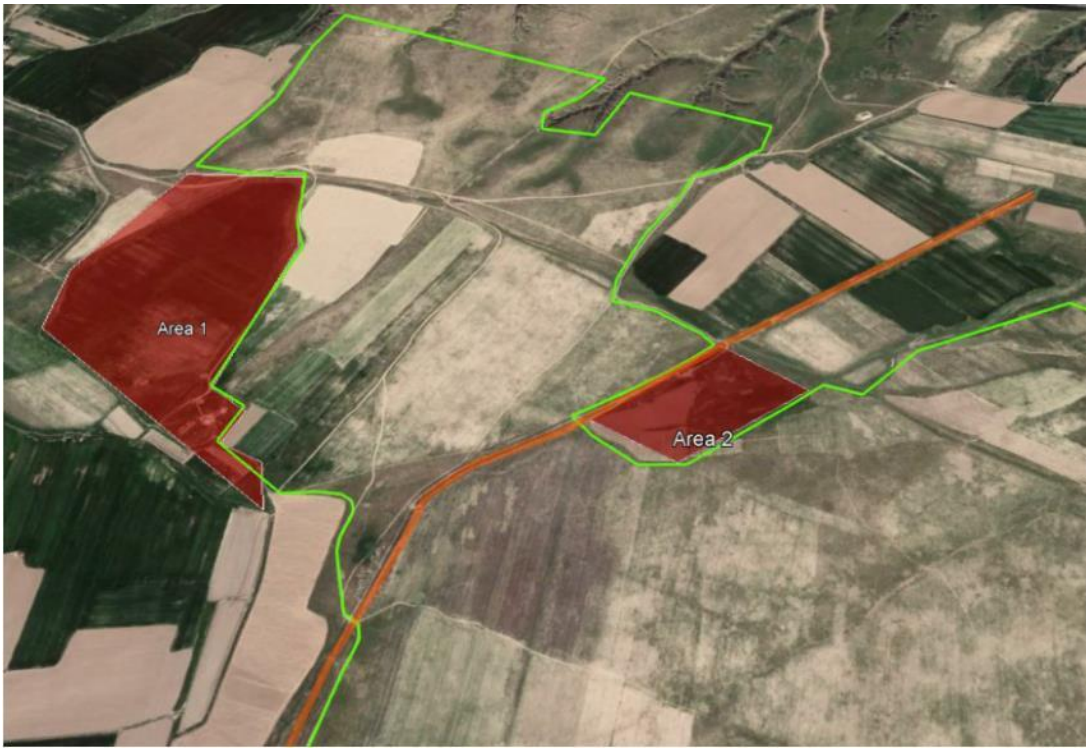

Figure 6-43. Drainage channel which passes through project site

6.7.5.4 Current Land Use under the Overhead Transmission Line

The proposed OHTL route, shown in Figure 6-44 has been designed to avoid populated areas and isolated structures however, it does pass over extensive areas of cultivation whilst several poles will need to be pegged within the boundaries of farms. A preliminary analysis of the route has identified the current land uses which could potentially be affected by the construction and operation of the OHTL. This analysis is based on the following assumptions:

- A clearance corridor of 32m at each side of the OTL will be required as a wayleave
- A clearance area of 5 m^2 has been defined around towers
- A total number 19 towers have been pre-designed

Figure 6-44. Proposed OTL Route (to be updated)

In summary, the OHTL will affect four farms and will need approximately 0.678 ha[81] of land to be acquired. No structures were identified along the route and all the fields which will be affected grow seasonal crops.

Out of the four farmers with leaseholds under the OHTL, the largest permanent land take is 0.03% of their land for the towers. The largest temporary land take is 0.8% of the land for assembly areas and construction route. The commercial farmers typically employ farmworkers who help to manage the farm and seasonal formwork during harvest is a significant source of livelihood for women in the nearby communities who help with the harvest of Wheat and Cotton. The impact on these workers is however expected to be negligible.

During the site visit and initial consultations with land users who will be affected by the OTL a few key points were noted.

For example, the leaseholder of Kattkurgan Cluster LLC land stated that they had no objection to the Project, so long as compensation for the loss of productive land is provided. Their land is mainly used for planting cotton and grazing cattle. They requested that their land specialist be informed when technical specialists visit the area as they want to be informed/consulted on each location of the towers along the route and avoid crossing the centre of the field if possible.

[81] All quoted land take figures are subject to change before the final draft of the LRP is issued

Another farmer, whose 400-ha farm is close to the village of Suyunjon, also noted that he had no objection to the Project, so long as compensation for the loss of productive land is provided. The land is used to grow cotton and wheat and to graze 100 cows and 200 sheep. The farmer also employees 40 seasonal workers. The farmer has three wells on his land and allows the community members of Suyunjon to use these wells. It was also noted that the farmer has no objection to the reconstruction of the road that passes through the area of his farm. He felt that it will be convenient road for the Project and can be jointly used by him and the project personnel. The farmer also requested to be consulted by the project technical specialist on the exact locations of the electrical towers along the route on his area, so that he can inform if there are any specific features that should be considered.

- Since the five historic leaseholds were altered or terminated to make way for the Solar PV site in 2019, the land in the Solar PV site has remained in the government reserve which is administrated by the local Khokimiyat. The land in the Solar PV site has been kept vacant in anticipation of the Project at the request of the Ministry of Energy but is still used for community herding and gathering of animal feed. Most of the land required for the OHTL falls into four Sub-Lease Agreements belonging to four households. Masdar is currently in the process working with the Ministry of Energy on the final land order which will then transfer the land into the jurisdiction of the Ministry of Energy. The land will then be leased by Masdar from the Ministry of Energy.

6.7.6 Community Infrastructure and Resources

6.7.6.1 Housing

The United Nations Economic Commission for Europe (UNECE) found that rural households are typically larger than urban ones, averaging between 4.9 and 6 people, compared to 3.8 in the urban Capital City of Tashkent (UNECE, 2015). However, living space per person is found to be lower in rural areas of Uzbekistan (14.5 m^2 in rural areas and 16 m^2 in urban areas) (Ministry of Economy of the Republic of Uzbekistan, 2014).

Rural housing in the project area typically consists of a detached house with an attached plot of land which accommodates several family generations living together. Many of these houses are self-built using available materials and therefore often fail to meet modern construction standards and lack important amenities. Figure 6-45 is the residence of the farmer of Area 5 and exemplifies the detached nature of most households in the Project AoI.

Figure 6-45. Area 5 farmer's house in the village of Bulokchi

6.7.6.2 Community Services and Facilities

Social infrastructure covers a range of services and facilities that meet local needs and contribute to a good quality of life. This may include the provision of healthcare, education, recreation and sport, faith, and emergency facilities. Across Kattakurgan District there are:

- 8 medical departments
- 9 rural medical posts
- 1 hospital
- 3 rural family polyclinics
- 8 emergency health institutions
- 1 central multidisciplinary polyclinic

According to information gathered during the scoping phase, the nearest mosque is 10 km from Damhodja makhalla towards Melikhodja makhalla, another mosque is 7 km from Damhodja makhalla towards Ishtikhan substation. The Scoping Report also identified two cemeteries in the vicinity of the project site. One of them is located in north-east corner of the project site (partly on the territory of the site according to some sources but this needs to be confirmed in future site visits). This cemetery has been used by the residents of Damhodja, Bulokcha, Upka, and Erkin Nafas makhallas for over 100 years. Another cemetery is found about 1.5 km from the southern boundary of the project site between Suyunjon and Partaabad Makhallas.

There is also a women's shelter in the Kattakurgan District, established by Tanzilya Narbaeva, Chair of Senate and Gender Commission of Uzbekistan. The building maintenance and utilities for the shelter are covered by district administration. A local NGO, *Mehr Sahova*, which operates under the local mosque provides financial support. The local population also provide support in the form of clothing and food for women and kids in the shelter. Currently there are two women with children in the centre, they are victims of domestic violence. Women receive psychological and medical support as well as opportunities to develop skills and gain employment. At the time of the site visit, the women were engaged in seasonal cotton picking to earn for children's school supply needs. Children at the shelter attend the village school. Most women who come to the centre are not educated and struggle to get a regular job.

6.7.6.3 Utilities

Access to electricity is nearly universal across Uzbekistan as most people are connected to the national grid. However, according to consultations undertaken during the site visits power cuts are common in the Project AoI, especially in winter and therefore community stakeholders hope to directly benefit from the power generated at the project site. Gas for heating and cooking is supplied by gas cylinders only. There is no centralized gas supply in the Makhallas around the site.

The nearest established landfill is located 35 km northwest of the Project Site in Yarbashi. The landfill has recycling facilities for plastic, paper, metal, and glass. The landfill site has been operating for 10 years and accepts all types of wastes which are sorted on site. However, stakeholder meetings undertaken during the scoping phase revealed there are no local licensed companies for removal of hazardous wastes, as there are no hazardous wastes generated in the project area and surroundings.

A new landfill is planned to be constructed following the decision of the Cabinet of Ministers of the Republic of Uzbekistan to change the boundaries of Kattakurgan District. The new landfill is expected to be 20 km from the site.

During the site visit, it was noted by multiple stakeholders that there is a weak mobile phone signal in the Project AoI. This makes communication between settlements quite difficult and usually means that local leaders either need to physically travel to the different settlements or use telegram channels to share news.

Water supply is mainly supplied by artesian wells approximately 200 meters deep. Two wells in Damhodja makhalla are gravity-fed, as the water is close to the surface. This type of water supply is typical in rural areas of Samarkand because, as shown in Table 6-14, only 41.2% of the rural households in the region have access to a centralised water supply. Furthermore, under 10% of the rural households of Samarkand have access to sewage utilities.

Stakeholders consulted during the site visit indicated that the lack of readily available and easily accessible drinking water and water for irrigation is a key concern for local communities.

Table 6-14. Households with access to centralised water supply and sewage facilities in Samarkand Region (2019)

Region	Access to a centralised water supply (percentage of households)		Access to sewage utilities (percentage of households)	
	Total	Rural Areas	Total	Rural Areas
Samarkand	57.3	41.2	25.6	9.9

Source: State Committee of Statistics

To put this in context of national utilities infrastructure, Table 6-15 compares the infrastructure and utilities available in rural and urban areas of Uzbekistan.

Table 6-15. Access to utilities in urban and rural areas in Uzbekistan (2013)

Utilities	Percentage of rural households with access (%)	Percentage of urban households with access (%)
Water Supply	50.3	82.8
Sewage	8.9	53.9
Heating	25.8	59
Hot Water	5.5	45.4
Natural Gas	72.1	87.5
Fixed Telephone Line	14	57

Source: Gender Country Assessment (Food and Agricultural Organisation, 2019)

6.7.7 Community Health

According to the World Bank and national statistics, life expectancy at birth has continuously been increasing in Uzbekistan, from 58 in 1960 to 71.725 in 2020 (World Bank, 2021). Table 6-16 shows how life expectancy varies depending on sex and location. Generally, women live longer than men and those in urban areas live longer than those who live in rural areas.

Table 6-16. Life Expectancy at birth by sex and location (2016)

Total		Urban		Rural	
Female	Male	Female	Male	Female	Male
74.9	71.1	77.1	71.8	74	68.5

Source: Gender Country Assessment (Food and Agricultural Organisation, 2019)

According to a review by the Food and Agricultural Organisation (FAO) Gender Country Assessment there have been significant improvements in the rural population's access to healthcare, maternal and child healthcare, and reproductive healthcare including access to contraception (Food and Agricultural Organisation, 2019). However, there are still some key health challenges in Uzbekistan, namely the prevalence of non-communicable diseases, which is largely attributed to consumption of tobacco, alcohol, poor nutrition, and lack of physical exercise. The burden of non-communicable diseases is serious in terms of socio-economic development because such diseases can *"result in reduced income, early retirement, decreased productivity and employee turnover, with further implications for social protection costs"* (UN and Government of the Republic of Uzbekistan, N.D).

At the local scale, the medical facilities available within the Samarkand Region are listed in Section 6.7.6.2. According to information provided in consultations undertaken during the scoping phase with a Damhodja Makhalla member, there is a medical post in all Makhallas around the site. The nearest hospital facility is located in Paishanba, the capital of Kattakurgan District, approximately 10 km from the project site.

During consultations the Deputy Khokim on Women and Families in Kattakurgan Khokimiyat shared that there are three cases of HIV/AIDs in the local mahallas, they are male labour migrants and they receive regular medication from district centre clinic. It was further understood that the most common health issues in the area are related to blood pressure, heart and kidney problems.

6.7.8 Education

The World Bank indicates that the net enrolment rate of primary school age children in primary education in Uzbekistan in 2018 was 96.845% (World Bank, 2021). Of all the pupils that enrolled 98.31% continued to the last grade of primary (ibid.). However, when analysed through a gender lens, this number is slightly higher for male students (97.560%) than for female students (96.152%) (ibid.).

At the secondary level over 4 million pupils are enrolled nationally, 48% of which are female (World Bank, 2021). Regionally, approximately 87% of the Samarkand population aged 16 and over have a secondary-level education, either from mainstream secondary education institutions (40.9%), or from vocational training centres (46.2%).

At the tertiary level under 10% of the national Uzbekistani population has a higher education degree. However, in the Samarkand region this percentage is slightly higher than the national average at 12.3% (World Bank, 2021). The literacy rate, according to data provided by the regional government, stands at 100%.

Consultations undertaken during the scoping phase identified two schools within the AOI, one in Damkhodzha Makhalla (Kattakurgan District) and one in Damhodja Makhalla (Pastdargom District). School №57, which hosted some of the stakeholder consultations, has 650 students and 55 teachers. Availability of other data education levels and facilities from other Makhallas was limited.

6.7.9 Economy and Employment

6.7.9.1 Economy

The World Bank classifies Uzbekistan as a lower middle-income country (World Bank, 2019)because its Gross National Income (GNI) per capita is between USD 1,026 and USD 3,995[82].

According to the International Monetary Fund, in 2019, the Gross Domestic Product (GDP) of Uzbekistan was at $60.490 billion USD (IMF, 2019). The national GDP composition by sector of origin is split between agriculture (28.1%), industry (36.4%) and services (35.5%). Comparing the changes in the structure of the economy between 2017 and 2019 shows a 30% increase in the share of the industrial sector and a decrease of 28.1% in the share of agricultural sector.

6.7.9.2 Livelihoods

In recent years, national statistics have shown an increase in the proportion of the population who are unemployed, increasing from 4.9% to 5.2% between 2009 and 2016 and reaching 9.3% in 2018. Nationwide, the vast Highity of the population (60.9%) are employed in the service sector, the agricultural sector also employs a significant proportion of the population (25.9%), and the industrial sector employs the smallest proportion of the population (13.2%).

Table 6-17 shows the distribution of the workforce by different sectors of the economy in Samarkand region. The proportion of people in Samarkand employed in primary sector work such as agriculture and forestry has gradually been decreasing since the early 1990s to approximately one-third of total employment (Hasanov & Sanaev, 2018). Whereas the secondary and tertiary sector provide a significant proportion of the regional population with employment. Employment in education and health care has slightly grown in the last decade, although jobs in these two sectors are scarce in the project area.

[82] The Uzbekistani Som (UZS) is the currency of Uzbekistan and, as of 5 October 2021, USD 1 was equal to UZS 10,638.30.

Consultations undertaken during the scoping phase in Damkhodzha Makhalla indicated that approximately 50% of the residents are engaged in dehkan and livestock farming under the agricultural cluster. The dehkan farms mostly cultivate wheat, various types of vegetables (potatoes, paprika pepper, eggplants etc.) and sell it in Chimbay bazaar, a market organized in the same town twice a week (on Mondays and Thursdays).

Most of the remaining 50% of the labour force is employed in the construction sector, according to consulted sources. Every year about 200-300 people leave for seasonal jobs abroad, mostly to Kazakhstan. There is also a perception among the local communities consulted that there are many migrant workers in the area. The local community was also very interested in the potential job opportunities to be created by the project and asked to be kept abreast of any vacancies.

Table 6-17. Percentage of the Samarkand Population employed by sector (2017-2019)

Employment Sector	2017 (%)	2018 (%)	2019 (%)
Agriculture, Forestry, Fishing	28.2	27.6	27.6
Industry	12.1	12.4	12.5
Construction	7.2	6.8	6.8
Trade	12.0	11.8	11.9
Transportation and Storage	5.6	5.6	5.7
Catering and Hotels	3.0	3.0	3.1
Education	8.7	9.0	9.0
Health Sector and Social Services	4.3	4.5	4.5
Other	19.0	19.1	19.0

Source: State Committee of Statistics

6.7.9.3 Poverty

Table 6-18 shows the proportion of Uzbekistanis living in poverty. According to a World Bank study conducted in 2018 titled “Listening to the Citizens of Uzbekistan” (World Bank, 2018), the Samarkand region had one of the lowest proportions of the population living on less than USD 3.2 per day (less than 12% of the population) when compared to Uzbekistan’s other 11 regions. The Karakalpakstan and Syrdarya regions were the poorest in country, with 30% and 38% of the population living on less than USD 3.2 per day respectively. However, in the project district, Kattakurgan, the proportion of people living on less than USD 3.2 per day is much higher than the national average at 23%.

Table 6-18. Proportion of the Uzbek Population living in poverty

Poverty Line	Percentage of Total Uzbek Population (%)	Percentage of Kattakurgan District Population (%)

Living on less than USD 3.2 per day	9.6	23
Living on less than USD 5.5 per day	36.6	48.3

Source: World Bank, 2021

6.7.10 Transportation

As can be seen in Table 6-19, automobiles are the most commonly used means of transport in Uzbekistan. Their use has experienced a 78% increase since 2000. Railroad and air travel have also both increased during the 20-year time-frame – yet only slightly. However, the use of trolleybus, tram and metro have all decreased (-99%, -95% and -45% respectively).

Table 6-19. Passenger transportation by transport type in Uzbekistan (per million population)

	2000	2005	2010	2015	2019
Passengers transported, mln. persons	3,596	3,962	4,072	5,380	6,025
of which:					
railroad	14.6	15.1	14.5	20	22.9
automobile	3,285	3,796	3,962	5,293	5,915
trolleybus	77.1	16.8	1.6	0.8	0.7
tram	92.4	43.3	25.8	11	3.8
metro (subway)	125.7	89.9	65.6	52	79.2
air	1.5	0.9	1.9	2	3.2

Source: State Committee of the Republic of Uzbekistan on Statistics, N.D.

In light of the large population size and high number of road users, Uzbekistan has a relatively dense road network and an appropriate hierarchy of roads. Of the total 185,000 km of roads in the country, 42,654 km make up the core network, of which 98% are paved (ADB, 2016). This network can be grouped into the following categories:

i. international (3,979 km)

ii. national (14,069 km)

iii. regional (local) roads (24,606 km)

There is an additional 140,000 km of urban and rural roads, which are managed by city municipalities and local districts (ADB, 2016). The High road which surrounds the project boundary is the M37 as shown in Figure 6-46. The speed limit is generally 70km/hr in towns and 100 km/hr on highways outside towns (OSAC, 2020).

While there is a large road network in Uzbekistan, roads often suffer from poor maintenance with problems including uneven surfaces and large potholes. Traffic lights are reported to malfunction frequently and street lighting is very poor, especially on secondary/local roads (OSAC, 2020). In addition to this, local drivers often disregard rules given a low rate of enforcement for traffic related rule breaking. As a result of these issues, minor and Medium traffic accidents are frequent (OSAC, 2020). In efforts to improve the state of travel safety in the area the government has been installing traffic radar and cameras on roads and intersections to detect speeding and traffic light violations (OSAC, 2020). These changes alongside improvements to the local road network are likely to result in a safer road network in the area in the coming years.

Figure 6-46. Road network surrounding the site

Source: Google Earth, 2021

Locally, several stakeholders pointed out that roads around the project site are in a poor condition making it difficult to reach remote areas, especially during winter months. One of the farmers whose land will be affected by the OTL route noted that the construction of site access roads would be convenient and used by local communities. Examples of roads around the project site and along the OTL route are shown in Figure 6-19 and Figure 6-20.

Community members consulted further shared that there are no regular buses from the villages in the Project AoI. Most people use taxis to get to the district centre and from there catch the buses to the city and other destinations. One taxi journey is approximately UZS 5,000.

Figure 6-47. Road in Project AoI- 1

Figure 6-48. Road in Project AoI - 2

In addition, as shown in Figure 6-48, there are several community pathways that cross through the project site. These pathways appear to connect the local communities to the onsite farms. Based on information gathered during the scoping phase it is understood that livestock keepers also use these pathways to move livestock for grazing.

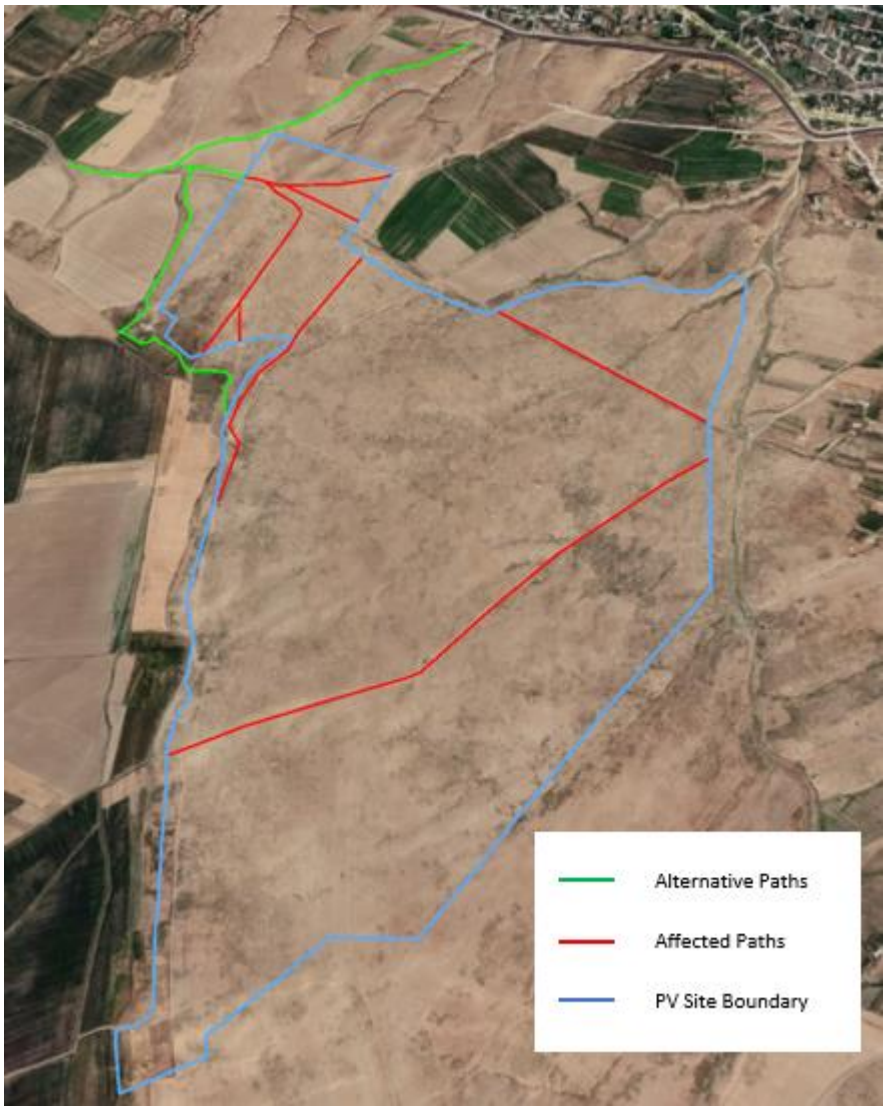

Figure 6-49. Local walking pathways in the project area

6.7.11 Vulnerable Groups

Vulnerable groups are those individuals or groups who may be directly and differentially or disproportionately affected by the Project's negative impacts and/or less able to participate in and benefit from the Project's positive impacts because of their disadvantaged or vulnerable status. This status may stem from ethnicity, property, level of income, economic situation, gender, language, religion, national or social origin, age, culture, literacy, physical or mental disability, and dependence on unique natural resources (IFC, 2012). Based on the above definition, the following groups within the Project social area of influence are considered vulnerable:

- Young families (where the parents are under 30) who have lost both parents
- Children and young people
- Families with disabled parents or children
- A widow
- A single parent family

- A single retired person
- An elderly person (over 65 years old)
- Women in the family
- Anyone farming or investing in the land without a legal title
- People in poor health
- Households under the poverty line
- Households in financial difficulty
- Households with a member who is addicted to drugs or alcohol

These categories should however be used as a guide and it is possible that some people may be vulnerable because of very specific circumstances which might not fit into the above list.

A more detailed vulnerability analysis among project affected people, is included in the LRP.

During consultations the Deputy Khokim on Women and Families for the Kattakurgan Khokimiyat shared that there is a registry of vulnerable families and individuals in the Project AoI and thus can communicate information regarding the project directly to them where necessary.

6.7.11.1 Gender

Although women should not inherently be considered vulnerable in every project context, it is important to recognise and understand the challenges women face in Uzbekistan in order to accurately assess the impact the Project may have and proactively manage these risks in a pragmatic and effective way.

At the national level there are still some key challenges to gender equality, including a high prevalence of gender-based violence (GBV) and in particular, domestic violence; gender disparities in higher and technical education; and, a high female unemployment rate accompanied by a low proportion of women in leadership positions (UN, 2020). This is particularly an issue for rural women in Uzbekistan who, according to the FAO (FAO, 2019), have very limited opportunities for employment outside of agricultural work and are overrepresented in informal employment markets. For example, women's labour in the agricultural sector tends to be low-skilled manual labour, and seasonal/temporary work not covered by a written contract.

When women work informally on dehkan frams, they do not receive protection under labour law in terms of social benefits, making them more vulnerable to exploitation. As formal farm owners and managers, women represent only around 4% of the heads of private farming enterprises across the entire country. There is no data available on the proportion of women heading dehkan farms, but since a very small number of women are heads of household, they are unlikely to be the formal heads of dehkan farms. Still, women contribute significant labour on dehkan farms, and, in migrant households, they can be the de facto farm managers.

In addition, Uzbekistan has also taken significant steps to improve women's prosperity in the world of work, however, gender pay gaps remain significant (ILO, 2020a). Table 6-19 shows a clear disparity between male and female labour activity rates, with females 26% less active than their male counterparts (Lloyds Bank Trade, 2021). While the Uzbekistani Government place emphasis on the rhetoric of women's rights and importance of women in the workplace, many women in Uzbekistan still are held to traditional roles of unpaid childcare and household work. Often only a few women work in government and other governing bodies (Saferworld, 2021). While in 2019 the Uzbekistan government established the first ever gender equality law "Guarantees of Equal Rights and Opportunities for Women and Men"; these issues are likely to persist for years into the future while cultural opinions and values shift towards a new rhetoric.

Table 6-20. Ratio of male to female active population in Uzbekistan

	2017	2018	2019
Total activity rate (%)	65.26	65.25	65.19

Male activity rate (%)	78.39	78.48	78.50
Female activity rate (%)	52.31	52.19	52.05

Source: (ILO, 2020b).

6.7.12Community Security

Since President Shavkat Mirziyoyev came into power in 2016, there has been a marked shift in Uzbekistan's approach to citizen safety and security through several government reforms in relation to forced labour (Saferworld, 2021). Despite these reforms there is still an embedded lack of trust between the police and public. For example, it was reported that in some regions that the community is reliant on the mahalla institution to prevent crime and enforce public order, rather than the police (Saferworld, 2021).

The government of Uzbekistan does not release crime statistics; most data acquired comes from informal sources (OSAC, 2020). Uzbekistan ranked 90th in the 2021 global organized crime index for criminality and was deemed a 'low criminality low resilience' country (Global Initiative Against Transational Organized Crime, 2021). It also ranked low in terms of drug trade (103rd) but slightly higher for criminal actor organisations (76th) (Global Initiative Against Transational Organized Crime, 2021).

6.7.13Ecosystem Services

Under IFC's Performance Standard 6, Ecosystem Services are the benefits that people, including businesses, derive from ecosystems. Based on the framework used for the Millennium Ecosystem Assessment (2006), Ecosystem services are organized into four types:

1. Provisioning services, which are the products people obtain from ecosystems (for example these may include food, freshwater, timber, fibres, medicinal plants). The provisioning services identified in the project site and AoI are:
    a. food from the crops located within the project boundaries from both small subsistence and larger scale agricultural crops, which seem to have been abandoned.
    b. Areas that are no longer used as cropland are used for grazing by pastoral farmers and their livestock herds.
    c. Carrion eating birds remove carcasses from the field. During interviews with locals they stated that livestock corpses are removed by vultures, which prevents the spread of diseases if they decompose in the landscape.
    d. The area also provides pathways that are used by communities and farmers to cross the area.
2. Regulating services, which are the benefits people obtain from the regulation of ecosystem processes (for example, regulating services can be surface water purification, carbon storage and sequestration, climate regulation, protection from natural hazards). The regulating services identified in the project site and AoI are:
    a. access to ground water (well water for irrigation).
    b. the natural streambed channels and gullies that convey runoff and floods during the spring rainfall events.
3. Cultural services, which are the nonmaterial benefits people obtain from ecosystems (for example, these could be natural areas that are sacred sites and area of importance for recreation and aesthetic enjoyment). The only cultural service identified was the burial ground located northeast of the project site boundary.

4. Supporting services, which are the natural processes that maintain the other services (such as soil formation, nutrient cycling, primary production). The project site was previously used for agriculture and this has affected the natural run-off and streamflow patterns by concentrating and redirecting flows in channels and irrigation canals. Rainfall events in the spring may provide supporting services such as sediment transport, nutrient cycling and primary production in the catchment that contributes run-off to the Zarafshan River located 2 to 3 km to the north.

Within the Solar PV Site, the only ecosystem service identified that is obtained by the communities is the feed/fodder which is either grazed by livestock herds owned by the community or is collected manually and stored for the winter months. More information about grazing and herding is discussed in section 6.7.6 and in the LRP. Some drainage channels also exist on the site and this is discussed in further detail in section 6.2.4.

6.7.14Potential Receptors

The baseline study has identified the potential socio-economic receptors that exist within the site and the project-affected communities. For the purposes of the assessment, potential receptors are defined as elements of the socio-economic environment which may interact with the Project activities or perceive an effect or change to their life conditions / quality of life as compared to their baseline characteristics, as discussed previously in this section. Receptors may be affected, directly or indirectly, positively or negatively, during the Project's construction, operations, and decommissioning phases. Table 6-21 lists the potential socio-economic receptors drawn from the baseline study.

Table 6-21: Potential socio-economic receptors

Receptor	Description
Project workforce	The construction workforce will either be based on site in a workers camp or within hotel or guest house accommodation in the nearby project-affected communities. Operational workforce will likely be housed within the project-affected communities as well. Associated risks of accident and ill health due to living or working conditions are relevant for this receptor, as well as their potential interaction with nearby communities.
Local economically active population	Project related employment and training needs may interact with the local economically active population. This receptor may encompass people living within the nearby project-affected communities.
General local businesses, services providers, and equipment suppliers	Project related procurement needs during the construction and operation phases may interact with local businesses, services providers and equipment suppliers (e.g. limited use of the local shops, procurement of equipment and materials supplies).
Communities	Project-affected communities as shown in Table 6-12: • Melikhodja • Erkin Nafas • Upka • Bulakchi • Damkhodzha • Partaabad • Suyunjon
Vulnerable groups	Groups with limited coping / adaptation capacities to external changes. Particular consideration is given to children, women and the elderly in the who reside within the project-affected communities. No indigenous peoples have been identified as part of the baseline study.

Livestock Keepers	Livestock keeping is one of the main sources of income for the project-affected communities and construction and operational activities may have an adverse effect on livestock health, thus having a knock-on effect on income in the area.
Current Land Users	The acquisition of land in the project site will, if it hasn't already, physically and/or economically displace current land users. As per IFC guidance, regardless of their land tenure status these people are entitled to compensation and/or resettlement assistance.

6.8 Labour and Working Conditions

6.8.1 Labour Laws

The Labour Code of the Republic of Uzbekistan,1995 (as most recently amended in September 2017) is the main law governing working conditions in the Republic. The key points which are relevant to the current project are:

- Chapter VI (Articles 4 and 72 to 76) determine the content, form and term of the employment contract, the limitation of rights of the employer to enter into a fixed-term employment contract, and the ratio of legal and contractual regulation of labour relations. This is relevant because there is no specific requirement to provide workers with documented information that is clear and understandable, regarding their rights, including their rights related to hours of work, wages, overtime, compensation, and benefits upon beginning the working relationship and when any material changes occur.
- Article 77 determines the age at which employment is permitted (i.e. 16 years old).
- Article 239 establishes that all persons under the age of 18 years shall be employed only after undergoing a preliminary medical examination and further until reaching the age of 18 are subject to mandatory annual medical examination.
- Article 7 prohibits forced labour, understood as work performed under threat of punishment (including as a means of labour discipline).
- Articles 211 and 212 establish requirements on labour protection, and the duties of the employee to comply with the norms, rules and regulations on labour and protection. The employee is obliged to comply with the norms, rules and regulations on labour protection, as well as the administration of the order of safe operation, use the obtained personal protective equipment, and immediately notify their supervisor (foreman, master, chief of a site, and others) if any accidents or situations that create a direct threat to human life and health occur.
- Article 213 establishes the right of the worker to the information on occupational health and safety (OHS). At the conclusion of the employment contract and the transfer to another job worker shall be informed by the employer about working conditions, including the presence of risk occupational and other diseases due to him in connection with these benefits and compensation, as well as personal protective equipment. The employer must also inform employees or their representatives about the state of OHS in specific workplaces and production.

As of 1 September 2021, the minimum wage in Uzbekistan is UZS 822,000 a month (at the time of writing, this equates to approximately USD 77). In addition, employers are responsible for social security contributions. Their contribution must be up to at least 25 percent of the worker's salary.

6.8.2 Working Conditions and Forced Labour

In Uzbekistan, employment relations are overseen by statutory legislation or by collective agreements. The law in Uzbekistan considers the concerns and interests of workers, employers, and the state to maximise market functioning, working conditions are just and the rights of workers are protected. Working conditions and the eradication of child labour is an area that has been showing improvement in Uzbekistan. The government put in place proactive measures to prevent the use of child labour by introducing criminal penalties for repeat violations

of hazardous work prohibitions, doubling the number of labour inspectors, and conducting extensive awareness-raising on child labour laws and penalties for violations (US Embassy in Uzbekistan, 2020). The government also established a new National Commission on Combating Trafficking in Persons and Forced Labour and adopted a new roadmap to combat these issues (US Embassy in Uzbekistan, 2020).

Despite these advancements, secondary research has identified that forced and child labour are still an issue in Uzbekistan's agricultural sector, particularly in cotton production which, according to the site visit undertaken by TYPSA in 2020, is the main land use just beyond the northwest boundary of the site. This was corroborated during the scoping site visit, when project team members observed cotton being transported around the Project AoI, see Figure 6-50. .

Figure 6-50. Cotton Collection and Transportation in the Project AoI

There is currently limited information available on the working conditions in the construction sector in Uzbekistan. No further information is available from the Project Developer or EPC Contractor.

6.9 Transportation and Access

6.9.1 Introduction

It is currently assumed that the Solar PV components will be transported to site by rail to Tashkent from a manufacturing plant in China, via Kazakhstan, and from Tashkent by road to the site. The transportation method will need to be confirmed by the EPC contractor. Both options are described in more detail below.

- For conventional goods, the equipment that can be carried by railway containers is transported by railway containers; all goods are sent from the Xi'an Xinzhu Railway Port to Tashkent.

- Equipment that cannot be carried by railway containers (Box-type and HV transformers) will be exported via Khorgos Port to reach its destination by truck.

6.9.1.1 Baseline Data Collection

A desktop review and site visits (undertaken in September and November 2021) have been undertaken to identify any key issues with regard to accessing the site and to consider potentially suitable access routes from an appropriate port or main road. This high-level route assessment was based on existing maps, satellite imagery and information gathered during the site visit.

There has been no data available to estimate the current national traffic volumes on the proposed roads to be used for transportation of materials on the site. Details of transportation (vehicles, numbers and loads) has been requested by AECOM. This should be provided by the EPC Contractor as part of detailed design. The report would be updated end of December 2022 if this information is provided.

6.9.2 Baseline Conditions

6.9.2.1 Overall Transportation Route

The transportation study has considered a route from China where the parts will be delivered up to the Project site utilising the main transport network and avoiding built-up areas where possible.

The initial stage of the journey will be by train from the manufacturing sites in China to the Khorgas/Altynkol border crossing by Block Train then on to Tashkent. From Tashkent, material will be delivered to site by road.

Trans-shipment is required in Kazakhstan due to difference in track width between China & Kazakhstan. Trans-shipment will not involve the unpacking of containers / loads however it will take approximately 24 hours to trans-ship, arrange necessary documentation, arrange transit clearance, and shunting in/out of the terminal to the station.

The Chinese border crossing is located over 1,000 km east of the project site and it is key for importing and exporting goods in and out of inland central Asian countries, including Uzbekistan. The EPC Contractor will be required to confirm the suitability of the route and border crossing for delivering and handling the Project materials and, if necessary, propose an alternative route.

The Project site can be accessed directly from the minor road heading west from Shurcha via a short access road however a large part of the access from Shurcha is through local, unpaved roads.

Given the importance of the route for trade between China and Central Asian countries, and review of satellite images, the road infrastructure between the border and the site will be of good quality and should not present any significant technical difficulties.

The proposed rail and road route comprise the following key roads (distances noted are estimates):

- Travel by rail from Xi'an Xinzhu Railway Port to Tashkent Chukursay Station.
- From Tashkent, transfer goods to truck then join the M39 towards Chinaz.
- Continue west for 5km, bearing right to continue on the M-39.
- Continue on the M-39 bearing left onto the M34 at Syrdarya then right onto to A365 at Khavast before reaching Samarkand via Jizzakh - 150km.
- Take the M-37 to Ishtihan – 50km and a further 10km to Kattakurgan before bearing left then left again past the village of Gish zavod.
- After 5km turn left to the village of Shurcha then take the minor rural roads to access the western side of the site.

Stopovers

A single stopover is planned between Tashkent and the site which is a distance of approximately 650km.

6.9.2.2 Rail Transport

The railway shipments are all containerized. Goods will be loaded at the Xi'an Xinzhu Railway Station warehouse, China and the arrival point will be Tashkent Chukursay Station. The containers are then transported to the project site by road using customs supervision vehicles. The empty containers are returned to Tashkent.

The "Chang'an" train runs from Xi'an to Horgos Port, covering a total distance of 3,200km. It passes through three railway bureaus and 10 marshalling stations and arrives at Horgos Port within three days.

On leaving China, the railway transportation route is 1,600km in total, passing through four marshalling stations, the Kazakhstan Railway and Uzbekistan Railway - Almaty, Shimkent, and Tashkent. After reloading at Altynkol Station, the train reaches Chukursay station in Tashkent, where materials are then transferred by road to the Project site.

6.9.2.3 Road Description

It is proposed to follow the main highways from Tashkent to Kattakurgan as highlighted below.

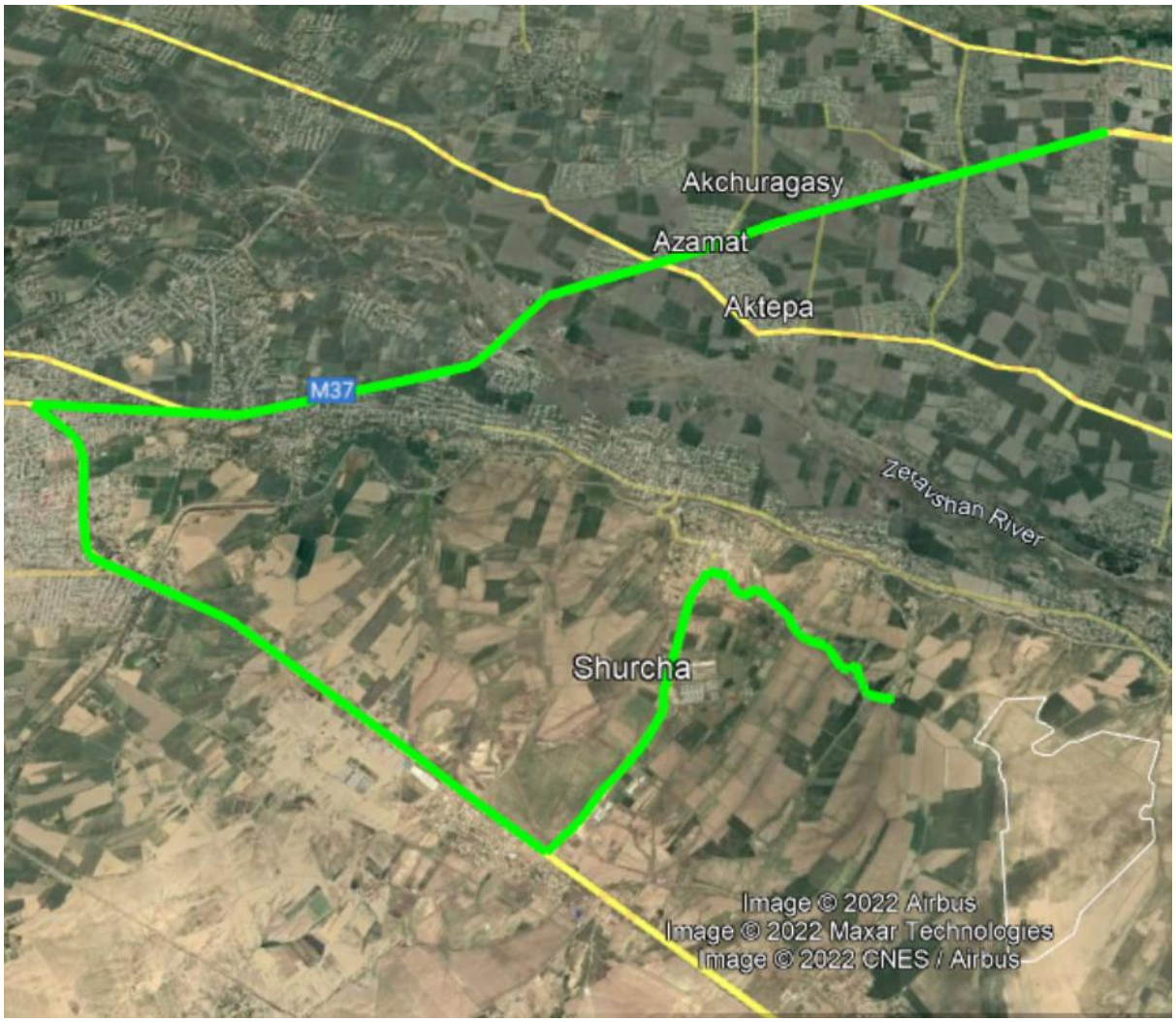

Figure 6-51. Transportation route from the M-37

Source: Masdar Transportation Study

M39 Highway

The road was driven as part of the ESIA visit in both September and November 2021. However, it is understood to be dual carriageway in sections and is used by HGV traffic. It is deemed suitable to use for delivery purposes and can accommodate HGV traffic.

Figure 6-52. M39 west of Jizzakh

Figure 6-53. M39 west of Jizzakh (2)

Minor Road Shurcha

The Project site is accessed from the M37 via a short stretch of minor road from Kattakurgan. Further grading of this road may be required for larger vehicles to access the site. It is unlikely that the road will allow for vehicular travel faster than 40 km / hr. The road is generally wide enough to allow for two vehicles to travel in opposite directions although there are some pinch points particularly closer to villages.

The last 1 km approach is earthen road which would developed further by the EPC considering the loads being transported.

Site access

The site is proposed to be accessed from the unpaved road at Shurcha through the village to the western side of the site. AECOM note that significant work may be required given the proximity of houses and services. Once past the village, the site becomes open and expansive. The exact point of access has not yet been confirmed by the EPC contractor.

Once available, final access road to the site will be shown on the map also allowing social receptors along the access road to be defined.

As of 10 November 2022, alternative access roads were still in the process of being evaluated for the Project.

Figure 6-54. Access route over collector close to Shurcha village

Figure 6-55. Access route close to Shurcha village

Figure 6-56. Entrance to the southwestern part of the site

6.9.3 Road Safety

Both Kazakhstan and Uzbekistan have relatively poor road safety records. According to the World Health Organisation (WHO) Road Safety Report, 2018[83], in 2016, there were 17.6 deaths per 100,000 population in Kazakhstan with the greatest proportion of these being drivers (60%) then pedestrians (31%). However, fatalities have more than halved in the past 10 years. In Uzbekistan, there were 11.5 deaths per 100,000 population which has increased slightly since 2007.

6.9.4 Roads Sensitivity Analysis

Table 6-22 sets out the level of sensitivity of the different sections of roads along the proposed route considering the type of road, current traffic volumes and the presence of any sensitive receptors.

Table 6-22: Sensitivity Analysis

Road	Receptor Details	Sensitivity
Road A353 (Kazakhstan)	Paved highway with medium daily traffic flows. Passing residential and commercial areas. Minimal traffic management measures in place. Highway suitable for all types of vehicles and volumes.	Low
Road A3 (Kazakhstan)	Paved dual carriageway road with moderate daily traffic flows. Passing residential and commercial areas.	Low

[83] World Health Organization (2018). Global Status Report on Road Safety 2018. Geneva: World Health Organization.

Road	Receptor Details	Sensitivity
	Minimal traffic management measures in place. Highway suitable for all types of vehicles and volumes.	
Route A2 (Kazakhstan)	Paved highway with moderate daily traffic flows. Passing residential and commercial areas. Minimal traffic management measures in place. Highway suitable for all types of vehicles and volumes.	Low
M39 (Uzbekistan)	Paved dual carriageway road with moderate daily traffic flows. Passing residential and commercial areas. Minimal traffic management measures in place. Road suitable for and regularly used by HGVs	Low
M37 (Uzbekistan)	Paved dual carriageway road with moderate daily traffic flows. Passing residential and commercial areas. Minimal traffic management measures in place. Road suitable for and regularly used by HGVs	Low

6.9.5 Rail Transport

The railway shipments are all containerized. Goods will be loaded at the Xi'an Xinzhu Railway Station warehouse, China and the arrival point will be Tashkent Chukursay Station. The containers are then transported to the project site by road using customs supervision vehicles. The empty containers are returned to Tashkent.

The "Chang'an" train runs from Xi'an to Horgos Port, covering a total distance of 3,200km. It passes through three railway bureaus and 10 marshalling stations and arrives at Horgos Port within three days.

On leaving China, the railway transportation route is 1,600km in total, passing through four marshalling stations, the Kazakhstan Railway and Uzbekistan Railway - Almaty, Shimkent, and Tashkent. After reloading at Altynkol Station, the train reaches Chukursay station in Tashkent, where materials are then transferred by road to the Project site.

6.9.5.1 Assessment Methodology

The assessment is based on the use of a number of different types of vehicles used during the construction and operation of the Project. These include:

- Light Goods Vehicles (LGVs) – contractors' vans, minibuses, private cars etc.
- Heavy Goods Vehicles (HGVs) – vehicles with a maximum rigid length of 12 m and a maximum articulated length of 16.5 m.
- Abnormal loads – vehicles over 25 m in length or 3.6 m wide.

6.9.5.2 Guidance

The assessment has been carried out using the IEMA (2003) "Guidelines for the Environmental Assessment of Road Traffic". The guidelines suggest the following thresholds are adopted to assess whether particular links of the network are to be subject to assessment:

- Rule 1 – Include highway links where traffic flows will increase by more than 30 % (or number of HGVs increasing by more than 30 %).
- Rule 2 – Include any other specifically sensitive areas where traffic flows will increase by 10 % or more.

6.9.5.3 Assessment of Effects

The following sections set out the methodology which has been used to determine if the increased traffic flows during the construction phase of the Project are likely to be significant.

Sensitivity Criteria

The sensitivity of roads, their users and settlements along the proposed route has been assessed in accordance with the criteria set out in Table 6-23. The IEMA guidance details that sensitive locations are defined as receptors that are sensitive to traffic including amenities such as hospitals, places of worship, schools and historic buildings.

Table 6-23: Sensitivity Criteria

Sensitivity	Criteria
High	Large rural settlement containing numerous amenities. Traffic management measures in place such as controlled crossings, signalled junctions etc. Minor / unclassified unpaved roads with low traffic flow volumes. These may not be suitable for large HGV vehicles.
Medium	Rural settlement with a number of amenities. Minor traffic management measures in place. Local road (paved / unpaved) suitable for HGV traffic.
Low	Small rural settlement with few local amenities. Minimal traffic management measures in place. Paved road capable of large volumes of HGV traffic.
Negligible	Scattered dwellings with no local amenities. No / little traffic management in place. Highway suitable for all types of vehicles and volumes.

Magnitude of Change Criteria

The magnitude of impact on traffic flow is determined based on criteria set out in the IEMA guidelines. This is set out within Table 6-24 below.

Table 6-24: Magnitude of Change Criteria

Sensitivity		Criteria
High	Above 90%	Above 90%
Medium	Between 60% and 90%	Between 60% and 90%
Small	Between 30% and 60%	Between 30% and 60%
Negligible	Under 30%	Under 30%

Assessing Level of Effect

Using these definitions, a combined assessment of sensitivity and magnitude has been made to determine the level of the predicted effect on a receptor i.e. Negligible, Low, Medium of High. All direct and indirect impacts causing Medium or High effects are considered to be significant.

6.9.5.4 Assumptions

It is assumed for the purposes of this assessment (and forecasted levels of traffic) that construction will commence in 2022/2023. Should this not be the case, it is unlikely that the change in forecasted levels of traffic will be of such a level as to change the assessment outcomes. The calculations are also based on a 220 MW (AC) solar plant.

As the details of how road stone and other materials will be supplied are not known at this stage, it is assumed that the routing of all materials will follow the route identified in the section below, thus presuming a “worst-case” scenario.

The construction schedule will be defined by the EPC Contractor. The assessment is based on an assumed construction phase duration of around 18 months, taking consideration of potential delays in transportation of

materials and weather conditions. It is also assumed that the Project will be constructed as one development rather than in a phased approach. The vehicle numbers and personnel requirements have been estimated based on these “worst-case” assumptions.

6.9.5.5 Traffic Generation

The Project will result in additional vehicles travelling to and from the site during construction. These will include heavy goods vehicles (HGVs) and light vehicles. Overall, the total number of vehicles required to travel to and from site is not expected to be significant. A worst-case scenario has been modelled where all materials are transported to site by road.

The first period of construction will be associated with the delivery of equipment to site and the construction activities that will be carried out on site. The second phase will involve set up and commissioning of all infrastructure and as such, this stage will have reduced vehicle requirements. The construction phase is expected to generate the traffic volumes detailed in Table 6-25 below. It should be noted that these traffic volumes are estimated by AECOM based on previous solar PV project experience and are to be confirmed once a construction strategy is available from the EPC Contractor.

This assessment is limited to the expected amount of HGV movements and construction staff transportation requirements. The HGV movements estimated peak is expected to last one month and to be 1,460 vehicles during this month. It is also likely that a larger bus would be provided for construction workers thereby reducing the number of vehicle movements. It is also considered that a large proportion of the staff will be accommodated at the workers camp, in the proximity of the project site.

Table 6-25: Estimated Volume of Vehicle Movements during Construction

Vehicle Type	Activity	Total Vehicle Movements
HGV	Delivery of materials, plant, containers, concrete, aggregate material and welfare facilities	13,266
LGV (people carrier up to 6 people)	Transportation for construction workers to site.	3,080

It should be noted that this does not include movements of any abnormal loads or specialist vehicles (bulldozers, cranes etc) to the Project site. The amount of construction workers being transported to site is based on a typical on-site presence of 20 project staff at any one time with approximately 115 to 900 contracted site staff needed for the installation of the modules and civil construction. A detailed assessment of vehicle movements should be provided in the TMP.

Construction times can be arranged to avoid local peak times and routing arrangements, particularly for HGVs to minimise potential impacts

6.9.5.6 Assessment Methodology

The assessment is based on the use of a number of different types of vehicles used during the construction and operation of the Project. These include:

- Light Goods Vehicles (LGVs) – contractors’ vans, minibuses, private cars etc.
- Heavy Goods Vehicles (HGVs) – vehicles with a maximum rigid length of 12 m and a maximum articulated length of 16.5 m.
- Abnormal loads – vehicles over 25 m in length or 3.6 m wide.

6.9.5.7 Guidance

The assessment has been carried out using the IEMA (2003) “Guidelines for the Environmental Assessment of Road Traffic”. The guidelines suggest the following thresholds are adopted to assess whether particular links of the network are to be subject to assessment:

- Rule 1 – Include highway links where traffic flows will increase by more than 30 % (or number of HGVs increasing by more than 30 %).
- Rule 2 – Include any other specifically sensitive areas where traffic flows will increase by 10 % or more.

6.9.5.8 Assessment of Effects

The following sections set out the methodology which has been used to determine if the increased traffic flows during the construction phase of the Project are likely to be significant.

Sensitivity Criteria

The sensitivity of roads, their users and settlements along the proposed route has been assessed in accordance with the criteria set out in Table 6-26. The IEMA guidance details that sensitive locations are defined as receptors that are sensitive to traffic including amenities such as hospitals, places of worship, schools and historic buildings.

Table 6-26: Sensitivity Criteria

Sensitivity	Criteria
High	Large rural settlement containing numerous amenities. Traffic management measures in place such as controlled crossings, signalled junctions etc. Minor / unclassified unpaved roads with low traffic flow volumes. These may not be suitable for large HGV vehicles.
Medium	Rural settlement with a number of amenities. Minor traffic management measures in place. Local road (paved / unpaved) suitable for HGV traffic.
Low	Small rural settlement with few local amenities. Minimal traffic management measures in place. Paved road capable of large volumes of HGV traffic.
Negligible	Scattered dwellings with no local amenities. No / little traffic management in place. Highway suitable for all types of vehicles and volumes.

Magnitude of Change Criteria

The magnitude of impact on traffic flow is determined based on criteria set out in the IEMA guidelines. This is set out within Table 6-27 below.

Table 6-27: Magnitude of Change Criteria

Sensitivity		Criteria
Large	Above 90%	Above 90%
Medium	Between 60% and 90%	Between 60% and 90%
Small	Between 30% and 60%	Between 30% and 60%
Negligible	Under 30%	Under 30%

Assessing Level of Effect

Using these definitions, a combined assessment of sensitivity and magnitude has been made to determine the level of the predicted effect on a receptor i.e. Negligible, Minor, Medium or High. All direct and indirect impacts causing Medium or High effects are considered to be significant.

Where the identified thresholds above are exceeded, the IEMA guidance sets out a list of effects which should be assessed. This includes:

- Accidents and safety.
- Driver delay.
- Pedestrian amenity.
- Severance.
- Air pollution.
- Dust and dirt.
- Ecological effects.
- Hazardous loads.
- Heritage and conservation.
- Noise.
- Pedestrian delay.
- Vibrations.
- Visual effects.
- A number of these effects are covered elsewhere in the ESIA and so those considered within this chapter include:
- Accidents and safety.
- Severance.
- Driver delay.
- Pedestrian amenity.
- Pedestrian delay.

Accidents and safety

IEMA guidelines do not recommend the use of thresholds for identifying significance of impacts due to numerous local causation factors involved in personal injury accidents. However, it is recognised that a significant increase in overall traffic volumes and abnormal loads may raise concerns over road safety. Therefore, measures to address road safety concerns will form a key part of the assessment methodology and development of mitigation options.

Driver delay

Driver delay occurs due to additional traffic present on the road network. IEMA guidelines note that additional delays are only likely to be significant if the traffic on the network is already at, or close to, capacity. Key areas where delays may occur include:

- At the site entrance due to turning of vehicles.
- On the highway passing the site.
- At key intersections along the highway.
- At junctions where the ability to find gaps in the traffic may be reduced, thereby lengthening delays.

Pedestrian amenity

This is broadly defined as the relative pleasantness of a journey and is considered to be affected by traffic flow, traffic composition and pavement width / separation from traffic. IEMA guidelines state that this may be significant where traffic is either halved or doubled.

Severance

IEMA guidelines state that severance is the perceived division that can occur within a community when it becomes separated by a High traffic artery. The term is used to describe a complex series of factors that separate people from places and other people. Severance can also result from difficulty in crossing a heavily trafficked road. The guidance indicates that severance effects are considered 'slight' in cases that include:

- Pedestrian at-grade crossings on new roads carrying below 8,000 vehicles per day (AADT) (DoT, June 1993); or
- Changes of traffic flow of less than 30% (IEMA, March 1993).

Pedestrian delay

Changes in the volume and composition or speed of traffic on the road network may affect the ability of people to cross roads. In general, increasing traffic volumes will lead to an increase in pedestrian delay. Thresholds are not recommended for use to identify significance of potential effects due to the range of local factors and conditions which can affect delay.

6.9.5.9 Assumptions

It is assumed for the purposes of this assessment (and forecasted levels of traffic) that construction will commence in 2023. Should this not be the case, it is unlikely that the change in forecasted levels of traffic will be of such a level as to change the assessment outcomes. The calculations are also based on a 220 MW (AC) solar plant.

As the details of how road stone and other materials will be supplied are not known at this stage, it is assumed that the routing of all materials will follow the route identified in the section below, thus presuming a "worst-case" scenario.

The construction schedule will be defined by the Project Developer. The assessment is based on an assumed construction phase duration of around 18 months, taking consideration of potential delays in transportation of materials and weather conditions. It is also assumed that the Project will be constructed as one development rather than in a phased approach. The vehicle numbers and personnel requirements have been calculated based on these "worst-case" assumptions.

7. Potential Environmental and Social Impacts

7.1 Construction Impacts

The assessment has been undertaken in accordance with the methodology and assessment criteria set out in Section 4 (Assessment Methodology). The impacts, including conclusions on their potential significance, are described below. Mitigation is described in Chapter 8. Residual impacts are described in Chapter 9.

7.1.1 Air Quality

Air pollution may arise as a result of dust emanating from vehicle movements and other construction activity. However, this will be a temporary effect that can be mitigated by restricting vehicles to sealed access tracks and the use of dust suppression measures.

The Project impacts may include:

- Dust and engine emissions created by construction activities (i.e. earthworks, demolition and operation of machinery) could influence the local ambient air quality.
- The release of exhaust emissions to the atmosphere could have an effect on the local ambient air quality.

The rural nature of the site, the expansiveness of the landscape and the limited amount of traffic present mean that vehicle emissions are not predicted to be significant. As a result, the air quality assessment considers only dust emissions.

Impact Assessment: Impacts on air quality during construction					
Impact Nature	Positive			Negative	
	Impact is negative because construction activities may result in increased air pollution.				
Impact Type	Direct		Indirect	Reversible	Irreversible
	The impact is direct as construction activities would directly increase air pollution.				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent
	The impact is temporary as impacts would occur during the construction phase only.				
Impact Extent	Local		Regional	National	
	The impact is expected to occur within the site and adjacent areas.				
Receptor Value / Sensitivity	Negligible	Low	Medium	High	
	A single residential receptors are located 225m from the Project site therefore receptor sensitivity is determined to be Medium.				
Impact Magnitude	No change	Negligible	Low	Medium	High
	Magnitude of change is anticipated to be low as there is unlikely to be an increase in levels and dust to air associated with construction of the Project at nearby settlements located <1km from the project. Individual properties are located at 225m and 470m from the site boundary. The imp[act magnitude is predicted as Medium at the closest property reducing to Low for the other nearest properties.				
Impact Significance	None	Negligible	Low	Medium	High
	The potential impact during construction is considered to be Medium adverse, on the basis that residential receptors are within 250m of the site boundary but construction vehicles may pass closer to and from site. The implementation of Good International Industry Practise pollution prevention measures is considered very likely to reduce the impacts. However, additional mitigation measures are therefore required.				

7.1.2 Archaeology and Cultural Heritage

The Project is not deemed to have a direct adverse impact on any international or nationally recognised cultural heritage. No significant archaeology or cultural heritage assets are currently known from within the Solar Array Site. It is not located in an area of known archaeological potential –although it has a south-facing aspect, there are no presently identified remains from this terrace. Known remains in the surrounding region focus on river valleys, prominent strategic positions, terraces, caves and rock shelters. The area has been subject to previous ploughing, which may have levelled any earthworks and resulted in minor damage to any underlying archaeological deposits.

In the Solar Array area, there is the potential for the discovery of unrecorded buried archaeological remains and surface findspots during the construction phase as the Project will involve ground clearance activities such as levelling, grading and excavation works. Components include the solar PV system, a new substation, and access roads; temporary construction stage elements include construction and laydown areas, worker accommodation, spoil disposal, and temporary access tracks. These works and related activities such as fence installation and vehicle tracking have the potential to directly impact on any unrecorded buried archaeological remains which may be present within the site boundary and may be of archaeological importance.

Irrigation works in the vicinity of the Transmission Line may have resulted in widespread levelling and burial beneath dredged deposits. There is therefore potential for localised preservation beneath alluvial and colluvial deposits and made ground, and for finds being brought to the surface by ploughing, irrigation and construction activities. The excavation of footings for the transmission towers and the crushing and rutting of the ground surface by machinery used to string the overhead line may result in localised impacts on any earthworks or buried archaeological remains or surface findspots.

The Solar Array will have no impact on the setting of heritage assets due to lack of intervisibility with receptors, intervening distance and topography. The Transmission Line will be visible from a number of heritage assets. It will be an additional large-scale industrial element in a landscape already characterised by intensive large-scale agriculture and existing transmission lines and light industry on the periphery of Kattakurgan. It is not anticipated that construction-stage views, noise, dust and vibration will affect the ability to appreciate the significance of the historic landscape or individual monuments. For this reason, the impact on the setting of heritage assets is assessed as low.

Impact Assessment: Impacts on archaeology and cultural heritage during construction					
Impact Nature	Positive			Negative	
	Impact is negative because construction activities may result in physical disturbance to cultural heritage features.				
Impact Type	Direct		Indirect	Reversible	Irreversible
	The impact is generally direct as archaeology features could be disturbed by construction activities.				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent
	The impact is permanent as impacts occur there would be an irreversible change to the baseline within the Project site.				
Impact Extent	Local		Regional	National	
	Any potential impact is expected to occur within the Solar Array site or Transmission Line. There are no known designated heritage assets within the site. Any impact would be on previously undiscovered remains.				
Receptor Value / Sensitivity	Low		Medium	High	
	There are no known heritage assets within the Solar Array site or Transmission Line.				
Impact Magnitude	No change		Low	Medium	High
	The magnitude of change is anticipated to be medium as there is localised potential to physically disturb any surviving archaeological remains. Setting impacts are low due to lack of views, intervening distance and topography.				
Impact Significance	None	Negligible	Low	Medium	High
	The impact is assessed as Low and not significant prior to additional mitigation measures being implemented.				

7.1.3 Biodiversity

7.1.3.1 Avifauna

Critical Habitat has been triggered for great bustard due to its Critically Endangered national conservation status as well as the Ecologically Appropriate Area of Analysis of this species overlapping with the Project AoI (refer to Appendix D). The Project is situated within the known wintering range of this species and it is likely that this species will fly over the Project AoI.

The proposed project site is not located on a major (high importance) flyway or in a geographical feature that would concentrate migrating species. Survey work has confirmed that the Project site is not important for breeding or migrating species, including raptor species of international and national conservation concern which have been assigned PBF status (refer to Appendix D). Registrations of a single steppe eagle (IUCN EN) and a single Egyptian vulture (IUCN EN) overflying the project site on migration during the baseline surveys A single little bustard (a PBF species) was recorded during the surveys undertaken by TYPSA/IFC in 2021. However, there is no reasonable likelihood that populations of any of the aforementioned PBF species are regionally significant.

Other PBF species which are vulnerable to construction disturbance were confirmed likely absent from the Project site, including Asian houbara and great bustard. Non-breeding little bustard was confirmed present during the winter but in small numbers which aren't significant. Sociable lapwing was confirmed likely absent; the Project site is not used as a major stop-over or flyway for this IUCN CR species. The Solar PV site and Overhead Line route are not considered to be suitable for great bustard as a staging or wintering habitat and therefore the likelihood that construction related disturbance to this species is significant is negligible for this CH qualifying species.

Construction impacts are likely to include habitat loss as well as disturbance impacts in the Project and adjacent areas. The existing habitat within the Solar PV and most of the Overhead Line route is Modified Habitat as defined in PS6. The degraded nature of the project site supports a low diversity of resident and breeding species which are not of international or national conservation concern. Therefore, significant impacts on resident and breeding bird species are not expected.

If site clearance and construction activities should occur during the breeding bird season (typically March-August for most species) this could result in the destruction of and/or damage to nests of ground nesting birds, including black-bellied sandgrouse, crested lark and isabelline wheatear.

Habitat loss associated with construction is unlikely to result in a significant impact to migrating birds as no major attractant features (e.g. lakes / wetlands) will be lost. As a result, there are not anticipated to be any impacts on resting or stopover sites for migrating birds.

Large avifaunal species utilise large tree species and these are not present within the PV area of the site, thus the Project is not

Project related human activity adjacent the respective Solar PV and Overhead Line construction footprints may impact on population growth of bird species due to hunting/take and disturbance, for example great bustard.

Impact Assessment: Impacts on Great Bustard (*Otis tarda*) during Construction – Critical Habitat is triggered for this species under Criteria 1: significant populations of nationally or regionally EN or CR species]				
Impact Nature	Positive		Negative	
	Impact is negative because construction activities may result in habitat loss, disturbance and mortality to this species.			
Impact Type	Direct	Indirect	Reversible	Irreversible

Impact Assessment: Impacts on Great Bustard (*Otis tarda*) during Construction – Critical Habitat is triggered for this species under Criteria 1: significant populations of nationally or regionally EN or CR species]					
	The impact is generally direct as disturbance caused by construction activities may directly displace birds from wintering foraging/resting/roosting areas within the ZoI due to noise and visual disturbance. Any changes in population due to project relating hunting/take may be irreversible.				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent
	The impact is expected to be short-term and temporary as it will be restricted to the construction phase of the project. Displacement impacts (relating to disturbance and barrier effects) are temporary and short-term as construction works are expected to continue for a period of approximately 12-15 months. Population changes relating to hunting/take are temporary and short-term as construction works are expected to continue for a period of approximately 18 months				
Impact Extent	Local	Regional	National	International	
	The impacts are considered unlikely at a regional level considering that no great bustards were recorded within the Project AOI or EAAA used in the CHA, based on the TYPSA/IFC2020/21 survey results				
Receptor Value / Sensitivity	Negligible	Low	Medium	High	
	As stated in the Critical Habitat Assessment (Turnstone Ecology, 2022 [Appendix D]), critical habitat requirements are applicable for Great Bustard. This species is assigned a 'High' sensitivity value.				
Impact Magnitude	Negligible	Low	Medium	High	
	Given the unsuitability of the Project site for foraging/resting/roosting great bustard, and that there were no records of great bustard in Samarkand during the surveys by TYPSA/IFC in 2020-21, the impact magnitude is assessed as Negligible.				
Impact Significance	None	Negligible	Low	Medium	High
	The impact is assessed as Low and not significant There is a requirement for the project to achieve Net Gains for this Critical Habitat qualifying species. The mitigation measures required to achieve net gains will be detailed within a Biodiversity Action Plan (BAP) for this species.				

Impact Assessment: Impacts on ornithology during construction (PBF species) – White-headed Duck Sociable Lapwing, Saker Falcon, Pallas's Fish Eagle, Steppe Eagle, Egyptian Vulture, Little Bustard and Asian Houbara				
Impact Nature	Positive	Negative		
	Impact is negative because construction activities may result in habitat loss and disturbance.			
Impact Type	Direct	Indirect	Reversible	Irreversible
	The impact is generally direct and irreversible as potential foraging habitat may be lost through construction activities (e.g. ground clearance to accommodate infrastructure). There will be no direct destruction or damage to active nests due to the unsuitability of the habitat within the project footprint for those PDF species which have breeding ranges that have the potential to overlap the project, ie. saker falcon and Asian Houbara.			

Impact Assessment: Impacts on ornithology during construction (PBF species) – White-headed Duck Sociable Lapwing, Saker Falcon, Pallas's Fish Eagle, Steppe Eagle, Egyptian Vulture, Little Bustard and Asian Houbara					
	Site clearance and construction of solar panel infrastructure, pylons, powerlines, access roads and other infrastructure may create barrier effects for PBF birds migrating (overflying) the Project site, particularly the following species autumn and spring passage: sociable lapwing, steppe eagle and Egyptian vulture. It is possible that individuals will be deterred from using preferred migration routes during periods where there is more intense activity and more people are present in the landscape. However, reversible barrier displacement effects for the Overhead Line will be limited to localised areas and focussed on pylon locations				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent
	The impact is permanent as there would be an irreversible change to the baseline within the Project site for the lifetime of the Project. Displacement impacts (relating to disturbance and barrier effects) are temporary and short-term as construction works are expected to continue for a period of approximately 12-15 months.				
Impact Extent	Local	Regional	National	International	
	The impact is expected to occur within or immediately adjacent to the Project site. Given the distance of 15km between the Project site and Kattakurgan Water Reservoir IBA (at its closest point), and the lack of habitat connectivity or potential pathways between the IBA and the Project site, there is no reasonable likelihood of significant direct or indirect impacts. This assessment is consistent with the TYPSA/IFC Scoping Report (2020), which states: '*Many species of birds stop to rest and feed during spring and autumn migration, but, after consultation with Birdlife International and ornithological experts (IBA Programme since 2008) none of the species for which the IBA site was designated use the proposed Project area, except the Asian houbara*'. The results of the baseline surveys undertaken by AECOM confirm that breeding populations of Asian houbara and stopover sociable lapwing are likely absent.				
Receptor Value / Sensitivity	Negligible	Low	Medium	High	
	The PBF bird species which have been recorded as present or assessed as having a reasonable likelihood of occurrence are not critical habitat qualifying species and are therefore not of very high or high sensitivity according to the criteria detailed above. In terms of the PBF species which have been recorded, these have been recorded in numbers which are not significant and are assigned a Medium sensitivity value. Sociable lapwing (IUCB [CR]) has the potential to occasionally overfly the project site on spring and autumn passage (the species was assessed as likely absent as a result of the targeted surveys for this species). However, there is no reasonable likelihood that the project is located on a significant migratory corridor for this species and the sensitivity is assessed a Low. Houbara bustard (IUCN [VU]) has been shown to be likely absent from the Solar PV and the Overhead Line, as a result of the targeted breeding surveys for this species undertaken by AECOM. The sensitivity for this species is therefore is determined as Low.				
Impact Magnitude	Negligible	Low	Medium	High	
	For the Solar PV the magnitude of the effect is predicted to be Negligible for breeding PBF birds given their likely absence from the Solar PV Project site. The magnitude of the effect is predicted to be Negligible for non-breeding birds PBF raptor species overflying on spring and autumn migration, in terms of disturbance displacement (barrier to movement) during the construction phase.				

Impact Assessment: Impacts on ornithology during construction (PBF species) – White-headed Duck Sociable Lapwing, Saker Falcon, Pallas's Fish Eagle, Steppe Eagle, Egyptian Vulture, Little Bustard and Asian Houbara					
	The magnitude of the effect for the Overhead Line is expected to be Negligible in terms of breeding by PBF birds considering the likely absence of nest sites at the areas to be cleared within the respective very localised pylon footprints. The magnitude of the barrier effect is predicted to be Negligible for non-breeding birds PBF raptor species overflying the AOI on spring and autumn migration, in terms of disturbance displacement (barrier to movement) during the construction phase.				
Impact Significance	None	Negligible	**Low**	Medium	High
	As a result, the impact is assessed as Low (overall) for PBF bird species and not significant for the Solar PV and the Overhead Line, respectively. There is a requirement for the project to achieve No Net Loss of species defined as PBFs.				

Impact Assessment: Impacts on ornithology (non PBF species) during construction					
Impact Nature	Positive		**Negative**		
	Impact is negative because construction activities may result in habitat loss and disturbance.				
Impact Type	**Direct**	Indirect	Reversible	**Irreversible**	
	The impact is generally direct as habitat will be lost through construction activities (e.g. ground clearance to accommodate infrastructure associated with the Solar PV and OHL [pylons]), this could include direct destruction or damage to bird nests (e.g. crested lark and wheatears). In addition, disturbance caused by construction activities may directly displace birds from breeding sites and/or foraging areas due to noise and visual disturbance.				
Impact Duration	**Temporary**	**Short-term**	Medium-term	Long-term	**Permanent**
	The impact is permanent as there would be an irreversible change to the baseline within the Project site for the lifetime of the Project. Displacement impacts are temporary and short-term as construction works are expected to continue for a period of approximately 12-15 months.				
Impact Extent	**Local**	Regional	National	International	
	The impact is expected to be restricted to the Project site. Given the distance of 15km between the Project site and Kattakurgan Water Reservoir IBA (at its closest point), and the lack of habitat connectivity or potential pathways between the IBA and the Project site, there is no reasonable likelihood of significant direct or indirect impacts. This assessment is consistent with the TYPSA/IFC Scoping Report (2020), which states: 'Many species of birds stop to rest and feed during spring and autumn migration, but, after consultation with Birdlife International and ornithological experts (IBA Programme since 2008) none of the species for which the IBA site was designated use the proposed Project area .				
Receptor Value / Sensitivity	Negligible	**Low**	Medium	High	
	The Solar PV footprint supports a limited assemblage of breeding species which are not of international or national conservation concern. This ornithological receptor has been assessed as Low value.				
Impact Magnitude	No change	Negligible	Low	**Medium**	High
	The magnitude of the effect for the Solar PV site is predicted to be Medium given the area of the site that will require to be cleared and / or disturbed and that there is potential for loss/damage to eggs and nests of common ground nesting birds if site clearance occurs during the breeding bird season. The magnitude of the effect for the Overhead Line is				

Impact Assessment: Impacts on ornithology (non PBF species) during construction					
	expected to be Low as the areas to be cleared within the respective pylon footprints will be very localised. Therefore, the magnitude of the effect for the Project site is assessed as Medium (overall).				
Impact Significance	None	Negligible	Low	Medium	High
	As a result, the impact is assessed as Low and not significant, however it is recommended standard mitigation measures are implemented to ensure impacts remain minimal[84].				

7.1.3.2 Terrestrial Ecology

Construction will cause the loss of habitat as well as disturbance in the adjacent areas. However, the natural vegetation at the Project site has been substantially altered by farming and irrigation. Due to the high level of anthropogenic disturbance to the natural vegetation and limited diversity on the Project site, there is little natural ecosystem function demonstrated by the site and it is therefore not considered a sensitive area.

The existing habitat within the Solar PV site and OHL is considered to be Modified Habitat as defined in PS6. For the Solar PV it is expected that there will be limited removal of vegetation during construction as it mainly consists of low growing species. Based on the initial site design, a total of 5.4 ha land would be cleared or just under 1.3% of the overall site area. This area currently does not include land required for internal access roads.. No vegetation removal is planned outside this area. For the construction of the OHL the removal of the intensively cultivated habitat will be very localised at the locations of the respective pylon locations.

Potential Impacts

Loss, degradation or fragmentation of species habitat

During site preparation, construction of project infrastructure (Solar PV and OHL pylons) will result in the direct loss of disturbed (cultivation) habitat, which is a habitat for faunal species, including Central Asian tortoise. It is expected that construction activities will be restricted to areas within the immediate project footprint.

Construction of project infrastructure within the Solar PV will result in direct loss of habitat, which is used by Central Asian tortoise. Project activities during this phase may result in loss of connectivity between habitat areas for tortoises and other faunal species due to construction activities, as well as degradation of this connecting habitat. No bat roosts or potential roosts are located within the proposed working footprint or within at least 10m radius of the Solar PV or pylons; given the temporary nature of the construction works and the expected low level of noise which will be generated, a standoff zone of at least 10m from any building that may support a bat roost in settlements lying adjacent to the project site, is judged to be large enough to ensure no potential disturbance impacts on any potential bat roosts that may exist outside the project site boundary. It is expected that no general site lighting at night will be required during construction works; there are no significant adverse impacts on foraging nocturnal fauna (including bats) during the construction of the Solar PV.

Temporary disturbance/ displacement/ degradation of habitat

Faunal species, including tortoises, are likely to be disturbed by the presence of people in the landscape, vehicle movements, noise and vibration from various stages of the project. As with other faunal species, the greatest potential for disturbance will be during site clearance and construction phases, particularly during site activities such as access road creation, earth moving and other excavations.

Vibration impacts on fauna within the ZoI of the project is not considered to be perceptible as a result of the project and no further assessment is required.

Direct mortality/injury

There is the potential for faunal species (including Central Asian tortoise) to be killed or harmed by machinery and/or vehicle collisions during the construction phase of the project.

[84] For example: NetRegs (2020). Guidance for Pollution Prevention (GPP). Available at: https://www.netregs.org.uk/environmental-topics/pollution-prevention-guidelines-ppgs-and-replacement-series/guidance-for-pollution-prevention-gpps-full-list/

Population changes
Project related human activity within the Solar PV and OHL habitat areas may impact on population growth of faunal species (including Central Asian tortoise) due to hunting/take, disturbance and loss of suitable habitat.

Hydrological alteration of habitat
No significant adverse effects on terrestrial habitats and fauna are expected within the ZoI for habitats and fauna during the construction phase.

Impact Assessment: Impacts on terrestrial ecology (PBF species) during construction – Central Asia Tortoise and Tatar Sand Boa					
Impact Nature	Positive			Negative	
	Impact is negative because construction activities may result in habitat loss and disturbance.				
Impact Type	Direct		Indirect	Reversible	Irreversible
	The impact is generally direct as habitat will be lost through construction activities (e.g. ground clearance to accommodate infrastructure associated with the Solar PV and transmission line [pylons]), this could include direct destruction or damage of fauna and flora. In addition, disturbance caused by construction activities may directly displace/disturb fauna. Construction vehicles and excavated areas can pose a risk of death or injury to fauna.				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent
	Initial topsoil stripping will take place during the first 1-2 months of construction within the parts of the Project Site required for permanent compounds and hard standing. The impact is permanent as there would be an irreversible change to the baseline within the Project site for the lifetime of the Project. Displacement impacts are temporary and short-term as construction works are expected to continue for a period of approximately 12-15 months.				
Impact Extent	Local		Regional	National	
	The impact is expected to occur within the Project site. Given the distance of 15km between the Project site and Kattakurgan Water Reservoir IBA (at its closest point), and the lack of habitat connectivity or potential pathways between the IBA and the Project site, there is no reasonable likelihood of significant direct or indirect impacts.				
Receptor Value / Sensitivity	Low		Medium	High	
	A single species of conservation concern was recorded: Central Asian tortoise (IUCN VU, Red Data Book of Uzbekistan). However, there is no reasonable likelihood that the tortoise population occurring within the Project site is of regional importance as the modified cultivated habitats within the site supports a population size which is very low and does not exceed 0.1 individuals/hectare, which is significantly lower than for areas of Uzbekistan which support the highest population densities. There are anecdotal records of tatar sand boa within the Solar PV site, but there is no reasonable likelihood that regionally significant populations occur as the modified habitat does not represent optimal for this species. The sensitivity of this receptor is assessed as Low overall.				
Impact Magnitude	No change	Negligible	Low	Medium	High
	The magnitude of the effect is predicted to be Medium given the area of the Solar PV site that will require to be cleared and / or disturbed and there is the potential for loss/mortality of these PBF reptile species.				

Impact Assessment: Impacts on terrestrial ecology (PBF species) during construction – Central Asia Tortoise and Tatar Sand Boa					
	The magnitude of the effect for the Overhead Line is expected to be Low, as the areas to be cleared within the respective pylon footprints will be very localised. Therefore, the magnitude of the effect for the Project site is assessed as Medium (overall).				
Impact Significance	None	Negligible	**Low**	Medium	High
	As a result, the impact is assessed as Low (overall) and not significant. There is a requirement for the project to achieve No Net Loss of species defined as PBFs				

Impact Assessment: Impacts on other terrestrial ecology (non PBF species) during construction					
Impact Nature	Positive			**Negative**	
	Impact is negative because construction activities may result in habitat loss and disturbance.				
Impact Type	**Direct**		Indirect	Reversible	**Irreversible**
	The impact is generally direct as habitat will be lost through construction activities (e.g. ground clearance to accommodate infrastructure associated with the Solar PV and transmission line [pylons]), this could include direct destruction or damage of fauna and flora. In addition, disturbance caused by construction activities may directly displace/disturb fauna. Construction vehicles and excavated areas can pose a risk of death or injury to fauna.				
Impact Duration	**Temporary**	**Short-term**	Medium-term	Long-term	**Permanent**
	Initial topsoil stripping will take place during the first 1-2 months of construction within the parts of the Project Site required for permanent compounds and hard standing. The impact is permanent as there would be an irreversible change to the baseline within the Project site for the lifetime of the Project. Displacement impacts are temporary and short-term as construction works are expected to continue for a period of approximately 12-15 months.				
Impact Extent	**Local**		Regional	National	
	The impact is expected to occur within the Project site. Given the distance of 15km between the Project site and Kattakurgan Water Reservoir IBA (at its closest point), and the lack of habitat connectivity or potential pathways between the IBA and the Project site, there is no reasonable likelihood of significant direct or indirect impacts.				
Receptor Value / Sensitivity	**Low**		Medium	High	
	The abundance and diversity of terrestrial fauna within the Solar PV site and Overhead Line route was found to be low. The AECOM 2021 and 2022 field surveys confirmed that the plant and animal species (other than PBF reptile species) recorded within the proposed project site during the AECOM field surveys are not of conservation concern. The sensitivity of the terrestrial habitat within the Solar PV has therefore been assigned as Low in terms of faunal species. The historic (within the last 20 years) and the more recent (within the last 5 years) cultivated land that prevails within the Solar PV site is Modified Habitat as defined in PS6. Spiny cocklebur and Isirik are noxious weeds and are prominent components of the weed flora; the former is an introduced species. The OHL route crosses intensively cultivated				

Impact Assessment: Impacts on other terrestrial ecology (non PBF species) during construction					
	and irrigated farmland habitat, with cropped fields (eg, cotton); it is Modified Habitat as defined in PS6. The habitat within the Project site is therefore assessed as Low sensitivity.				
Impact Magnitude	No change	Negligible	Low	Medium	High
	The magnitude of the effect is predicted to be Medium given the area of the Solar PV site that will require to be cleared and / or disturbed and the potential for loss/mortality of reptiles and small mammals. The magnitude of the effect for the Overhead Line is expected to be Low, as the areas to be cleared within the respective pylon footprints will be very localised. Therefore, the magnitude of the effect for the Project site is assessed as Medium (overall).				
Impact Significance	None	Negligible	Low	Medium	High
	As a result, the impact is assessed as Low (overall) and not significant. A suite of both standard mitigation measures[85] and species-specific mitigation measures will be implemented to ensure impacts are reduced to Low significance or below.				

7.1.4 Geology and Soils

7.1.4.1 General

The main impact on soils during construction will be the potential for soil contamination from spills and leaks and increase in vulnerability to erosion. Soil compaction and loss of limited vegetation present increases in the soils' vulnerability to erosion. Soils will be particularly vulnerable when wet (i.e. during snowmelt or heavy rain), when vehicle traffic is likely to cause the greatest damage.

Where roads are un-surfaced, rutting and gully erosion eventually make the roads impassable so that vehicles drive off the track and the area affected by erosion continually widens.

The following types of construction activity could lead to potential soil erosion:

- Vehicle traffic along dirt tracks used during construction of on- and off-site roads, power lines, control centre and solar panels will cause soil compaction.
- Off-road vehicle traffic will damage vegetation and cause soil compaction.
- Any vegetation and some soil will be removed for the control centre, solar panel foundations, transmission towers, and both on- and off-site roads.
- The use of heavy equipment will cause soil compaction if used outside designated roads.
- Soil erosion from increased water run-off, can cause sediment release to nearby water bodies.
- Ability of soils to support foundations.

Soil compaction and loss of limited vegetation present increases in the soils' vulnerability to erosion. Soils will be particularly vulnerable during the rainy seasons, when vehicle traffic is likely to cause the greatest damage.

Where roads are un-surfaced, rutting and gully erosion eventually makes the roads impassable so that vehicles drive off the track and the area affected by erosion continually widens.

7.1.4.2 Ground conditions

Electrical equipment (transformers, inverters, electrical switchgear) heavy duty equipment and ancillary buildings (office building, meteorological towers) are usually earthed by means of surface mats.

[85] For example: NetRegs (2020). Guidance for Pollution Prevention (GPP). Available at: https://www.netregs.org.uk/environmental-topics/pollution-prevention-guidelines-ppgs-and-replacement-series/guidance-for-pollution-prevention-gpps-full-list/

The existence of weak soils up to a depth of around 15 meters, suggests the likely existence of partial collapsible areas that could develop until reaching the surface.

It is considered that collapse behaviour can take place within this superficial unit in different areas of the PV parcel.

Consequently, it is not advisable to rely on the strength of this soil to support any foundation but to undertake ground improvement treatment.

Impact Assessment: Impacts on soil quality during construction					
Impact Nature	Positive			Negative	
	Reduction in local soil quality as a result of construction activities causing erosion related to increased water run-off, soil compaction and loss of limited vegetation. Soil quality can also be negatively affected by spillage of oils during maintenance of machinery, improper storage of hazardous materials, spillage during transfers of fuel and improper disposal of waste.				
Impact Type	Direct		Indirect	Reversible	Irreversible
	The impact is generally direct as soils / geology resources will be affected through construction activities.				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent
	The impact is short-term as construction works are expected to continue for a period of approximately 18 months.				
Impact Extent	Local		Regional	National	
	The impact is expected to occur within the site and sedimentation/oil or chemical release would be at a local level only.				
Receptor Value / Sensitivity	Negligible	Low		Medium	High
	The sensitivity of soils in the Project area is assessed as Low. The poor quality of the soils to support agriculture has resulted in the cessation of wheat production on the site. No evidence of erosion or mudflows were identified during site surveys. Whilst it is recognised that soils will be most vulnerable during high rainfall and snowmelt, the limited geographical extent and poor quality does not justify higher sensitivity.				
Impact Magnitude	No change	Negligible	Low	Medium	High
	The magnitude of the effect is predicted to be Low, given that there is potential for construction activities to notably change the resource, particularly during rainy season. Impacts of fuel spills are deemed to be highly localised.				
Impact Significance	None	Negligible	Low	Medium	High
	As a result, the significance of the impact is assessed as Low. The extent of reduced soil quality due to construction activities is considered local, and the duration assessed as being temporary and short-term.				

7.1.5 Hydrology and Hydrogeology

7.1.5.1 Surface Water

There are no permanent waterbodies within the Solar PV Site. Permanent watercourses nearest to the Solar PV Site boundary are the Zarafshan lead canal and Zarafshan River, approximately 850m and 1.8km north of the site, respectively.

Surface water may be subject to reduction in quality should proper mitigation not be implemented. The waterbodies adjacent to the site are currently used as a source of irrigation water.

During construction, earthworks, road construction and use of heavy vehicles could alter surface drainage patterns. The removal of vegetation and compaction of soils will reduce infiltration and surface run-off will increase. The risk is greatest during severe precipitation events, which are most likely to occur in spring. The increased volume of water flowing into drainage channels is likely to cause additional soil erosion. Surface run-off

will also contain higher concentrations of suspended sediments during construction than would otherwise be the case. Other potential sources of pollution during construction comprise leaks and spills of oils from machinery and discharge of sanitary waste and wastewater.

There is a historic collector (drainage gully) that runs across the northern part of the site. AECOM understand that the man-made gullies across the site would be filled in for the project however this would be confirmed by Masdar and the EPC Contractor as part of detailed design. The detailed design would also include details of the proposed surface water drainage system.

Impact Assessment: Impacts on surface water during construction					
Impact Nature	Positive			Negative	
	Impact is negative because construction activities may generate pollutants that reduce the quality of surface water used for irrigation.				
Impact Type	Direct	Indirect		Reversible	Irreversible
	The impact is generally direct and potential sources of pollution to surface water during construction comprise leaks and spills of oils from machinery and discharge of sanitary waste and wastewater which may subsequently run off to nearby surface water bodies. Surface water run-off may have a higher sediment load. The localised nature of spills likely to be experienced can be addressed through standard construction practises including appropriate drainage and containment. Pollution risks will continue during the construction phase.				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent
	The impact is short-term as construction works are expected to continue for a period of approximately 18 months.				
Impact Extent	Local	Regional	National		
	The impact is expected to occur within the site and run-off from potential spills or sediment would be at a local level only. Chemicals and fuels are not stored in sufficient quantities to result in a spill of regional importance.				
Receptor Value / Sensitivity	Negligible	Low	Medium	High	
	The sensitivity of surface water is assessed, recognising that the Zarafshan lead canal feeds the Kattakurgan reservoir, which is a source of irrigation water.				
Impact Magnitude	No change	Negligible	Low	Medium	High
	The magnitude of the effect is predicted to be low given the limited area of the Project site in relation to the overall catchment area.				
Impact Significance	None	Negligible	Low	Medium	High
	As a result, the significance of the impact is assessed as Low. The extent of reduced surface water quality due to construction activities is considered local, and the duration assessed as being temporary and short-term. Nevertheless, Good International Industry Practise pollution prevention measures will be implemented.				

7.1.5.2 Groundwater

The amount of water required during construction is estimated at 45,840 m3. The source of water required for construction has not yet been determined.

Local communities within the vicinity of the Project use wells for drinking water.

Potential sources of pollution to groundwater during construction comprise leaks and spills of oils from machinery and discharge of sanitary waste and wastewater. During construction, sanitary waste will be collected in containers below portable toilets and transported to a registered waste disposal facility for disposal. Storage and handling procedures for oils and other chemicals will be required to minimize risk of pollution.

Potential impacts on groundwater include:

- Accident/ unplanned event: Groundwater could be contaminated through accidental fuel spills.

- Accident/ unplanned event: Depending on the method of waste disposal, impacts could be felt on surface or groundwater, flora and fauna and/ or local communities.

Impact Assessment: Impacts on groundwater during construction					
Impact Nature	Positive			Negative	
	Impact is negative because construction activities may generate pollutants that reduce the quality of groundwater used by local residents for domestic purposes.				
Impact Type	Direct	Indirect	Reversible	Irreversible	
	The impact is generally direct and potential sources of pollution to groundwater during construction comprise leaks and spills of oils from machinery and discharge of sanitary waste and wastewater. The localised nature of spills likely to be experienced can be addressed through standard construction practises including appropriate drainage and containment. Pollution risks will continue during the construction phase.				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent
	The impact is short-term as construction works are expected to continue for a period of approximately 18 months.				
Impact Extent	Local	Regional	National		
	The impact is expected to occur within the site and run-off from potential spills would be at a local level only. Chemicals and fuels are not stored in sufficient quantities to result in a spill of regional importance.				
Receptor Value / Sensitivity	Negligible	Low	Medium	High	
	The sensitivity of groundwater is assessed as low, recognising that groundwater is abstracted by only two farmers who have been offered alternative land.				
Impact Magnitude	No change	Negligible	Low	Medium	High
	The magnitude of the effect is predicted to be low, given that the depth of the groundwater is greater than 15 m and is likely to be considerably deeper.				
Impact Significance	None	Negligible	Low	Medium	High
	The potential impact during construction is considered to be Low adverse, on the basis that only two farmers abstract groundwater for their use. The implementation of Good International Industry Practise pollution prevention measures is considered to make the contamination of groundward very unlikely.				

7.1.6 Labour and Working Conditions

A sound worker-management relationship is a key requirement of the Project and a constructive worker-management relationship, by treating the workers fairly and providing them with safe and healthy working conditions, is required to ensure protection of the fundamental rights of workers.

The implementation of the actions necessary to meet these requirements will be managed through the Project's Environmental and Social Management System (ESMS).

The requirements apply to workers directly engaged by the client (direct workers), workers engaged through third parties to perform work related to the Project.

The aim of the Project's policies on labour and working conditions will be:

- To promote the fair treatment, non-discrimination, and equal opportunity of workers especially vulnerable workers facing particular risks due to context-specific socioeconomic characteristics..
- To establish, maintain, and improve the worker-management relationship.
- To promote compliance with national employment and labor laws.
- To protect workers, including vulnerable categories of workers such as children, migrant workers, workers engaged by third parties, and workers in the client's supply chain.

- To promote safe and healthy working conditions, and the health of workers.
- Zero tolerance for the use of forced labour and child labour.
- Respecting the principles of freedom of association and collective bargaining.
- Ensuring that accessible and effective means to raise and address workplace concerns are available to workers.

During the construction phase, there may be occupational health and safety risks to workers from the various operation and maintenance activities expected to take place for the Project. Key risks could include, *inter alia*, collision with vehicles and plant and exposure to a variety of hazards such as electric shock from exposed cables and thermal burn hazards and exposure to chemicals, hazardous or flammable materials.

Labour and working conditions, including occupational health and safety impacts, are considered to be of medium-term duration throughout the construction phase and are expected to be of potential high magnitude and high sensitivity as in extreme cases they could entail permanent impacts (e.g. death or permanent disability). As such, the impacts are considered to be of High impact and appropriate mitigation will be developed.

Impact Assessment: Occupational health and safety impacts during construction					
Impact Nature	Positive			Negative	
	There will be a range occupational health and safety risks throughout construction activities. This includes risk of injury, collision with plant and equipment, electrocution, thermal burn hazards, exposure to hazardous chemicals and working in extreme temperatures. Mismanagement of wastes (such as domestic solid waste, sewage and hazardous wastes) can also represent a health and safety risk to workers, such as disease, injury or death.				
Impact Type	Direct			Indirect	
	The risks are predominantly associated with direct impacts on the operational and maintenance workers due to the operation of the Project. Health and safety risks associated with waste mismanagement are considered indirect impacts. The Project's policies on labour and working conditions will further impact worker's income and wellbeing.				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent
	The impacts will persist throughout the 18 month construction timeline and are therefore considered medium-term.				
lImpact Extent	Local		Regional	National	
	The impacts will be limited to the project site and local area.				
Receptor Value / Sensitivity	Low	Medium		High	
	The receptors in this case are the operational workers. There are likely to be up to 1,000 workers at the peak and all are considered high value/sensitivity.				
Impact Magnitude	No change	Negligible	Low	Medium	High
	Occupational health and safety impacts could result in disease, injury, or death to workers and so the magnitude is high.				
Impact Significance	None	Negligible	Low	Medium	High
	Pre-mitigation, the impact is assessed as High and significant. An independent Labour Assessment shall be undertaken by a qualified labour specialist, which shall include a corrective action plan with appropriate mitigation and remediation measures as well as monitoring requirements that will be implemented by the Project and its subcontractors.				

7.1.7 Landscape and Visual

7.1.7.1 Impacts on Landscape Character and Visual Amenity

These include areas for temporary works, construction compounds, access road and on-site roads, areas for solar PV panels, substations and transformer stations, on-site and off-site transmission lines. New machinery and equipment will be introduced into the landscape, including heavy goods vehicles excavators, bulldozers, and other heavy equipment.

Impact Assessment: Impacts on Landscape Character					
Impact Nature	Positive			Negative	
	Impact is negative because construction activities will result in additional features within the landscape. It is assumed that all Project related changes are negative in nature.				
Impact Type	Direct		Indirect	Reversible	Irreversible
	The impact is generally direct and experienced within 5km of the Project site. The impact will continue for the duration of the Project and is therefore deemed to be irreversible.				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent
	The construction impact is short-term as construction works are expected to continue for a period of approximately [HOLD – TBC] months. However impact will continue for the duration of the Project lifetime.				
Impact Extent	Local		Regional	National	
	It is assessed that only a small proportion of the local landscape will be affected by the presence of construction works, topsoil stripping and bare ground.				
Receptor Value / Sensitivity	Negligible	Low	Medium	High	
	The sensitivity this landscape is assessed to be Low as it is not important in a local context. It is noted that the landscape is not designated at the local or national level and is influenced by man-made features.				
Impact Magnitude	No change	Negligible	Low	Medium	High
	The magnitude of the effect is predicted to be low, as it is unlikely that construction works become the dominant feature in an area already impacted by human activity.				
Impact Significance	None	Negligible	Low	Medium	High
	As a result, the significance of the impact is assessed as Low. Although impacts will be visible in places, the surrounding features such already include man-made features. Therefore, changes can be easily accommodated.				

Impact Assessment: Impacts on Visual Amenity					
Impact Nature	Positive			Negative	
	Impact is negative because construction activities will result in additional features within the landscape. It is assumed that all Project related changes are negative in nature.				
Impact Type	Direct		Indirect	Reversible	Irreversible
	The impact is generally direct and experienced within 5km of the Project site. The impact will continue for the duration of the Project and is therefore deemed to be irreversible.				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent
	The construction impact is short-term as construction works are expected to continue for a period of approximately 18 months. However, impact will continue for the duration of the Project lifetime.				
Impact Extent	Local		Regional	National	
	It is assessed that the views experienced will include OHLs and pylons, roads, substation and other man made structures which reduce the quality of the views experienced.				
Receptor Value / Sensitivity	Negligible	Low	Medium	High	
	The sensitivity of the site is assessed to be Medium at VP1 and assessed as the worst case. The land at which the Project is located is flat, with very few trees, hedges or fences				

Impact Assessment: Impacts on Visual Amenity					
	to obscure visibility, and as such visibility can extend for several kilometres. This applies to VP1 on the western site. Sensitivity is low at Vp2 and VP3 to the east and north.				
Impact Magnitude	No change	Low	Medium	High	
	The magnitude of the effect is predicted to be low, because the visual impact of ground-level features is likely to be low, except at close range, due to the lack of vantage points overlooking the landscape.				
Impact Significance	None	Negligible	Low	Medium	High
	As a result, the significance of the impact is assessed as Low. Although impacts will be visible in places, the surrounding features are often of a larger scale in height and extent. Therefore, changes can be easily accommodated.				

7.1.8 Noise

Noise pollution may result from the large workforce and construction activities, particularly the movement of trucks used to carry material to the site and removal of debris. Some heavy earth moving, and compacting machinery may be required for brief periods during construction but it is expected that much of the civil work will involve manual labour. Work will not take place at night.

The Project impacts may include:

- Truck and vehicle traffic along main transport/access routes will create noise and vibration that may increase ambient noise levels.
- Construction equipment and machinery could create noise and vibrations that may increase ambient noise levels.

Typical construction for a solar development does not produce significant noise issues due to the small number of plant items, the relative size of the development and typical distance to the nearest NSRs.

A construction noise assessment has been undertaken based on British Standard BS5228-1:2014 assuming the construction of the control building / transformers and inverters as a worst-case construction noise scenario.

Construction noise will be temporary and short term. The construction noise assessment is provided in Table 7-1 below. When compared with the relevant noise limit set out above it can be seen that generally the project will meet construction noise limits with the exception of ground preparation works which have the potential to exceed the construction noise limits by 4 dB. Ground preparation works are considered to be short term, and further micrositing will be undertaken as part of detailed design to ensure construction noise impacts are minimised and equipment is located as far as possible from NSRs. This assessment assumes the use of heavy machinery, as detailed in Table 7-1.

Table 7-1: Construction Noise Assessment

Phase	Sound Power Level at Source (BS5228:2014)	Noise Level at NSR (assumed 200 m distance)
Ground preparation.	Dumper truck 118 dB SWL. Backhoe excavator 99 dB SWL.	64 dB
Concrete preparation.	Cement mixer (petrol or diesel) 92 dB SWL.	38 dB
Installation of transformer and invertor.	Delivery truck (4axle wagon) 110 dB SWL. Mobile telescopic crane (50t) 67dB spl 98 dB SWL.	56 dB

This may be updated following completion of detailed design and agreement of access to site.

Impact Assessment: Impacts on noise during construction					
Impact Nature	Positive			Negative	
	Impact is negative because construction activities may result in increased noise and air pollution.				
Impact Type	Direct		Indirect	Reversible	Irreversible
	The impact is direct as construction activities would directly increase noise levels.				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent
	The impact is temporary as impacts would occur during the construction phase only.				
Impact Extent	Local		Regional	National	
	The impact is expected to occur within the site and adjacent areas.				
Receptor Value / Sensitivity	Negligible	Low	Medium	High	
	No residential receptors are located within 200 m of the Project site therefore now exceedances of noise levels are predicted. The closest property is 225m to the west of the site boundary and receptor sensitivity is determined to be Medium.				
Impact Magnitude	No change	Negligible	Low	Medium	High
	Magnitude of change is anticipated to be Low as the increase in noise levels associated with construction of the Project is predicted to be within IFC limits for construction noise at nearby residential receptors.				
Impact Significance	None	Negligible	Low	Medium	High
	The potential impact during construction is considered to be Low adverse, on the basis that no residential receptors are within 200m of the site boundary. The implementation of Good International Industry Practice pollution prevention measures is considered very likely to reduce the impacts further.				

7.1.9 Socio-economic Impacts

Based on the pathways described above, the following potential impacts were scoped in as the most relevant for the AoI and the socio-economic receptors.

- Community expectations of the Project
- Economic displacement
- Capacity strain contribution to local public services and facilities
- Loss of public access and reduced mobility through local paths
- Reduced access to grazing and pastoral land
- Increased presence of workers and interaction with local communities
- Increased presence of security personnel
- Increased levels of gender-based violence, sexual exploitation and harassment

These will be described below. Increased road traffic will be detailed in the following section as a specific potential impact. Unplanned events are described below.

7.1.9.1 Community expectations of the Project

Local communities and the local economically active population may develop high expectations of the direct or indirect benefits of the Project, specifically regarding the number of work opportunities available. High expectations for jobs for the local communities will need to be continually managed from the early stages to avoid unrealistic Project expectations. It is proposed that a Local Recruitment and Employment Plan be developed to maximise employment opportunities for the local communities.

Impact Assessment: Community expectations of the Project				
Impact Nature	Positive		Negative	
	Impact is negative because unmanaged expectations may lead to heightened concerns / conflict with the local community that may ultimately negatively affect the Project's social license to operate.			
Impact Type	Direct	Indirect	Reversible	Irreversible
	The impact is both direct and indirect as the Project will be announced and presented both as part of the regulatory process in the AoI and through the Project's own Stakeholder engagement efforts. It is also indirect because local stakeholders may disseminate expectations about the Project before it is formally disclosed. It is, however, reversible with robust stakeholder engagement.			
Impact Duration	Short-term	Medium-term	Long-term	Very Long-term
	The impact is short-term as potential expectations will likely be highest in the lead up to the start of construction works but are not likely to continue beyond that. It is highly unlikely that expectations will be high during the operational phase.			
Impact Extent	Local	Regional	National	
	Given the high-level publicity surrounding the Project, the impact is expected to occur at a regional level in Kattakurgan.			
Impact Magnitude	Negligible	Low	Medium	High
	Kattakurgan is a predominantly rural area and thus its population may not have a clear understanding of the employment opportunities created by industrial development. However, the levels of unemployment in the Kattakurgan region are low and therefore expectations may be higher than at the regional level. Therefore, the impact magnitude is medium at the local level (<10km) but reducing to Low at the regional level.			
Receptor Value / Sensitivity	Negligible	Low	Medium	High
	The receptor value is low given that local communities and local economically active population are not depending on this Project specifically as their main source of income. However, this impact has the potential to increase unmanaged expectations among the unemployed and more vulnerable groups.			
Impact Significance	Negligible	Low	Medium	High
	The overall impact significance is Low. This is an adverse impact and the ongoing consultation and dissemination of Project information will be included in the Stakeholder Engagement Plan currently under development. This impact will be continuously managed throughout the construction phase (and ongoing operation phase).			

7.1.9.2 Economic displacement

The Solar PV Area[86] is used by four communities to herd livestock and collect animal feed. There are nine known herds from the four communities which are regularly taken to the Solar PV Area by community herders or professional herders. While the project will not eliminate community grazing areas, the majority of the area will no longer be accessible, and the remaining areas to the north and east will not be sufficient to sustain the current level of grazing.

Most of the land required for the OHTL falls into four Sub-Lease Agreements belonging to four households: the Project will require both permanent and temporary land take from these Sub-Lease Agreements.

Impact Assessment: Economic displacement		
Impact Nature	Positive	Negative
	Impact is negative because economic displacement would negatively affect a person's livelihood.	

[86] It should be noted that the land within the Solar PV area was previously occupied by five historic leaseholders and the historic impact of land acquisition has been investigated and mitigated through the Land Acquisition Audit (LAA) and the Livelihood Restoration Plan (LRP), and it is not the subject of this assessment.

Impact Assessment: Economic displacement				
Impact Type	Direct	Indirect	Reversible	Irreversible
	The impact is direct because the Project may occupy land previously used for farming/grazing.			
Impact Duration	Short-term	Medium-term	Long-term	Permanent
	The impact is permanent as it would be in place for the full project lifetime.			
Impact Extent	Local	Regional	National	
	The impact may occur at a local level within the site boundary, including the OHTL, and immediate surroundings.			
Impact Magnitude	Negligible	Low	Medium	High
	The impact magnitude is Medium as there is the potential to result in economic resettlement, particularly of herders.			
Receptor Value / Sensitivity	Negligible	Low	Medium	High
	The receptor value is Low for leaseholders along the OTL given they will have sufficient land remaining. However herders will have limited alternative land and so the receptor value is high.			
Impact Significance	Negligible	Low	Medium	High
	The overall impact significance is High and specific mitigation in the form of cash compensation and livelihood restoration has been developed as part of the LRP.			

7.1.9.3 Loss of public access and reduced mobility through local paths

A boundary fence line shall be installed at the start of construction activities to prevent the entry of unauthorised personnel into working areas to maintain public health and safety. From the moment the fences are erected, local people from the AoI will lose access to footpaths inside the Project site. This shall result in longer time periods being required to move between locations when the footpaths are generally used. Of note, this impact does not relate to potential economic impacts (described above) or legal land lease aspects, but to the loss of informal mobility access in local paths.

Impact Assessment: Impacts from a loss of public access to footpaths inside the project area				
Impact Nature	Positive	Negative		
	Impact is negative as there will be a loss of access by footpaths into the Project area.			
Impact Type	Direct	Indirect	Reversible	Irreversible
	The impact is direct because local people shall no longer be able to access the roads/footpaths to travel. Users will no longer be travelling inside the Project area as access to this land shall be lost. This impact is Irreversible as users will no longer have access though the site during the project lifetime.			
Impact Duration	Short-term	Medium-term	Long-term	Very Long-term
	The impact is considered to be long term as the as the Project design does not have an alternative community pathway which will allow community members and their herds to cross the area during the lifetime of the project.			
Impact Extent	Local	Regional	National	
	The impact will occur at a local level only as the restrictions to land shall most likely impact people within 2 km of the site boundary.			
Impact Magnitude	Negligible	Low	Medium	High
	The impact magnitude is Low as the limited number of people who currently use the dirt tracks will be able to access alternative tracks or roads to reach their destination.			
	Negligible	Low	Medium	High

Impact Assessment: Impacts from a loss of public access to footpaths inside the project area				
Receptor Value / Sensitivity	The receptor value is Medium given that local communities and local herders rely on these pathways for access to livelihoods.			
Impact Significance	Negligible	Low	Medium	High
	The impact is assessed as Low adverse, primarily because the local farm users may need to adapt and readjust to their new timings and distances compared to baseline conditions.			

7.1.9.4 Reduced access to grazing and pastoral land

This impact will commence at the start of construction as working areas are fenced off to prevent unauthorised entry inside the site boundary. The change in land use in the Project area may result in change in local livelihoods mainly as a result of the reduction in available grazing area and reduction in income.

- Site clearing and grading will affect farming activities in the area.
- Transportation of waste from the site and materials and equipment by road may disrupt local livelihoods.

Within areas where construction works are ongoing, spatial impacts to access to grazing and pastoral land (in contrast to distance and time-altering impacts from the mobility impact above) will occur arising from a loss of access to grazing and pastoral land.

Impact Assessment: Reduced access to grazing and pastoral land				
Impact Nature	Positive		Negative	
	Impact is negative as existing land users shall experience a reduction of access to typical livelihood areas due to the restrictions in access to the land within the site boundary. No physical displacement will occur.			
Impact Type	Direct	Indirect	Reversible	Irreversible
	The impact is direct because the local farms will no longer be able to access land inside the Project area during the Project life cycle. Resulting impacts are reversible after the Project's decommissioning stage or after an alternative land is procured.			
Impact Duration	Short-term	Medium-term	Long-term	Very Long-term
	The impact is very long-term as land users will not be able to conduct pastoral activities inside the Project area from the moment fences are installed along the site boundary during the Project's lifetime			
Impact Extent	Local	Regional	National	
	Impacts associated with a loss of access to land will likely only affect those within the Project AoI.			
Impact Magnitude	Negligible	Low	Medium	High
	The impact magnitude is Medium because no grazing will be available of the Solar PV area and grazing area will be significantly reduced as there is limited alternative grazing land. Local herders may need to adapt to a new farming area and will need to travel around the Solar PV Area to access alternative grazing areas.			
Receptor Value / Sensitivity	Negligible	Low	Medium	High
	The receptor's sensitivities is High as herders will require alternative land.			
Impact Significance	Negligible	Low	Medium	High
	The impact is assessed as High significance primarily because the local herders will need to adapt and readjust to their new timings and distances to access grazing land compared to baseline conditions. This will be assessed further as part of the LRP..			

7.1.9.5 Increased presence of workers and interaction with local communities

Community H&S may be at risk from worker migration and the presence of workers in the Project area, resulting in a potential change in the disease profile of the local population. A more robust social baseline study will expand on communicable disease morbidity, crime incidence .

It is fundamentally important that the Project fully considers the COVID-19 risks as communicable respiratory diseases will most likely be the most significant concern for potential interactions between the workforce and community members. Local workers may be exposed to potential COVID-19 risks where they are employed on the workers' camp. In turn this could result in further spread of COVID-19 back to the local community. A detailed assessment will be undertaken once more information on the workforce numbers, composition, and accommodation is available. While the full details of the workforce have not been provided yet, the mitigation measures to avoid and reduce risk exposure will be implemented, as detailed in the Interim Advice for IFC Clients on Preventing and Managing Health Risks of COVID-19 in the Workplace (IFC, 2020).

Impact Assessment: Increased presence of workers and interaction with local communities				
Impact Nature	Positive		Negative	
	This is an adverse impact because of the potential for people from outside the local area to turn up seeking employment and other types of economic opportunities. The Project workers will also be exposed to H&S risks. This may result in an increased risk and exposure to spreading communicable diseases, increased tensions between residents and newcomers, and may result in an increase in the local incidence of crime, in addition to potential surges of COVID-19 risks.			
Impact Type	Direct	Indirect	Reversible	Irreversible
	The impact is direct and indirect because the Project will cause potential local employment that will attract direct and indirect opportunities and other potential worker migration. This is largely Reversible once the construction phase is concluded.			
Impact Duration	Short-term	Medium-term	Long-term	Very Long-term
	The impact is short-term as community health and safety risks will be introduced from the start of the construction phase and although there will be residual risks throughout operation of the project, no significant worker migration is expected. Depending upon the type of incident and impact to human health, the duration could be medium-term. Workers' accommodation will further restrict the movement and interaction of workers with local communities outside the site, and the workers' camp will implement COVID-19 prevention measures within its quarters.			
Impact Extent	Local	Regional	National	
	Risks will be generated at a local level within the AoI.			
Impact Magnitude	Negligible	Low	Medium	High
	The impact magnitude is Medium because the potential for workers to travel and interact with local residents may extend past the Project AoI. Both residents and workers may be exposed to increased health and safety risks.			
Receptor Value / Sensitivity	Negligible	Low	Medium	High
	The sensitivity is Medium as the local communities may be able to adapt to this change depending on the actual location of worker accommodation. Whereas Kattakurgan will have sufficient means to adapt, other localities such as may not have the same resilience to intake a large workforce or prevent their vulnerable groups from this potential increase to community H&S risks. Depending on the workforce composition, vulnerable worker population may be more sensitive to avoiding or treating communicable diseases, and this will have to be identified as a priority during the planning stage.			
Impact Significance	Negligible	Low	Medium	High
	The potential impact during construction is considered to be Medium adverse, pre-mitigation.			

7.1.9.6 Increased presence of security personnel

In addition to the expected workforce, during the construction phase, private security personal shall be used to provide general security at construction working areas to ensure that there is no entry of unauthorised personnel and that construction equipment is safe and secure. There is the potential for security personnel to use excessive force that results in intimidation or even physical damage, acting as a trigger event to further potential conflicts and Human Rights risks.

Impact Assessment: Increased presence of security personnel				
Impact Nature	Positive		Negative	
	This is an adverse impact because of the potential use of excessive force or intimidating presence of security guards that may interact with local herders or community members traveling near the Project site.			
Impact Type	Direct	Indirect	Reversible	Irreversible
	The impact is direct because the Project will employ security personnel as part of its planned activities and to avoid access from local community members to other OHS risks inside the site.			
Impact Duration	Short-term	Medium-term	Long-term	Very Long-term
	The impact is short-term as community health and safety risks will be largely limited to the construction phase.			
Impact Extent	Local	Regional	National	
	Risks will be generated at a local level within Project AoI.			
Impact Magnitude	Negligible	Low	Medium	High
	The impact magnitude is Medium because the potential for security guards to interact with local community members is a very perceptible change to the baseline conditions of ample passage and access to the site area.			
Receptor Value / Sensitivity	Negligible	Low	Medium	High
	The sensitivity is Medium as the local communities may be able to adapt to this change depending on the timing of previous disclosure of Project starting activities.			
Impact Significance	Negligible	Low	Medium	High
	The potential impact during construction is considered to be Medium adverse, pre-mitigation. It is expected that HR training and the full implementation of the Voluntary Principles on Security and Human Rights, UN Basic Principles on the Use of Force and Firearms by Law Enforcement Officials, the UN Code of Conduct for Law Enforcement Officials and the International Code of Conduct on Private Security Providers will reduce this to Minor.			

7.1.9.7 Increased levels of gender-based violence, sexual exploitation and harassment

Baseline data has found that there are generally relatively high levels of physical, sexual, economic and social violence in Uzbekistan, including sexual exploitation, domestic violence; gender disparities in higher and technical education; and a high female unemployment rate accompanied by a low proportion of women in leadership positions, particularly in rural communities.

The construction and transportation sector are recognised as being amongst the industries most affected by HIV globally (WHO, 2018). This is attributed to the fact that construction work employs mainly young male, low skilled workers, the workforce is highly mobile, and the working and living conditions are conducive to engagement in casual sexual relationships, including with sex workers (WHO, 2018). Therefore, Women (including vulnerable young girls) may be particularly at risk from the increased presence of local and migrant men looking for work opportunities near the Project AoI. The Project could contribute to this prevalence of GBVSEH in the following ways:

- Security personnel hired by the Project could abuse their positions of power through sexual violence and exploitation.
- Project workers could use their financial status to engage in sexual exploitation of local people, including vulnerable women and girls. This could be in the form of prostitution or other forms of transactional sex where money or gifts are used to exploit local people, including those who are vulnerable due to poverty and children.
- Project workers could exert domestic economic abuse over their family members, and particularly female spouses, because of the wages that they will earn during their Project employment.

- Domestic economic abuse associated with resettlement compensation, particularly withholding of financial payments from spouses.
- Project workers could engage in GBVSEH[87] of other Project workers, including those labourers in subordinate positions who come from local communities.

The receptors of this impact will be the children, women resident in communities located within the Project AoI, who have a High vulnerability.

Impact Assessment: Increased levels of gender-based violence, sexual exploitation and harassment				
Impact Nature	Positive		Negative	
	This is an adverse impact because of the potential violence, exploitation and harassment of vulnerable groups such as women and children in all aspects of the Project.			
Impact Type	Direct	Indirect	Reversible	Irreversible
	The impact is direct and indirect because the Project will employ Project workers directly and through subcontractors. It is largely reversible through the implementation of appropriate mitigation measures.			
Impact Duration	Short-term	Medium-term	Long-term	Very Long-term
	The impact is short-term as it will be largely limited to the construction phase.			
Impact Extent	Local	Regional	National	
	The impact will be generated at a regional and local levels.			
Impact Magnitude	Negligible	Low	Medium	High
	The impact magnitude is Medium.			
Receptor Value / Sensitivity	Negligible	Low	Medium	High
	The sensitivity is High as women and children are regarded as vulnerable receptors. .			
Impact Significance	Negligible	Low	Medium	High
	The potential impact during construction is considered to be High adverse, pre-mitigation. It is expected that the introduction of specific measures to prevent and address GBVSEH (as outlined in Section 8.8.1.10), will reduce this to Low.			

7.1.10 Transportation and Access

7.1.10.1 Effects on the Road Network and Local Community

As stated in Section 2.5,2.9 it is estimated that up to 15,000 total vehicle movements will be expected to be carried out to/from the Project site. These numbers reflect what is anticipated to be required during the construction phase and may slightly decrease in number.

It is anticipated that the Project traffic will use a combination of national roads and motorways which are of low sensitivity, However, local roads near the Project AoI experience limited vehicle traffic and are used by pedestrians, bicycles, animals, vehicles for personal use (e.g. cars, small trucks) and livestock. Furthermore, it has been noted by international agencies that Uzbekistan has relatively poor road safety records with the majority of fatalities being drivers and pedestrians

The increase in traffic flow of larger vehicles, resulting from Project construction activities, will impact local road users and those receptors living and working alongside local roads in a number of ways:

- Increase in noise, vibration and dust creation;
- Increase in traffic and journey times;

[87] Gender-based Violence, Sexual Exploitation and Harassment

- Disruption to businesses and day to day activities (e.g. livestock rearing);
- Accidental damage to community assets, crops and livestock which may lead to temporary loss of income; and
- Potential injuries to existing road users.

Those receptors living or working directly alongside local roads near the Project site will be more adversely impacted.

Impact Assessment: Impacts on traffic during construction (National and Regional)					
Impact Nature	Positive			Negative	
	Impact is negative because construction activities may result in increased traffic volumes.				
Impact Type	Direct		Indirect	Reversible	Irreversible
	The impact is direct as construction activities would directly increase construction traffic. The volume of traffic expect makes the impact likely to be irreversible.				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent
	The impact is temporary as impacts would occur during the construction phase only.				
Impact Extent	Local		Regional	National	
	The impact is expected to occur within the site and on national roads in both Uzbekistan and Kazakhstan.				
Receptor Value / Sensitivity	Low	Medium		High	
	Although the transportation route passes a number of towns, the road is likely to have existing HGV traffic and the receptor sensitivity is determined to be low.				
Impact Magnitude	No change	Negligible	Low	Medium	High
	Magnitude of change is anticipated to be Low at the national and regional levels as the increased number of HGV movements is not expected to exceed 30% above baseline for High roads..				
Impact Significance	None	Negligible	Low	Medium	High
	The impact is assessed as Negligible at the national and regional levels and not significant pre mitigation. Although no specific mitigation is required, standard good construction practice will be maintained to ensure no increase in predicted impacts during construction.				

Impact Assessment: Impacts on traffic during construction (Local)					
Impact Nature	Positive			Negative	
	Impact is negative because construction activities may result in increased traffic volumes.				
Impact Type	Direct		Indirect	Reversible	Irreversible
	The impact is direct as construction activities would directly increase construction traffic. The volume of traffic expect makes the impact likely to be irreversible.				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent
	The impact is temporary as impacts would occur during the construction phase only.				
Impact Extent	Local		Regional	National	
	The impact is expected to occur within the local roads in minor road from Kattakurgan to Shurcha .				
Receptor Value / Sensitivity	Low	Medium		High	
	At the local level, settlements are small with few amenities. There is likely to be large volumes of construction traffic in close proximity to local roads, residential properties and amenities.				
Impact Magnitude	No change	Negligible	Low	Medium	High
	At the local level, impacts are likely to be significantly above baseline and High given that very limited HGV traffic is likely to use the local dirt roads on a regular basis.				
	None	Negligible	Low	Medium	High

Impact Assessment: Impacts on traffic during construction (Local)	
Impact Significance	At the local level impacts are assessed to be Medium-High and will require the project to prepare a traffic management plan to mitigate the impact. The plan will include safety measures such as a signals network and driving rules, measures to reduce the creation of dust, and community-related measures such as the use of the Grievance Mechanism for managing and rectifying cases where road users or local residents are injured as a result of Project traffic.

7.1.11 Waste Management

Based on recent experience, AECOM expect that wastes will be disposed of at landfill. The EPC Contractor will provide details of the most suitable disposal site as part of detailed design but it is not expected that there are any recycling facilities at this landfill.

Impact Assessment: Impacts on waste during construction					
Impact Nature	Positive			Negative	
	Impact is negative because construction activities will result in increased waste volumes.				
Impact Type	Direct	Indirect	Reversible	Irreversible	
	The impact is direct as construction activities would directly increase both hazardous and non-hazardous wastes. This would include fuels, oils, inert construction waste and used, broken panels.				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent
	The impact is temporary as impacts would occur during the construction phase only.				
Impact Extent	Local	Regional	National		
	The impact is expected to occur within the site, on the road to the landfill site and in the landfill site itself.				
Receptor Value / Sensitivity	Low	Medium	High		
	Although hazardous wastes will be produced, amounts are likely to be low and the landfill site confirms it can accept construction water. As a result the receptor sensitivity is determined to be low.				
Impact Magnitude	No change	Negligible	Low	Medium	High
	Magnitude of change is anticipated to be Low as the increased volume is not deemed to be significant.				
Impact Significance	None	Negligible	Low	Medium	High
	The impact is assessed as Low and not significant. Standard good construction practice will be maintained to ensure no increase in predicted impacts during construction. Wastes will be segregated and stored appropriately. Although wastes would be landfilled at present, the EPC Contractor will seek to identify appropriate recycling facilities should they become available.				

7.2 Operational Impacts

7.2.1 Air Quality

Air pollution is unlikely to arise from the operation of the project. Air emissions would be limited to vehicles carrying our maintenance work and potential dust.

Impact Assessment: Impacts on air quality during operation					
Impact Nature	Positive			Negative	
	Impact is negative because construction activities may result in increased dust.				
Impact Type	Direct		Indirect	Reversible	Irreversible
	The impact is direct as construction activities would directly increase air pollution.				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent
	The impact is temporary as impacts would occur during the construction phase only.				
Impact Extent	Local		Regional	National	
	The impact is expected to occur within the site and adjacent areas.				
Receptor Value / Sensitivity	Negligible	Low	Medium	High	
	A single residential receptor is located 225m from the site, therefore receptor sensitivity is determined to be Medium. The next closet receptors are located 470m and above from the boundary.				
Impact Magnitude	No change	Negligible	Low	Medium	High
	Magnitude of change is anticipated to be Negligible as almost no ground disturbance will take place.				
Impact Significance	None	Negligible	Low	Medium	High
	The potential impact during construction is considered to be Negligible adverse, on the basis that a single residential receptor is 225m from the site boundary and almost no ground disturbance will take place.				

7.2.2 Archaeology and Cultural Heritage

During the operational phase there will be no new impacts on existing cultural sites. Any archaeological remains that may have been present within the footprint of the Project will either have been removed in the course of archaeological mitigation works, or will be preserved in place. The lack of setting impacts on cultural heritage sites and the absence of a construction workforce mean that no impact is predicted.

The Solar Array will have no impact on the setting of heritage assets due to lack of intervisibility with receptors, intervening distance and topography. The Transmission Line will be visible from a number of heritage assets, particularly the kurgan field. It will be an additional large-scale industrial element in a landscape already characterised by intensive large-scale agriculture and existing transmission lines and light industry east of Kattakurgan. It will not affect the ability to appreciate the significance of the historic landscape or individual monuments. For this reason, the magnitude of impact on the setting of heritage assets is assessed as low.

Impact Assessment: Impacts on archaeology and cultural heritage during operation					
Impact Nature	Positive			Negative	
Impact Type	Direct			Indirect	
	These are direct impacts associated with the operation of the Project.				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent
Impact Extent	Local		Regional	National	
	Impacts on archaeology are limited to Project footprint.				
Receptor Value / Sensitivity	Low	Medium	High		
	Any remains within the project footprint will have been recorded and removed during the construction phase.				
Impact Magnitude	No change	Negligible	Low	Medium	High
	No works will be taking place other that maintenance and security. No physical impacts on archaeological remains are predicted. The new Transmission Line will impact on the setting of heritage assets.				
	None	Negligible	Low	Medium	High

Impact Significance	The impact is assessed as Low and not significant.

7.2.3 Biodiversity

7.2.3.1 Avifauna

Critical Habitat has been triggered for great bustard due to its Critically Endangered national conservation status as well as the Ecologically Appropriate Area of Analysis (EAAA) of this species overlapping with the Project AoI (refer to Appendix D). The Project is situated within the known wintering range of this species and it is likely that the airspace of the Project AoI, including route of the OHL is likely to be used by birds moving between core wintering areas within Uzbekistan, as well as migrating between wintering and breeding habitats. The EAAA is therefore likely to support significant numbers of the Central Asian population and the thresholds for Critical Habitat are met for Criterion 1. Due to the unsuitability of the terrestrial habitats within the Project AoI the thresholds for Criterion 3 are however not met. Great bustards are known to be highly susceptible to collision with overhead lines and the project is in an area with a significant proportion of the Central Asian population of this species (refer to Appendix D).The proposed project site is not located on a major (high importance) flyway or in a geographical feature that would concentrate migrating species. Survey work has confirmed that the Project site is not important for breeding or migrating species, including raptor species of international and national conservation concern which have been assigned PBF status (refer to Appendix D). Registrations of a single steppe eagle (IUCN EN) and a single Egyptian vulture (IUCN EN) overflying the project site on migration during the baseline surveys A single little bustard (a PBF species) was recorded during the surveys undertaken by TYPSA/IFC in 2021. However, there is no reasonable likelihood that populations of any of the aforementioned PBF species are regionally significant.

Potential Impacts

Potential impacts to birds from the proposed operational phase of the project are:

- Displacement of birds by the presence of new infrastructure (pylons, overhead wires), which may occur as both the deterrence of bird activity among and close to the pylons and also as a barrier effect to movement of birds across the Project area in the vicinity of new overhead wires;
- Permanent habitat loss, fragmentation and / or degradation resulting from the construction of new infrastructure associated with the Solar PV and OHL (pylons);
- Increased bird mortality due to collision with new operational overhead line infrastructure;
- Loss (mortality) of birds from electrocution from perching on the powerline infrastructure and risk of electrocution by large birds whilst flying (eg. raptors); and
- Disturbance of birds from people and traffic during operational maintenance of Solar PV and OHL.

Impact Assessment: Impacts on Great Bustard (*Otis tarda*) during Operation – Critical Habitat is triggered for this species under Criteria 1: significant populations of nationally or regionally EN or CR species.					
Impact Nature	Positive			Negative	
	Impact is negative because construction activities may result in habitat loss, displacement (barrier to movement) and mortality to this species.				
Impact Type	Direct	Indirect	Reversible	Irreversible	
	Potential impacts during operation of the Project are as follows: • Displacement of wintering and stop-over migratory birds due to habitat loss (Solar PV); • Displacement and barrier to movement (Overhead Line); • Disturbance of birds from people and traffic due to operational maintenance activities (Solar PV and Overhead Line); and • Bird collision mortality with power lines (Overhead Line). AECOM do not assess there to be an impact as a result of the so-called 'lake effect' of solar panels.				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent
	The impacts will persist throughout operation and are therefore considered permanent.				
Impact Extent	Local	Regional	National	International	
	Great bustard has the potential to overfly the project site from known wintering areas within and outside the Samarkand region, as well as migrating between wintering and breeding habitats outside of Uzbekistan.				
Receptor Value / Sensitivity	Negligible	Low	Medium	High	
	This species, which is Critically Endangered nationally, is assigned a 'High' sensitivity value.				
Impact Magnitude	Negligible	Low	Medium	High	
	Loss and change of habitat for the Solar PV would be an effect of Negligible magnitude for great bustard considering the unsuitability for this species and absence of records during the surveys undertaken. Whilst Overhead Line route is not considered to be suitable for this species as a staging or wintering habitat, it is considered possible that this species could fly over the Overhead Line when moving between wintering grounds as well as migrating between wintering and breeding habitats. This species is known to be highly susceptible to collision with overhead lines. Therefore, the impact magnitude is assessed as High for the Overhead Line.				
Impact Significance	None	Negligible	Low	Medium	High
	The potential impact is assessed as High and significant for the Overhead Line. The potential impact is assessed as Low and not significant for the Solar PV. There is a requirement for the project to achieve Net Gains for this Critical Habitat qualifying species. The mitigation measures required to achieve net gains will be detailed within a Biodiversity Action Plan (BAP) for this species.				

Impact Assessment: Impacts on Ornithology (PBF species) during Operation – White-headed Duck, Sociable Lapwing, Saker Falcon, Pallas's Fish Eagle, Steppe Eagle, Egyptian Vulture, Little Bustard and Asian Houbara					
Impact Nature	Positive				Negative
	Potential impacts during operation of the Project are as follows: • Displacement of breeding, wintering and stop-over migratory birds due to habitat loss (Solar PV); • Displacement and barrier to movement (Overhead Line); • Disturbance of birds from people and traffic due to operational maintenance activities (Solar PV and Overhead Line); • Loss of birds from electrocution from perching on the powerline (Overhead Line); and • Bird collision mortality with power lines (Overhead Line). AECOM do not assess there to be an impact as a result of the so-called 'lake effect' of solar panels.				
Impact Type	Direct				Indirect
	The impacts listed above are all considered to be direct effects of Project operation.				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent
	The impacts will persist throughout operation and are therefore considered permanent.				
Impact Extent	Local	Regional	National		International
	The extent of potential operational impacts includes the operational Project footprint, including the Overhead Line from the Solar PV to the grid connection point. Given the distance of 15km between the Project site and Kattakurgan Water Reservoir IBA (at its closest point), and the lack of habitat connectivity or potential pathways between the IBA and the Project site, there is no reasonable likelihood of significant direct or indirect impacts. This assessment is consistent with the TYPSA/IFC Scoping Report (2020), which states: '*Many species of birds stop to rest and feed during spring and autumn migration, but, after consultation with Birdlife International and ornithological experts (IBA Programme since 2008) none of the species for which the IBA site was designated use the proposed Project area, except the Asian houbara'*. The results of the baseline surveys undertaken by AECOM confirm that breeding populations of Asian houbara are likely absent.				
Receptor Value / Sensitivity	Negligible	Low	Medium	High	
	The PBF bird species which have been recorded as present or assessed as having a reasonable likelihood of occurrence are not critical habitat qualifying species and are therefore not of very high or high sensitivity according to the criteria detailed above. In terms of the PBF species which have been recorded, these have been recorded in numbers which are not significant and are assigned a Medium sensitivity value. The project does not support breeding populations for PBF birds and the habitat is not suitable for these species. Sociable lapwing (IUCB [CR]) has the potential to occasionally overfly the project site on spring and autumn passage (the species was assessed as likely absent as a result of the targeted surveys for this species). However, there is no reasonable likelihood that the project is located on a significant migratory corridor for this species and the sensitivity is assessed a Low. Houbara bustard (IUCN [VU]) has been shown to be likely absent from the Solar PV and the Overhead Line, as a result of the targeted breeding surveys for this species undertaken by AECOM. The sensitivity for this species is therefore is determined as Low.				
Impact Magnitude	Negligible	Low	Medium		High
	Loss and change of habitat for the Solar PV would be an effect of Medium magnitude for the breeding, wintering and migratory birds which utilise habitat within the working areas for				

<table>
<tr><td></td><td>breeding, roosting or foraging within the operational footprint of the Solar PV; a high proportion of the habitat will be covered by the solar panels. Loss of habitat for the transmission line would be an effect of Low magnitude for breeding, wintering and migratory birds which utilise habitat within the working areas for breeding, roosting or foraging, with only small areas are taken up by transmission line infrastructure (ie. pylon bases).

The operational Solar PV and transmission line will result in partial reduction of bird activity through the displacement of birds; this is assessed as Medium magnitude for the breeding, wintering and migratory bird assemblage. Human influences (primarily the land management) unique to each site. Consideration has been given to the Project site is already characterised by a high level of anthropogenic disturbance (primarily due to farming activities and proximity to human habitation).

The 4.5km transmission line alignment is not extensive in terms of migrating birds passing through the wider Samarkand region on a broad front and it is orientated along an approximately north-east-south-west alignment, which reduces the potential barrier effect of the power line/pylons with respect to birds migrating through the Project site south to north (in spring) or north to south (in autumn); a perfect east-west alignment would potentially be more impactful in this respect. Therefore, the magnitude of this potential impact is assessed as Low.

The Project Site is not sited on a migration bottle neck or High migration route; it is not located close to a mountain pass or wetland where large numbers of migratory birds could be concentrated or sited in an area where significant populations of species of conservation concern occur. The impact magnitude for collision of birds is therefore cautionary assessed as Medium, as the predicted mortalities for species of national and international concern are unlikely to be significant in the context of the Samarkand or Uzbekistan populations. The assessment does not take into account the probable reduction of bird activity resulting from displacement of birds around the proposed transmission line infrastructure, assuming instead that flight activity will continue unchanged during the operational period. Also, the assessment does not take into account that a proportion of bird flights will take avoiding action when flying towards the power line and therefore avoiding avoid collision with the power-line; assuming instead that all flights will result in a collision.

The proposed powerline is high voltage (220 kV) and therefore doesn't typically present the same risk of electrocution to raptors and other large birds as some lower-voltage powerlines (eg. where the distribution conductor cables attached via relatively short insulators to poles constructed of conducting materials) of medium voltage (e.g. 1kV to 59kV). However, the precise configuration and dimensions of the electrical design is not yet available for this project. Species recorded during the baseline surveys which are potentially most vulnerable to electrocution, both in flight and from perching, due to their likely frequent presence within the project site (and also behavioural trait for perching whilst feeding, resting and hunting), are: long-legged buzzard (not of national or international conservation concern). The risk of electrocution to steppe eagle and Egyptian vulture (both IUCN Endangered) is considered to be low due to their respective likely infrequent flight transits through the project area (in small numbers which are highly unlikely to be significant in terms of regional/national populations). The impact magnitude has been cautionary assessed as medium (overall) for electrocution. The impact magnitude is assessed as Medium (overall).</td></tr>
<tr><td>Impact Significance</td><td>None | Negligible | Low | Medium | High

The potential impact is assessed as Medium and significant for the Overhead Line

The potential impact is assessed as Low and not significant for the Solar PV.

There is a requirement for the project to achieve No Net Loss of species defined as PBFs.</td></tr>
</table>

Impact Assessment: Ornithology impacts (non PBF) during operation					
Impact Nature	Positive				Negative
	Potential impacts during operation of the Project are as follows: • Displacement of breeding, wintering and stop-over migratory birds due to habitat loss (Solar PV); • Displacement and barrier to movement (Overhead Line); • Disturbance of birds from people and traffic due to operational maintenance activities (Solar PV and transmission line); • Loss of birds from electrocution from perching on the powerline (Overhead Line); and • Bird collision mortality with power lines (Overhead Line). AECOM do not assess there to be an impact as a result of the so-called 'lake effect' of solar panels.				
Impact Type	Direct			Indirect	
	The impacts listed above are all considered to be direct effects of Project operation.				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent
	The impacts will persist throughout operation and are therefore considered permanent.				
Impact Extent	Local		Regional	National	
	The extent of potential operational impacts includes the operational Project footprint, including the Overhead Line from the Solar PV to the grid connection point. Given the distance of 15km between the Project site and Kattakurgan Water Reservoir IBA (at its closest point), and the lack of habitat connectivity or potential pathways between the IBA and the Project site, there is no reasonable likelihood of significant direct or indirect impacts. This assessment is consistent with the TYPSA/IFC Scoping Report (2020), which states: '*Many species of birds stop to rest and feed during spring and autumn migration, but, after consultation with Birdlife International and ornithological experts (IBA Programme since 2008) none of the species for which the IBA site was designated use the proposed Project area, except the Asian houbara'*. The results of the baseline surveys undertaken by AECOM confirm that breeding populations of Asian houbara are likely absent.				
Receptor Value / Sensitivity	Low		Medium		High
	The Solar PV footprint supports a limited assemblage of breeding species which are not of international or national conservation concern. This ornithological receptor has been assessed as Low value.				
Impact Magnitude	No change	Negligible	Low	Medium	High
	Loss and change of habitat for the Solar PV would be an effect of Medium magnitude for the breeding, wintering and migratory birds which utilise habitat within the working areas for breeding, roosting or foraging within the operational footprint of the Solar PV; a high proportion of the habitat will be covered by the solar panels. Loss of habitat for the transmission line would be an effect of Low magnitude for breeding, wintering and migratory birds which utilise habitat within the working areas for breeding, roosting or foraging, with only small areas are taken up by transmission line infrastructure (ie. pylon bases). The operational Solar PV and transmission line will result in partial reduction of bird activity through the displacement of birds; this is assessed as Medium magnitude for the breeding, wintering and migratory bird assemblage. Human influences (primarily the land management) unique to each site. Consideration has been given to the Project site is				

Impact Assessment: Ornithology impacts (non PBF) during operation					
	already characterised by a high level of anthropogenic disturbance (primarily due to farming activities and proximity to human habitation). The 4.5km transmission line alignment is not extensive in terms of migrating birds passing through the wider Samarkand region on a broad front and it is orientated along an approximately north-east-south-west alignment, which reduces the potential barrier effect of the power line/pylons with respect to birds migrating through the Project site south to north (in spring) or north to south (in autumn); a perfect east-west alignment would potentially be more impactful in this respect. Therefore, the magnitude of this potential impact is assessed as Low. The Project Site is not sited on a migration bottle neck or High migration route; it is not located close to a mountain pass or wetland where large numbers of migratory birds could be concentrated or sited in an area where significant populations of species of conservation concern occur. The impact magnitude for collision of birds is therefore cautionary assessed as Medium, as the predicted mortalities for species of national and international concern are unlikely to be significant in the context of the Samarkand or Uzbekistan populations. The assessment does not take into account the probable reduction of bird activity resulting from displacement of birds around the proposed transmission line infrastructure, assuming instead that flight activity will continue unchanged during the operational period. Also, the assessment does not take into account that a proportion of bird flights will take avoiding action when flying towards the power line and therefore avoiding avoid collision with the power-line; assuming instead that all flights will result in a collision. The proposed powerline is high voltage (220 kV) and therefore doesn't typically present the same risk of electrocution to raptors and other large birds as some lower-voltage powerlines (eg. where the distribution conductor cables attached via relatively short insulators to poles constructed of conducting materials) of medium voltage (e.g. 1kV to 59kV). However, the precise configuration and dimensions of the electrical design is not yet available for this project. Species recorded during the baseline surveys which are potentially most vulnerable to electrocution, both in flight and from perching, due to their likely frequent presence within the project site (and also behavioural trait for perching whilst feeding, resting and hunting), are: long-legged buzzard (not of national or international conservation concern). The risk of electrocution to steppe eagle and Egyptian vulture (both IUCN Endangered) is considered to be low due to their respective likely infrequent flight transits through the project area (in small numbers which are highly unlikely to be significant in terms of regional/national populations). The impact magnitude has been cautionary assessed as low (overall) for electrocution. The impact magnitude is assessed as Medium (overall).				
Impact Significance	None	Negligible	Low	Medium	High
	The impact is assessed as Low and not significant.				

7.2.3.2 Terrestrial Ecology

Given the absence of non-avian fauna or flora of high conservation concern (IUCN CR) and IUCN EN), the sensitivity of the operational Project site is assessed to be Low. Furthermore, the high levels of anthropogenic disturbance associated with the Project site (which is primarily related to the prevailing agricultural activity) will reduce the magnitude of the impact to Low. This results in a low impact (not significant), which does not require to be mitigated. There will be negligible direct impacts on Central Asian tortoise other than potential traffic impacts. The workforce will be fully briefed on the need to be aware of tortoises. Any drains or trenches will be routinely inspected and if tortoises are found they will be moved to an appropriate area within the site.

The ongoing site restoration will be actively managed to ensure the success of natural revegetation. This will include regular watering and if necessary manual seeding will be considered if suitable seeds are available commercially.

Impact Assessment: Impacts on PBF species: Central Asian Tortoise and Tartar Sand Boa					
Impact Nature	Positive				Negative
	Disturbance of fauna from presence of people, machinery, traffic, and noise, primarily within the operational Solar PV site, although less frequent maintenance will be required for the transmission line.				
Impact Type	Direct				Indirect
	There are indirect impacts associated with the operation of the Project.				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent
	The impacts will persist throughout operation and are therefore considered permanent.				
Impact Extent	Local		Regional	National	
	The impacts on terrestrial ecology are primarily limited to the footprint of the Project.				
Receptor Value / Sensitivity	Low	Medium	High		
	The abundance and diversity of terrestrial fauna was found to be low. A single species of conservation concern was recorded within the proposed project site: Central Asian tortoise (IUCN VU, RDB of Uzbekistan). However, there is no reasonable likelihood that the tortoise population occurring within the Project site is of regional importance. The sensitivity of the terrestrial habitat has been assigned as Low. Other plant and animal species recorded during the AECOM field surveys are not of conservation concern.				
Impact Magnitude	No change	Negligible	Low	Medium	High
	It is anticipated that there will be very limited personnel and vehicle movements within the operational Solar PV site and that maintenance visits for the transmission line will be infrequent and will involve limited personnel and vehicle movements.				
Impact Significance	None	Negligible	Low	Medium	High
	The impact is assessed as Low and insignificant.				

Impact Assessment: Impacts on non PBF species during operation					
Impact Nature	Positive				Negative
	Disturbance of fauna from presence of people, machinery, traffic, and noise, primarily within the operational Solar PV site, although less frequent maintenance will be required for the transmission line.				
Impact Type	Direct				Indirect
	There are indirect impacts associated with the operation of the Project.				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent
	The impacts will persist throughout operation and are therefore considered permanent.				
Impact Extent	Local		Regional	National	
	The impacts on terrestrial ecology are primarily limited to the footprint of the Project.				
Receptor Value / Sensitivity	Low	Medium	High		
	The abundance and diversity of terrestrial fauna was found to be low. Plant and animal species (other than PBFs) recorded during the AECOM field surveys are not of conservation concern.				
	No change	Negligible	Low	Medium	High

Impact Assessment: Impacts on non PBF species during operation					
Impact Magnitude	It is anticipated that there will be very limited personnel and vehicle movements within the operational Solar PV site and that maintenance visits for the transmission line will be infrequent and will involve limited personnel and vehicle movements.				
Impact Significance	None	Negligible	**Low**	Medium	High
	The impact is assessed as Low and insignificant.				

7.2.4 Geology and Soils

During this phase of the Project, the main impacts on soils would be from continued vehicle traffic. Vehicle movements will comprise:

- Movement of staff and materials to and from the site along the access roads.
- Movements between the control centre and across the site for operation and maintenance. Workers are expected to visit the site at least once per week for routine maintenance.

There should be no need for vehicles to travel off the improved roads, and this should be actively discouraged. As described with regard to the construction phase impacts, the main risk to soils would be where vehicles leave prepared roads and drive cross-country. If designated roads are not used, vehicle movements can cause damage over a wide area.

Impact Assessment: Impacts on soil quality during operation					
Impact Nature	Positive	**Negative**			
	The main operational impacts on soils would be from continued vehicle traffic. Vehicle movements will comprise: Movement of staff and materials to and from the site along the access roads. Movements between the control centre and across the site for operation and maintenance. Workers are expected to visit the site at least once per week for routine maintenance. Risk of pollution from solid, liquid and hazardous wastes and leaks and spills from maintenance activities.				
Impact Type	Direct	**Indirect**			
	These are indirect impacts associated with the operation of the Project.				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	**Permanent**
	The impacts will persist throughout operation and are therefore considered permanent.				
Impact Extent	**Local**	Regional	National		
	The impacts on geology and soils are primarily limited to the footprint of the Project.				
Receptor Value / Sensitivity	Negligible	**Low**	Medium	High	
	The soils are considered to have a low sensitivity.				
Impact Magnitude	No change	**Negligible**	Low	Medium	High
	The magnitude of the effect during operation is very low, since there will be much less frequent traffic than during construction, and only occasional use of heavy equipment. In addition, the use/handling of chemicals /oils/wastewater during operation will be limited.				
Impact Significance	None	**Negligible**	Low	Medium	High
	The impacts are assessed as Negligible and insignificant.				

7.2.5 Noise

General EHS Guidelines sets out noise limits for industrial areas, commercial areas, residential areas and construction. The relevant limit is therefore shown as the residential limit of 45dB(A) for night time. At levels above these criteria the noise emissions from the Project would be considered to have a significant effect.

Solar PV panels themselves do not provide a noise source during operation, however equipment within the site (typically inverter stations and transformers) will emit noise during operation. While the Project will only be operational during daylight hours, as the transformers are permanently energised, they may emit some noise by way of magnetostriction hum during night-time. The distance between the substation transformers and the nearest residential properties is assumed to be approximately 500 m, although this will be confirmed as part of the ESIA.

For the purposes of this assessment it is assumed that the substation transformer is the dominant source of noise as the other sources (transformer and invertor stations) are over 200 m from the closest receptor.

No breach of the lower 45 dB limit is considered to be likely.. Detailed design information will be provided by the EPC Contractor. As a result, no further clarification is possible. The report will be updated by end of Dec 2022 assuming that such information is provided.

Impact Assessment: Noise impacts during operation					
Impact Nature	Positive				Negative
	Solar PV panels themselves do not provide a noise source, however equipment within the site (typically inverter stations and transformers) will emit noise during operation. While the Project will only be operational during daylight hours, as the transformers are permanently energised, they may emit some noise by way of magnetostriction hum during night-time.				
Impact Type	Direct				Indirect
	Noise received at nearby receptors would be considered a direct impact of the operation of the Project.				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent
	The impacts will persist throughout operation and are therefore considered permanent.				
Impact Extent	Local		Regional		National
	Operational noise impacts will be restricted to an area immediately adjacent to the Project.				
Receptor Value / Sensitivity	Low		Medium		High
	There are settlements in relatively close proximity to the Project, receptors are of high sensitivity.				
Impact Magnitude	No change	Negligible	Low	Medium	High
	The distance between the transformers and the nearest residential properties is considered sufficient to reduce any noise to an acceptable level, however the substation is in close proximity to receptors. Noise calculations have deemed operational noise to be within specified limits. A negligible magnitude of change is therefore predicted.				
Impact Significance	None	Negligible	Low	Medium	High
	The impact is assessed as Low and not significant.				

7.2.6 Hydrology and Hydrogeology

Potential impacts to surface waters by operating activities would include pollution, increased runoff and erosion, primarily in existing or new erosion channels that receive run-off from roads. The sensitivity of surface water is assessed as medium, recognising the fact that a small number of local residents use the two watercourses adjacent to the site for drinking water for livestock. The sensitivity of groundwater is assessed as high, recognising the fact that local communities abstract groundwater for domestic use from local wells.

The magnitude of the effect is predicted to be low given the limited area of the Project site in relation to the overall catchment area. As a result, the significance of the impact is assessed as low.

The source of water required for construction has not yet been determined. This will be provided by the EPC Contractor as part of detailed design.

Potential sources of pollution to groundwater during operation include sanitary waste and leaks and spills from maintenance activities.

Impact Assessment: Hydrology and hydrogeology impacts during operation					
Impact Nature	Positive				Negative
	Impacts on surface water would include increased runoff and erosion, primarily in existing or new erosion channels that receive run-off from roads. Surface and ground water are also at risk of pollution from solid, liquid and hazardous wastes and leaks and spills from maintenance activities. The canals and ephemeral water courses within the site will be filled in if not being used. Much of the irrigation and drainage across the region is artificial. The EPC Contractor will prepare a surface water drainage system as part of detailed design.				
Impact Type	Direct				Indirect
	Pollution due to increased run-off, leaks, spillages and waste mismanagement are all considered to be indirect effects of Project operation.				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent
	The impact will persist throughout operation and is therefore considered permanent.				
Impact Extent	Local		Regional	National	
	Impacts anticipated to be limited to the local area, primarily adjacent wetland areas and local communities.				
Receptor Value / Sensitivity	Negligible	Low		Medium	High
	The sensitivity of surface water is assessed, recognising that the Zarafshan lead canal feeds the Kattakurgan reservoir, which is a source of irrigation water. The sensitivity of groundwater is assessed as low, recognising the fact that no local communities will abstract groundwater for domestic use during operation.				
Impact Magnitude	No change	Negligible	Low	Medium	High
	The magnitude of the effect in relation to surface water is predicted to be low given the limited area of the Project site in relation to the overall catchment area. The magnitude of the effect in relation to groundwater is predicted to be low, given that the soil and superficial deposits present in the area are expected to provide protection to the groundwater, and that the use/handling of chemicals /oils/wastewater during operation will be limited.				
Impact Significance	None	Negligible	Low	Medium	High
	Pre-mitigation, the impact in relation to surface water is assessed as low, due to the limited extent. Pre-mitigation, the impact in relation to groundwater is assessed as low and not significant.				

7.2.7 Labour and Working Conditions

A sound worker-management relationship is a key requirement of the Project and a constructive worker-management relationship, by treating the workers fairly and providing them with safe and healthy working conditions, is required to ensure protection of the fundamental rights of workers.

The implementation of the actions necessary to meet these requirements will be managed through the Project's Environmental and Social Management System (ESMS).

The requirements apply to workers directly engaged by the client (direct workers) and workers engaged through third parties to perform work related to the Project.

The aim of the Project's policies on labour and working conditions will be:

- To promote the fair treatment, non-discrimination, and equal opportunity of workers especially vulnerable workers facing particular risks due to context-specific socioeconomic characteristics..
- To establish, maintain, and improve the worker-management relationship.
- To promote compliance with national employment and labor laws.
- To protect workers, including vulnerable categories of workers such as children, migrant workers, workers engaged by third parties, and workers in the client's supply chain.
- To promote safe and healthy working conditions, and the health of workers.
- Zero tolerance for the use of forced labour and child labour.
- Respecting the principles of freedom of association and collective bargaining.

Ensuring that accessible and effective means to raise and address workplace concerns are available to workers. During the operational phase, there may be occupational health and safety risks to workers from the various operation and maintenance activities expected to take place for the Project. Key risks could include, *inter alia*, collision with vehicles and plant and exposure to a variety of hazards such as electric shock from exposed cables and thermal burn hazards and exposure to chemicals, hazardous or flammable materials.

Occupational health and safety impacts are considered to be of long-term duration throughout the operational phase and are expected to be of high magnitude and high sensitivity as in extreme cases they could entail permanent impacts (e.g. permanent disability). As such, the impacts are considered to be of High impact and appropriate mitigation will be developed.

Impact Assessment: Occupational health and safety impacts during operation					
Impact Nature	Positive			Negative	
	There will be some occupational health and safety risks through carrying out operational and maintenance activities. This includes risk of electrocution, thermal burn hazards, exposure to hazardous chemicals and working in extreme temperatures. Mismanagement of wastes (such as domestic solid waste, sewage and hazardous wastes) can also represent a health and safety risk to workers, such as disease, injury or death.				
Impact Type	Direct			Indirect	
	The risks are predominantly associated with direct impacts on the operational and maintenance workers due to the operation of the Project. Health and safety risks associated with waste mismanagement are considered indirect impacts. The Project's policies on labour and working conditions will further impact worker's income and wellbeing.				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent
	The impacts will persist throughout operation and are therefore considered long-term.				
Impact Extent	Local		Regional	National	
	The impacts will be limited to the project site and local area.				
Receptor Value / Sensitivity	Low	Medium	High		
	The receptors in this case are the operational workers. Although there will be few personnel involved in the operational and maintenance activities (approximately 25), each individual is of high value/sensitivity.				
Impact Magnitude	No change	Negligible	Low	Medium	High
	Occupational health and safety impacts could result in disease, injury, or death to workers and so the magnitude is high.				
Impact Significance	None	Negligible	Low	Medium	High
	Pre-mitigation, the impact is assessed as High and significant. An independent Labour Assessment shall be undertaken by a qualified labour specialist, which shall include a corrective action plan with appropriate mitigation and remediation measures as well as monitoring requirements that will be implemented by the Project and its subcontractors.				

7.2.8 Landscape and Visual Impacts

The Project will cover approximately 600 hectares of land but the Highity of the Solar Park is less than 3m in height and there is limited potential for the project to have a High impact on the people living in the local residential properties to the north and east of the project site. Residents to the west and south west are likely to experience more expansive views of the project for the lifetime of operation.

Impact Assessment: Landscape and visual impacts during operation					
Impact Nature	Positive			Negative	
	The introduction of large-scale infrastructure has potential for impacts that would be perceived by some as being detrimental.				
Impact Type	Direct		Indirect		
	Impacts can be direct (the introduction of the Project changes the landscape itself) or indirect (when the Project affects views from other adjacent or more distant landscapes).				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent
	The impact will persist throughout operation and is therefore considered permanent.				
Impact Extent	Local		Regional	National	
	Given the low height of solar arrays (approximately 2.4 m) and the screening offered by surrounding topography (particularly to the east) and vegetation, potentially significant effects will generally be restricted to the local area.				
Receptor Value / Sensitivity	Low	Medium	High		
	The local landscape is already altered due to the presence of man-made structures such as overhead power lines, main highway, existing electricity substation and other commercial structures. Sensitivity is also reduced by anthropogenically altered watercourses. The whole area was extensively farmed in Soviet times and it is only in the past decade that the level of farming has been reduced, most likely due to poor soil quality. However, receptors in proximity to the site are predominately related to residential settlement. Sensitivity is considered Low.				
Impact Magnitude	No change	Negligible	Low	Medium	High
	The magnitude of change is assessed to be Low as the Project will introduce a notable change to the landscape, particular to receptors in closest proximity to the Project site but this will be on a very localised level.				
Impact Significance	None	Negligible	Low	Medium	High
	As a result, the effect is assessment as Low and not significant.				

7.2.8.1 Glare and Glint

The potential for glare and glint from the Project during operation is low. It is important to note that the PV panels work on the concept of absorbing sunlight rather than reflecting it as compared to other technologies that concentrate solar energy. The PV panels that will be used for the Project have very limited levels of either glint or glare and are substantially less reflective than most surfaces such as still water, glass or steel. Glint will be substantially reduced by the anti-reflective coating of the modules that is incorporated to maximise the light capture of the solar cells.

Previous studies have been undertaken to compare the reflectivity of solar panels with other materials. The most commonly referenced source is a Federal Aviation study focusing on solar panels located at airports. This study states that modern solar panels reflect as little as 2% of the incoming sunlight. Solar PV panels have a lower level of reflectivity than many commonly occurring features such as bare soil and vegetation.[88]

[88] Federal Aviation Administration (FAA), July 2015. Final Report: Evaluation of Glare as a Hazard for General Aviation Pilots on Final Approach.

Impact Assessment: Glint and glare impacts during operation					
Impact Nature	Positive				**Negative**
	There is a perception that solar PV panels (in a similar way to glass buildings and large metal structures) can cause significant solar reflections that can cause a distraction or nuisance. This can be an important concern for airports and highways particularly when located in the pilot's direct field of vision on approach to the runway.				
Impact Type	**Direct**			Indirect	
	This is a direct impact resulting from sunlight reflecting off the Project.				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	**Permanent**
	Any glint and glare issues would persist throughout operation.				
Impact Extent	**Local**		Regional	National	
	Any impacts would be limited to areas in relatively close proximity to the site.				
Receptor Value / Sensitivity	Low		Medium		**High**
	There are obvious safety concerns with regard to any potential to distract aircraft pilots and vehicle drivers, causing accidents leading to potential injuries or deaths.				
Impact Magnitude	No change	**Negligible**	Low	Medium	High
	PV panels work on the concept of absorbing sunlight rather than reflecting it as compared to other technologies that concentrate solar energy. Previous studies have been undertaken to compare the reflectivity of solar panels with other materials. The most commonly referenced source is a Federal Aviation study focusing on solar panels located at airports. This study states that modern solar panels reflect as little as 2% of the incoming sunlight. Solar PV panels have a lower level of reflectivity than many commonly occurring features such as bare soil and vegetation.				
Impact Significance	None	Negligible	**Low**	Medium	High
	The impact is assessed as Low and not significant.				

7.2.9 Socio-economic Impacts

Potential socio-economic impacts during operation of the Project are largely similar to the Construction phase, with reduced impact Magnitudes and Significance.

The following potential impacts for the operation phase were considered as the most relevant for the AoI and the socio-economic receptors:

1. Impacts on land and livelihoods from land occupied by the project area
2. Impacts from local employment during operation
3. Impacts on the national and regional economy during operation
4. Potential for gender-based violence, sexual exploitation and harassment

7.2.9.1 Impacts on land and livelihoods from land occupied by the project area

Impacts to land and livelihoods will be mitigated and completed prior to construction works. No other related impacts are expected to take place during the operational phase.

7.2.9.2 Impacts from local employment during operation

The number of local people that are to be employed during operation are expected to comprise of a mix of Uzbek nationals working for the Proponent, in addition to personnel provided through local subcontractors to provide a range of supporting services, including security.

As the project transitions from construction into operation, there will be a shift in the skills required. Consequently, it will be necessary to develop the skills of local people during construction so that suitable individuals are able to take up the long-term (potentially 20 years) positions during operations.

The individuals employed and their household members, will benefit from increased income that is likely to increase their overall quality of life and access to healthcare, educational and other types of resources across a longer time frame. The household is also expected to experience increased resilience to external shocks from the supply of income, that could arise from a sudden change in health status or external factor such as food price inflation.

Impact Assessment: Impacts from local employment during operation					
Impact Nature	Positive			Negative	
	The impact during operations is positive.				
Impact Type	Direct	Indirect		Reversible	Irreversible
	The impact is both direct and indirect because the individuals and their household members are expected to benefit from an increase in standard of living and reduced vulnerability to external shocks. The impact is reversible as the income generated from local employment shall cease at the end of their employment at the end of the operational phase (20 years).				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent
	The period of employment will continue over the lifetime of the Project which is 20 years.				
Impact Extent	Local		Regional	National	
	The impact will occur at a local level amongst the communities where employees are based.				
Impact Magnitude	Negligible	Low		Medium	High
	The impact magnitude is low as the workforce required during operations is relatively small when compared to the construction stage.				
Receptor Value / Sensitivity	Negligible	Low		Medium	High
	The sensitivity is high as local employment during both construction and operations is a key expectation amongst local communities and their representatives. It is essential that Uzbeks comprise a significant component of the operational workforce.				
Impact Significance	Negligible	Low		Medium	High
	As a result of the above, the overall impact is assessed as Medium and positive.				

7.2.9.3 Impacts on the national and regional economy during operation

Operation of the Project shall generate up to 100 MW of renewable energy which shall be fed into the national grid. The Proponent shall also make annual tax payments to central government in parallel with the generation of revenue.

During operations, there will also be an ongoing demand for general support from other national and regional businesses, such as consulting, legal, and accounting using small to medium enterprises.

Impact Assessment: Impacts on the national and regional economy during operation					
Impact Nature	Positive			Negative	
	Impact is positive because the operation of the Project will generate energy, which is fed into the national grid, contributing towards the ongoing development of the country which is currently severely lacking in energy generation.				
Impact Type	Direct	Indirect		Reversible	Irreversible
	The impact is both direct and indirect because the company will provide energy to the national grid which will benefit other electricity users (households, businesses and government buildings), pay taxes, purchase materials and services which will lead to the growth of small and medium business. The impact is reversible as it will only continue during operation.				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent

	The impact is long-term because it would continue throughout the whole period of project operation of 20 years.			
Impact Extent	Local	Regional	National	
	The impact will occur at a regional and national level as energy shall be injected into the national grid. The local communities shall not be provided with electricity as this is the responsibility of the offtaker.			
Impact Magnitude	Negligible	Low	Medium	High
	The impact magnitude is medium as the quantity of energy generated by the project is an important contribution at 100MW.			
Receptor Value / Sensitivity	Negligible	Low	Medium	High
	The sensitivity is medium as the countries' energy demand shall continue to increase during the lifespan of the project.			
Impact Significance	Negligible	Low	Medium	High
	The overall impact significance is Medium.			

7.2.9.4 Potential for of gender-based violence, sexual exploitation and harassment impacts

Although the number of project workers will reduce considerably during operation, the impact of GBVSEH on members of the community may remain. The Project could contribute to this prevalence of domestic and non-domestic violence and GBVSEH through:

- Any security personnel hired by the Project for protecting stations or other Project facilities could act violently when interacting with local community members, including physical and sexual violence as well as coercion and threats.
- Project workers could exert domestic economic abuse over their family members, and particularly female spouses, because of the wages that they will earn during their Project employment. This is anticipated to be less of a risk during operations compared to construction due to the lower numbers of workers and the long-term, stable nature of the income earnt during operations.
- Project workers could use their financial status to engage in sexual exploitation of local people, including vulnerable women and girls. This could be in the form of prostitution or other forms of transactional sex where money or gifts are used to exploit local people, including those who are vulnerable due to poverty and children.
- Project workers could engage in GBVSEH of other Project workers, including those insubordinate positions.
- The receptors of this impact will be the children, women resident in communities located within the Project AoI, who have a High vulnerability.

Impact Assessment: Potential for gender-based violence, sexual exploitation and harassment				
Impact Nature	Positive	Negative		
	This is an adverse impact because of the potential violence, exploitation and harassment of vulnerable groups such as women and children in all aspects of the Project.			
Impact Type	Direct	Indirect	Reversible	Irreversible
	The impact is direct and indirect because the Project will employ Project workers directly and through subcontractors. It is largely reversible through the implementation of appropriate mitigation measures.			
Impact Duration	Short-term	Medium-term	Long-term	Very Long-term
	The impact is short-term as the mitigation measures would help to identify any violence and GBVSEH-related impacts and allow the Project to put in place corrective actions, rather than allow them to continue long-term.			
Impact Extent	Local	Regional	National	

	The impact will be generated at local level.			
Impact Magnitude	Negligible	**Low**	Medium	High
	The impact magnitude is Low.			
Receptor Value / Sensitivity	Negligible	Low	Medium	**High**
	The sensitivity is High as women and children are regarded as vulnerable receptors. .			
Impact Significance	Negligible	Low	**Medium**	High
	The potential impact during operation is considered to be Medium adverse, pre-mitigation. It is expected that the continued implementation of specific measures introduced during the construction phase to prevent and address GBVSEH (as outlined in Section 8.8.1.10), will reduce this to Low.			

7.2.10 Transportation and Access

The main transport impacts will occur during the construction phase. The number of vehicles during operation is likely to be very low, with access required only for maintenance and servicing. The majority of these will be light vehicles and, at the worst case, a HGV trip may be required to transport a replacement transformer to site. The effects of traffic movements stemming from the operational phase are therefore considered Negligible and so insignificant.

7.2.11 Waste Management

Based on recent experience, AECOM expect that wastes will be disposed of at landfill. The EPC Contractor will provide details of the most suitable disposal site as part of detailed design but it is not expected that there are any recycling facilities at this landfill.

Impact Assessment: Impacts on waste during construction					
Impact Nature	Positive			**Negative**	
	Impact is negative because construction activities will result in increased waste volumes.				
Impact Type	**Direct**	Indirect	Reversible	Irreversible	
	The impact is direct as operational activities would directly increase both hazardous and non-hazardous wastes. This would include fuels, oils and used, broken panels.				
Impact Duration	Temporary	Short-term	Medium-term	**Long-term**	Permanent
	The impact is long-term as impacts would occur during the full operational phase.				
Impact Extent	**Local**	**Regional**	**National**		
	The impact is expected to occur within the site, on the road to the landfill site and in the landfill site itself.				
Receptor Value / Sensitivity	**Low**	Medium	High		
	Although hazardous wastes will be produced, amounts are likely to be low and the landfill site confirms it can accept such waste. As a result the receptor sensitivity is determined to be low.				
Impact Magnitude	No change	**Negligible**	Low	Medium	High
	Magnitude of change is anticipated to be Negligible as the increased volume is not deemed to be significant.				
Impact Significance	None	**Negligible**	Low	Medium	High
	The impact is assessed as Negligible and not significant. Wastes will be segregated and stored appropriately. Although wastes would be landfilled at present, the EPC Contractor will seek to identify appropriate recycling facilities, including for broken solar panels.				

7.3 Decommissioning Impacts

7.3.1 Air Quality

The change in ambient air quality may arise at decommissioning as a result of fugitive dust and particulate matter emissions. However, such impacts are expected to be temporary and of short-term nature as they are limited to the decommissioning phase only. The impacts will be similar to the construction phase.

7.3.2 Archaeology and Cultural Heritage

The activities which may impact upon archaeological and cultural heritage sites include an increased workforce presence, reinstatement activities and vehicle movements, which may result in damage to, or interference with, archaeological and cultural heritage sites. It is unlikely however to present any significant effects. Following the removal of the structures and the reinstatement of the land use there would be no further potential effects to the archaeology and cultural heritage receptors.

7.3.3 Biodiversity

7.3.3.1 Avifauna

Similar to construction, the main impacts during decommissioning are likely to comprise disturbance to birds. Following decommissioning, reinstatement will be important to re-establishing the ecosystem in areas previously occupied by solar panels, site roads and other structures. At the time of decommissioning, the sensitivity of some species, particularly those which are regionally rare, may have increased.

7.3.3.2 Terrestrial Ecology

Similar to construction, the main impacts during decommissioning are likely to comprise habitat loss, loss of small numbers of mammals, and disturbance to animals. Following decommissioning, reinstatement will be important to re-establishing the ecosystem in areas previously occupied by solar panels, site roads and other structures. At the time of decommissioning, the sensitivity of some species, particularly those animals which are regionally rare, may have increased.

7.3.4 Geology and Soils

Similar to construction, soils will be highly vulnerable to traffic and erosion during decommissioning. The movement of materials off-site may involve the construction of temporary roads and use of large vehicles. There is also potential for chemical or oil spills, or the incorrect handling/disposal of wastes during decommissioning. Similar measures to those outlined for the construction phase will need to be taken to minimize impacts on soils. Reinstatement of land and after-care will be critical to mitigating the damage to soils.

The panels and supports will be dismantled and steel and other useful materials will be recycled. Inert materials which cannot be recycled will be taken to a suitable disposal site. However, foundations and other inert belowground materials will be buried. This is not likely to have a significant impact on soils as it will not prevent re-vegetation or restoration of land.

7.3.5 Hydrology and Hydrogeology

Effects on water resources during decommissioning are likely to be similar to those during construction, so sensitive features such as drainage channels would need to be avoided. Contaminated materials such as oil storage tanks would need to be removed from the site and taken to a suitable disposal site to prevent future contamination of surface and groundwater.

7.3.6 Labor and working conditions

Similar to construction, the use of a workforce and decommissioning activities could potentially generate a variety of risks to the workforce, due to general site decommissioning activities (removal of site equipment and

infrastructure) and the presence of project vehicles on local risks posing a risk to. As per the construction phase, an independent Labour Assessment shall be undertaken by a qualified labour specialist, which shall include a corrective action plan with appropriate mitigation and remediation measures as well as monitoring requirements that will be implemented by the Project and its subcontractors Also, an Occupational Health and Safety Plan, Traffic Management Plan and Emergency Response Plan will be in place for the decommissioning phase of the Project. Appropriate policies will be in place to protect worker's rights.

7.3.7 Landscape and visual

Impacts of landscape will result from removal of solar PV panels, substations and transformer stations, on-site and off-site transmission lines. New machinery and equipment will be introduced into the landscape, including heavy goods vehicles excavators, bulldozers, and other heavy equipment. The impacts are expected to be the same as those experienced during construction.

7.4 Noise

Local noise levels will be affected temporarily by decommissioning activities such as equipment movement during building demolition and use of heavy machinery. The impacts will be similar to those experienced during the construction phase.

7.4.1 Socio-economic Impacts

Similar to construction, the use of a workforce and decommissioning activities could potentially generate a variety of health and safety risks to the local residents, due to general site decommissioning activities (removal of site equipment and infrastructure) and the presence of project vehicles on local risks posing a risk to local residents and school children. A Community Health and Safety Plan, Traffic Management Plan and Emergency Response Plan will be in place for the decommissioning phase of the Project.

7.4.2 Transportation and Access

Decommissioning effects are likely to be similar to that during construction although reduced in magnitude. At this stage, it is not possible to quantify the traffic effect during decommissioning of the Project as it is considered to be too far in the future to estimate any baseline traffic flows. It is unlikely however to present any significant effects.

8. Mitigation

Proposed mitigation measures are described below, and an outline Environmental and Social Mitigation and Monitoring Plan is provided in Appendix B with suggested KPIs provided in Appendix C. This will be incorporated into the Construction ESMP which will be the means of implementation.

8.1 Air Quality

8.1.1 Construction Phase

The change in ambient air quality may arise during construction as a result of fugitive dust and particulate matter emissions. However, such impacts are expected to be temporary and of short-term nature as they are limited to the construction and decommissioning phases only.

A Dust Suppression Management Plan will be prepared to identify potential sources of dust emission and provide guidance to EPC on measures to control the generation of dust, particularly during construction.

Dust emissions can be generated directly from construction activities of the project, its ancillary facilities and associated traffic, including clearing of topsoil, transport and open storage of materials, and from unpaved roads.

If visible dust dispersion to off-site locations becomes apparent additional control measures may include a maximum speed limit in dust-prone areas, cover stockpiles, temporarily suspend activities at the source of the dust emissions until wind speed is reduced, and/or apply additional water to access roads and work areas as necessary.

Internal access roads will be constructed of a base of crushed rock topped with a layer of gravel to minimise dust.

In addition, the following mitigation will be implemented:

8.1.1.1 Vehicle movements, roads and parking area

- Dusty material should be covered during transport.
- The main vehicular access roads to the project site shall be stabilized to eliminate visible fugitive dust from vehicular travel and wind erosion.
- Construction exit-wash bays shall be provided to control sediment, dust, weed (seed), etc and not to avoid scattering of any muds in the roadway when vehicle is exiting the construction site. Wash bay shall be provided in the temporary construction compound.
- Roads will be maintained to ensure dust levels are minimised.
- Implement speed limits of 20 kmph within the site to reduce dust emissions. Traffic speed signs shall be displayed prominently at all site entrances and at egress point(s).
- Spray water on roads and dusty materials stockpiles, to increase the moisture content, a few times a day along the construction traffic route. The use of oil and oil by-products are not permitted to control road dust.
- All soil and quarry materials will be covered when being transferred to site by truck.

8.1.1.2 Site clearance

- Maintain the natural topography and vegetation where possible for soil stabilization.
- Establish parking / laydown areas and paved roads first in the construction programme where possible.
- Turn off equipment when it is not in use.
- When wind speeds exceed 10 m/s minimize new disturbance to the extent possible and/or mobilize additional water spraying to minimize dust emissions from exposed surfaces. This would be the equivalent of a 6 on the Beaufort Scale where large branches are in continuous motion and whistling sounds heard in overhead or nearby power and telephone lines.

8.1.1.3 Disturbed and uncovered surfaces

- Stabilize surfaces upon completion of grading when subsequent development is delayed; except when such a delay is due to precipitation that dampens the disturbed surface sufficiently to eliminate visible fugitive dust emissions.
- When feasible, use a water to maintain moist disturbed surfaces and actively spread water during visible dusting episodes to minimise visible fugitive dust emissions.
- Minimise disturbance areas to the maximum extent feasible.
- Stockpiles should not exceed 2.5 m in height.
- For non-road or parking area earthen surfaces, stabilize surfaces by compaction, or other means sufficient to prohibit visible fugitive dust from wind erosion.

8.1.1.4 Roads

In order to minimise dust emissions from traffic movement within the site, all traffic will be required to keep to designated access roads. All roads within the site will include a subbase and base course consisting of well graded crushed stone. Roads will be surfaced with either concrete or asphalt.

8.1.2 Operational Phase

No specific mitigation is proposed during the operational phase.

8.1.3 Decommissioning Phase

Impacts during decommissioning are expected to be similar to the construction phase. The mitigation measures proposed for construction would be implemented during decommissioning.

8.2 Archaeology and Cultural Heritage

8.2.1 Construction Phase

Appropriate mitigation will be carried out in tandem with construction works. An archaeological examination was undertaken as part of the OVOS approval process and no additional archaeological investigation was required.

The following range of archaeology and cultural heritage mitigation measures are proposed at this preliminary stage. These have been developed with reference to national legislation, IFC PS 8 and other applicable standards.

The main method of mitigation will be the implementation of the following chance finds procedure followed by specifical management measures if appropriate:

- A **Chance Find Procedure** is the key mitigation proposed and will be implemented during construction groundworks to reduce the likelihood of impacts occurring without adequate mitigation. The Developer or its contractors will not disturb any chance find further until an assessment by a competent professional is made and actions consistent with the requirements of IFC PS8 are identified.
- **Cultural Heritage Awareness Training** will be integrated into workforce site inductions and toolbox talks for all Project staff, contractors and subcontractors.

Should chance finds be recorded, the following management and mitigation will be implemented:

- **Design amendments – micrositing of design components (embedded mitigation)**. Should potentially significant archaeological remains be identified, elements of the Project may be micro-sited to avoid impacts upon them.
- **Excavation and recording**. For practical reasons, when archaeological sites cannot be preserved by altering the Project design or protected by signage/fencing, and relocation is not practicable, sites will be excavated and recorded in mitigation according to the principle of ‘replacement by record’. This may involve a set-piece excavation undertaken prior to development, or a watching brief on groundworks alongside development.

- **Protection of vulnerable sites**: Vulnerable sites will be protected, if appropriate, by temporary flagging/ fencing and signage subject to the agreement of heritage authorities, ensuring an adequate buffer and staff awareness training.
- **Traffic management** including designated temporary access routes will be used to prevent soil erosion and vehicular and pedestrian damage to archaeological and cultural heritage sites.

8.2.2 Chance Finds

A review of the known archaeology and history of the wider project area indicates that there is low potential for the presence of Palaeolithic, Mesolithic and Neolithic material. Throughout the later prehistoric, antique and medieval periods, it is likely that this semi-arid desert area was populated by mobile herders. There is some potential for the presence of stray finds (casual losses), travellers' campsites and for burial mounds (kurgan).

Any terrestrial archaeological remains within the Project Area are likely to comprise:

- In situ surface scatters or features identified on bare ground.
- Surface scatters identified in areas of disturbed ground or in up-cast spoil from groundworks.
- Buried features, which may have moderate depth and complexity.

8.2.2.1 Procedure

Although there are not likely to be direct impacts on any features during construction, mitigation will focus on the implementation of appropriate archaeological chance finds procedure during initial construction works to identify any uncovered archaeological features.

The Contractor during its activities will follow the following procedures:

- The person or group (identifier) who identified or exposed the archaeological sites, objects or artefacts must cease all activity in the immediate vicinity of the site.
- The identifier must immediately inform his/her supervisor of the discovery; The supervisor must then inform the Company representative at the construction site.
- Record every chance find and complete the documentation, keep an overall record that is reportable on a monthly basis. In the case of chance finds of high archaeological potential will implement the chance find procedure, the area affected by the finding will be defined and fenced off by the contractor.
- The supervisor must ensure that the site is secured and control access.
- Archaeological materials uncovered during excavations should be stored in finding boxes (with appropriate lists indicating the stratigraphic units of provenance and the general classification of the finds).
- The finds should be stored in the nearest museum or in the regional directories.
- Photographic documentation for the chance finds (if any).
- The EPC must inform the Department of Culture and request their presence to inspect the find.
- The Department of Culture will propose adequate mitigation measure for findings protection.

8.2.2.2 Stop Work Protocol

Construction work may uncover previously unidentified artefacts. This may occur for a variety of reasons. In the case of chance finds, the following stop protocol work will be used.

Upon the discovery of archaeology and cultural heritage elements EPC will:

- Inform the Company that will inform, discuss and agree with Department of Culture how to proceed (stop work, remove the discovery etc.).
- Where the Department of Culture requires further investigation, the EPC will:

- Report substantial archaeological finds immediately to a museum as specified by the Department of Culture, so that an investigation and evaluation of the finds can be carried out;
- Publish the results of any investigation or excavation by an archaeologist in order to bring this information into the public domain; and
- The EPC will address any additional reasonable requests by the Department of Culture that are not explicitly described herein.

8.2.2.3 Mitigation Strategies

In case of chance find, the Construction Manager will be promptly informed. The Construction Manager will involve the Project Manager who will be responsible to inform the Company about the chance find. The Company will advise the Department Culture which will be in charge to arrange the following actions to undertake.

The item found will not be moved or touched until the arrival and intervention of the Department of Culture.

Mitigation strategies will be implemented, if necessary, to reduce the impact on Cultural Heritage in the project area. These will involve:

- Documentation and assessment of chance finds;
- Mitigation of development impacts: it includes implementing long-term protection strategy for archaeological sites to be impacted by the project (according to the ESIA there are no archaeological sites in the project area and nearby it). If protection of the site is not possible the Contractor conducts an archaeological excavation to document the site and remove the artefact.
- If archaeological finds of major significance will be discovered on site and cannot be removed, the EPC, in accordance with the Company and relevant Department of Culture, will follow IFC PS8 requirements as follows:
- Company shall consider protection through preservation in place.

If archaeological finds must be removed, this should be done where:

- When no technically or financially feasible alternatives existed.
- The benefits of the projects outweighed the anticipated CH loss of removal.
- Removal was by the best available technique.
- Consulted with relevant national or local regulatory agencies entrusted with the protection of archaeological find and with affected communities who use, or have used within living memory, the archaeological finds, and incorporated the views of these communities into the decision-making process.
- Where archaeological finds have been identified and significant damage may be unavoidable, the Company shall conduct good faith negotiations with, and documented the informed participation of affected communities and the successful outcome of negotiations.
- Appropriately mitigated other impacts on critical CH with the affected communities.

If archaeological finds are kept:

- Company identified proposed project use of cultural resources, knowledge, innovations, or practices of local communities embodying traditional lifestyles for commercial purposes.

8.3 Biodiversity

8.3.1 Pre-Construction Surveys

Searches of potential burrows with endoscope and live capture of reptiles, including species of international and national concern (including all PBF reptile species i.e., Central Asian tortoise and tatar sand boa) will be undertaken within the footprint of the solar farm infrastructure under the supervision of suitably experienced

herpetology specialists in accordance with regional government permitting requirements[89]. Any reptiles which are found will be translocated to a reptile receptor area, as advised by the herpetologists. Successful translocation from the construction footprint and returning them to the site once construction is complete is part of the requirement to achieve No Net Loss (NNL) of species defined as PBFs and net gain of CHs. The BAP will fully detail all relevant construction mitigation measures (BAP) and habitat restoration and operation mitigation and enhancement measures which will be completed during and after the construction period to achieve the objectives of Net Gain and/or No Net Loss for PBFs, NH and CH as appropriate.

8.3.2 Site condition assessment and definition of no net loss / net gain

In line with GN43 of PS6, the Project will "design and implement mitigation measures to achieve at least no net loss of biodiversity, where feasible, through the application of on-site and offset mitigation measures". The mitigation strategy will also align with EBRD PS6, para 16, and will be described in a Biodiversity Action Plan or biodiversity action plan (BAP), wherever appropriate. It is proposed to develop a BAP for this project that will incorporate measures normally part of a BAP.

The term no net loss is defined as "the point at which project-related impacts on biodiversity are balanced by measures taken to avoid and minimize the project's impacts, to undertake on-site restoration, and finally to offset significant residual impacts, if any, on an appropriate geographic scale (for example, local, landscape-level, national, regional)." Net gains are additional conservation outcomes that can be achieved for the biodiversity values for which the critical habitat was designated. In the context of this project, Net gain would equate to an improvement of habitat quality (increased HHs) and/or an increase in population density for NH, PBFs and CHs.

No net loss and net gain includes natural habitat and its associated significant biodiversity values. Significant biodiversity values in this case include NH, PBFs and CHs.

EBRD's PR6 requires No Net Loss (NNL) of Priority Biodiversity Features (PBFs) and the habitats that support them. This requirement is triggered by the Central Asian Tortoise. There is a requirement to demonstrate net gain for CHs designated due to overwintering populations of Great bustard.

The project will achieve NNL/NG by implementing the following general measures:

1. Ensuring the local population of PBFs remains stable (if not improves) at the site. For Central Asian tortoise, this is accomplished by temporary re-location of the tortoises to a relocation area located on similar habitat adjacent to the site during construction and subsequent re-release into the larger project area post construction.

2. Restoring the habitat in the project area that supports PBFs and improving its quality relative to the pre-project baseline.

3. Protecting the project area from human interventions, such as poaching, grazing, or other activities that could have a negative impact on the tortoises and their habitat. This will be achieved by fencing the full PV area.

4. Providing passages in fencing for tortoises to move in and out of the project site.

Performance against the NNL and NG requirement will be measured as follows.

1. The population of PBFs at the site will be measured annually using a *mark-recapture* method or as appropriate. [90]

2. The quality of the habitat at the site will be measured by comparison with a benchmark site considered to be high-quality tortoise habitat in the same ecosystem. This is accomplished by:

[89] The full details of the reptile mitigation which has been undertaken in 2022 will be added to the BAP. The GBI ecological summary report is provided as Appendix E.
[90] https://en.wikipedia.org/wiki/Mark_and_recapture

a. Finding an area of high-quality tortoise habitat in the same ecosystem, install sampling plots (enough to allow for statistical comparison with project site), and measure the following variables: % vegetative cover; % native species; richness of native species; Pielou's evenness index of native species (J'); % herbaceous plants; % shrubs. This is the *benchmark* against which the project site will be compared. The project site does not need to attain these benchmark values – the benchmark is simply a reference point.

b. Install sampling plots in the project area (enough to allow for statistical comparison with benchmark and post-construction samples at this same site) *prior* to construction, and measure the variables enumerated above. Compare the values for each variable relative to the benchmark site. Express the comparison as a percentage of the benchmark values.

c. Return to the project site sampling plots every year *post* construction, and measure the variables enumerated above. Compare the values for each variable relative to the benchmark site. Express the comparison as a percentage of the benchmark values.

3. Metrics to be determined, that demonstrate the presence of protective infrastructure (e.g., adequate fencing) and enforcement monitoring.

4. Documented presence, maintenance, and use of passages in fencing by tortoises.

Monitoring will be undertaken for the first three years of operation, at which point the success of the BAP will be reviewed and a decision taken to either extend monitoring or to confirm that NNL/NG has been achieved and that monitoring can be discontinued.

NNL and NG will be achieved when:

1. The population of PBFs is the same or better than pre-construction baseline.

2. The post-construction project site has equal or better habitat scores (measured as a % of the benchmark) as the pre-construction project site (baseline).

The BAP will be prepared and will include for the repeat surveying of the Project area to confirm the findings of the ESIA and monitor restoration.

The following metrics will be used to identify NNL and NG.

8.3.2.1 Habitat Metrics

As noted in the construction earthworks activities, the following areas will be cleared during the initial earthworks.

Table 8-1. Earthworks

Parameter	Area
Length of fence (m)	11,000
Area of internal roads (m2)	90,000
Area of external access road (m2)	2,500
Area of substation (m2)	24,388
Area of inverter bases and any other infrastructure or hardstandings (m^2)	566
Area of laydown area (m^2)	18,000
Area shaded by PV panel (m^2)	1,160,045
Area of land left free of panels (m^2)	3,099,955
Land Boundary Area (m2)	4,260,000

Source: Masdar

Based on the initial site design as set out in the table above, a total of 14.6 ha land would be cleared or just over 3% of the overall site area. It is deemed that there are significant areas on the PV site to allow habitat restoration to take place.

8.3.2.2 Infrastructure Metrics

NNS has included measures to avoid habitat fragmentation (GN46) and this will focus on the inclusion of tortoise gates in the site fencing to allow free movement back and forth. Furthermore, the site will be fenced to prevent grazing and hunting. The following metrics will be measured:

- Site fully fenced to exclude grazing and hunting.
- Tortoise gates on perimeter fence at a distance of 1 gate per 100m of fence

8.3.2.3 Great bustard offsets

Consultation on impacts and mitigations on Great bustard will be carried out prior to finalising the ESIA and BAP with relevant stakeholders including Birdlife, IUCN SSC Bustard Specialist Group, Eurasian Bustard Alliance and UzSPB.

From winter 2022/23, the project will set up a working group to help further research and mitigation to improve the populations of overwintering Great Bustard. The group has yet to be determined but it is expected to include at least consultation with the Birdlife International, IUCN SSC Bustard Specialist Group, Eurasian Bustard Alliance and UzSPB and others if appropriate.

The purpose of the working group will be to further understand the key overwintering areas and occurrence schedules of the species, how they relate to the Project location and to provide a Net Gain for this species.

The working group will include a local specialist(s) to undertake further monitoring of this species during the winter periods and will provide input into the proposed action plan to conserve the species. This will include collision monitoring along the route of the OHTL. Monitoring will commence with the 2022/23 winter period and will be repeated annually up to the end of the first three years of operation. Monitoring will be reviewed

It has been identified that the highest priority for Great Bustard conservation to be protection from poaching as it migrates through and winters in Uzbekistan. The Project will work within local communities and will train local people as ‘caretakers’, who observe Great Bustards in their vicinity and promote conservation of the species; raising awareness of the Great Bustard among local people and hunters. The actual numbers have yet to be confirmed but will be confirmed following further investigation. At this stage approximately four caretakers are envisaged.

The caretakers will be funded for life of project (25 years) by the project, and will attempt to reduce poaching in the wintering areas near the project sites, and that relevant government authorities involvement on this issue will be supported to ensure effectiveness. This action is a proposed offset for the potential impacts of collisions on project OHTLs.

Further details will be provided in a Biodiversity Action Plan. The proposals will be shared with recognised subject specialists (tbc) who will be given the opportunity to comment and input into the final BAP as it relates to monitoring and promoting conservation efforts.

8.3.3 Construction Phase

8.3.3.1 Impacts on terrestrial ecology (PBF species) during construction

- Prior to undertaking any works on site, the EPC contractor/Ecologist shall clearly delineate the approved clearing and disturbance footprint using temporary fencing, flagging tape, para-webbing or similar.
- Pre-clearing surveys will be carried out by the ecology team prior to topsoil stripping or other works starting in the pre-construction area. The Ecologist will identify burrows that appear suitable for hibernating Central Asian tortoise and will carry out searches with endoscope to confirm presence of hibernating tortoises. If found within the hibernation period, burrows will be marked and fenced to ensure that works will be excluded from the area until they can be moved between March and July.

- The Ecologist will undertake an assessment to establish a suitable receptor area adjacent to the northern boundary of the project site, in close proximity to the operational footprint of the northern boundary fence (to overlap with typical movement within a home range for this species, as advised by the Ecologist). The precise location of the receptor area will be agreed with the Ecologist and the regional Goscomecology representative. The exact release date will be determined by temperature, weather conditions and suitability of habitat. Animals will be marked and numbered to allow ongoing monitoring.
- The EPC/Ecologist should provide awareness training during site induction and toolbox talks with an emphasis on the sensitivities relating to PBF and CH species in particular and the specific Project requirements. The awareness will focus on identifying the species, preferred habitat and what to do in the event of a chance find. This will require the ecologist on-site to be informed. They will assume control of the situation and will physically move the reptile to a safe location away from construction vehicles. The ecologist will determine the most suitable location.
- Project vehicles will be restricted to designated construction roadways and designated parking areas.
- Where construction is continuing from March onwards, wooden planks or similar will be placed in excavations to allow tortoises or other animals to escape should they fall into the excavation. Excavations will be checked at the start of each shift and if an animal is identified, the EPC/Ecologist will be notified and will remove the animal to a safe location.

8.3.3.2 Minimise loss/damage of existing habitat during construction

- No work will take place on areas identified as Habitat Management Areas on the PV site. This area will be demarcated to ensure vehicles and workers do not enter the area. Currently the full site is assessed as MH.
- EPC and subcontractors adhere to the IFC Good Practice Note: Managing Contractors' Environmental and Social Performance.
- Project staff and contractor(s) shall compile and implement a faunal protection policy to avoid unnecessary killing of fauna, ensures speed limits are controlled, hunting and possession of hunting equipment is prohibited, and taking pets and/or purchase/sale of wild animals or animal products is prohibited.
- Project staff and contractors require environmental toolbox talks during construction to raise awareness, limit conflict and reduce additional disturbance to fauna and avifauna.
- Staff will be briefed on risks of exposure to scorpions, spiders and snakes as well as the preventative measures. Workers in the field will wear protective clothing, long trousers, closed shoes and leather gloves. Information regarding nearest location of treatment for any bites and stings will be made available.
- Any snakes encountered at the site must not be handled or harmed by Project workers. Animals must be relocated by appointed personnel.
- Construction vehicles must remain on the access roads and not drive over vegetation which is not subject to site clearance.
- Prior to undertaking any works on site, the EPC contractor/Ecologist shall clearly delineate the approved clearing and disturbance footprint using temporary fencing, flagging tape, para-webbing or similar.
- Habitat Improvement Areas shall be clearly delineated using temporary fencing, flagging tape, para-webbing or similar. These areas will be used to offset loss of habitats on site.
- The EPC/Ecologist should provide awareness training during site induction and toolbox talks.
- The EPC shall disturb only the areas necessary for construction. This is the best way to limit the amount of erosion control that is required throughout the project.
- The EPC shall keep natural vegetation in place and leave topsoil undisturbed wherever possible during the main construction phase (e.g. piling works).

- Geotextile membranes will be used to avoid damage to natural habitat during the main construction phase (e.g. piling works).
- Project shall be developed in phases to minimise vegetation disturbance and control erosion. The EPC shall not break new ground until absolutely necessary. This will limit the amount of erosion during each construction phase and will help to conserve the natural seed bank contained within the topsoil.
- Project vehicles will be restricted to designated construction roadways and designated parking areas.
- The EPC shall manage stockpiles and exposed ground to minimise dust and erosion. Stockpiles shall be a maximum height of 2m.
- The EPC shall locate stockpiles at least 50 m away from watercourses, ditches and drains.
- The EPC shall locate stockpiles on areas of Modified Habitat.
- All waste shall be stored within the designated storage area.

8.3.3.3 Habitat Restoration and Rehabilitation Measures

- Habitat restoration to achieve No Net Loss of PBFs, based on guidance provided by the appointed specialist team of herpetologists. Habitat restoration will be applied within the PV site. Further detail will be provided in the BAP.

8.3.3.4 Minimise loss/damage of topsoil (and associated seedbank)

- Soil storage areas should be located on modified (historically cultivated land) within the project area.
- Excavated soils will be stored separately in accordance with their stratigraphic layers.
- Topsoil will be stripped to a maximum depth of 30 cm and stored separately in clearly demarcated areas. These areas will be recorded via spatial mapping.
- Subsoil will be stored separately and again will be recorded via spatial mapping.
- Stockpiles do not exceed 2 m in height.
- Areas of excavated soil and stockpiles shall be compacted to minimise erosion. There is a presumption against spraying with water as it may stimulate germination and hinder future restoration.
- Remove all alien or invasive species from the site area if encountered. Removal shall be manually in the first instance.
- Project staff require environmental toolbox talks during construction to raise awareness, limit conflict and reduce additional disturbance to fauna and avifauna.
- Searches for other reptiles (will be undertaken above ground or using an endoscope to search likely burrows during the construction phase within the footprint of the solar farm infrastructure (e.g. location of piles) under the supervision of a suitably experienced ecologist/herpetologist. If tortoises are found they will be removed to the designated tortoise mitigation area, as advised by the ecologist/herpetologist. Translocation from the construction footprint is a requirement to achieve No Net Loss (NNL) of reptile species defined as PBF's. Further detail will be provided in a Biodiversity Action Plan.
- During routine maintenance any invasive flora species will be removed.
- Ground stabilisation and revegetation shall be undertaken once work is complete in a given area.

8.3.3.5 Storage of Excavated Soil

- Soil that is excavated should not be stored in areas of ecological importance. The designated storage area may need to be checked for reptiles and breeding birds by the appointed ecological specialists.

8.3.3.6 Zoning of Ecological Sensitive Areas

- It may be necessary to establish temporary exclusion zones within the main working area, as advised by the appointed ecological specialist. These ecological sensitive areas may need to be protected due to season constraints, such as the presence of a rubble pile that could be used by hibernating reptiles; or an active bird nest. Barrier fencing mesh is considered suffice for this purpose and zone should be signed 'Ecological Sensitive Area'.

- No excavations will be left uncovered as this presents a risk of reptiles and small mammals becoming unnecessarily trapped. If trenches and pits are exposed over-night then escape routes for fauna must be made at regular intervals.

8.3.3.7 Bird deflectors

- The key operational mitigation measures for the transmission line relates to the mitigation of avian collision. Bird deflectors will be installed along the entire length of the Overhead Line between the Solar PV and the existing sub-station at Ishithan; one diverter (Firefly or equivalent type to be agreed with Lenders) every 10m and staggered placement of them on the different lines to provide maximum coverage (refer to Ferrer et al, 2020)[91].

- The final mitigation design will be discussed with Birdlife International, IUCN SSC Bustard Specialist Group, Eurasian Bustard Alliance and UzSPB who will be provided the opportunity to provide input into the most suitable design. An initial introductory call with BirdLife International took place on 21 December 2022.

8.3.4 Operational Phase

Operational mitigation measures for the Solar PV site are detailed below:

- No work will take place on areas identified as Habitat Management Areas on the PV site. This area will be demarcated to ensure vehicles and workers do not enter the area. The only Project access will be the ecology team who will monitor the level of improvement of the habitat to monitor the effectiveness of the BAP.

- During routine maintenance any invasive flora species will be removed.

- Natural revegetation of the cleared areas will take place. The success will be monitored and if necessary additional measures will be undertaken such as watering of those areas.

- All cleared areas will be infilled to avoid the risk of reptiles and small mammals becoming unnecessarily trapped.

- Following completion of construction works and in order to allow the free movement of reptiles and small mammals in/out of the site, a series of holes (minimum of 12cm height/breadth) will be dug under the base of the fencing . Further detail will be provided in a Biodiversity Action Plan.

- Internationally and nationally protected fauna and flora will be subject to post-construction monitoring . Further details will be provided in a Biodiversity Action Plan.

The key operational mitigation measures for the transmission line relates to the mitigation of avian collision, as follows:

- Bird deflectors will be installed along the entire length of the Overhead Line between the Solar PV and the existing sub-station at Ishithan; one diverter (Firefly or equivalent type to be agreed with Lenders) every 10m and staggered placement of them on the different lines to provide maximum coverage (refer to Ferrer et al, 2020)[92]. As noted, the final design will be discussed with the Great bustard working group who will provide

[91] Ferrer *et a*l (2020), *Efficacy of different types of "bird flight diverter" in reducing bird mortality due to collision with transmission power lines*. Global Ecology and Conservation, Vo. 23, September 2020, e01130.
Found at: https://www.sciencedirect.com/science/article/pii/S2351989420306715

[92] Ferrer *et a*l (2020), *Efficacy of different types of "bird flight diverter" in reducing bird mortality due to collision with transmission power lines*. Global Ecology and Conservation, Vo. 23, September 2020, e01130.
Found at: https://www.sciencedirect.com/science/article/pii/S2351989420306715

input into the most suitable design. During operation the project will monitor the condition of the deflectors and if necessary replace any that are broken or deficient.

- Collision monitoring will be undertaken along the OHTL.

All mitigation and monitoring will be included in a Biodiversity Action Plan which will also need to include a robust Adaptive Management Strategy should the results of monitoring indicate an impact on Great Bustard or other species of global conservation concern (e.g. Sociable Lapwing or raptors). The BAP will include an outline Off-setting Plan (as described above) which will need to be developed and in place should the results of the monitoring indicate an impact on bird species of global or national conservation concern

Further details will be provided in a Biodiversity Action Plan.

The BAP will validate the accuracy of predicted impacts and risks to biodiversity values posed by the Project, and the predicted effectiveness of biodiversity management actions and should include the following:

- Baseline: measures of the status of biodiversity values prior to the Project's impacts
- Process: monitoring of the implementation of mitigation measures and management controls
- Outcomes: monitoring of the status of biodiversity values during the life of the project, compared to the baseline.

The BAP should include a practical set of indicators (metrics) for the biodiversity values requiring mitigation and management. Specific thresholds (e.g. KPIs) should be set for monitoring results that will trigger a need to adapt the management plan(s) to address any deficiencies in performance.

Monitoring of populations of CH and PBF species known to be present on site will be undertaken to ensure that there are no long-term negative impacts as a result of the Project. On-going monitoring and reporting will be completed throughout the construction and operation phases of the Project in accordance with the relevant monitoring plans.

8.4 Geology and Soils

8.4.1 Site Preparation

To reduce the potential for erosion of drainage channels during road construction, routes will be selected to avoid ephemeral drainage channels where possible. Culverts or other drainage control features will be installed where crossings of drainage routes are unavoidable. Stormwater run-off onto roads and uncontrolled flow from roads will be minimized. Soil will be stripped on areas required for roads and hardstandings, including temporary construction compounds, offices and other buildings. Outside of these areas, soils will not be stripped with the aim of reducing erosion and preserving habitats within the site.

8.4.2 Construction Phase

The risk of contamination through temporary storage facilities will be reduced through the storage of all materials within designated areas. Supplies will also be provided for the clean-up of minor spills. A Pollution Prevention Plan will be prepared to prevent accidental spillage of fuels, chemicals or other substances.

To reduce the risk of soil and water pollution from leaks and spills through storage of oil the following will be implemented:

- A designated storage area is established with an impervious base and impermeable bund walls. Capacity must be sufficient to contain 110% of the full volume within a bund and secured area.
- All fuel, oil and chemical storage is stored in a designated secure area.

- Hoses and valves are checked regularly for signs of wear and ensure that they are turned off and securely locked when not in use.
- Diesel pumps and similar items are placed on drip trays to collect minor spillages. Trays will be checked regularly and accumulated oil removed.

With regards to potential impacts associated with the construction workforce, it is proposed that sanitary waste is collected in containers below portable toilets and transported for disposal. Wastewater will be disposed of at a suitably licensed facility.

8.4.3 Operational Phase

The potential for soils and groundwater contamination associated with waste disposal will be reduced through the reduction of wastes to the extent possible whilst maximising the re-use and recycling of materials. All waste and rubbish will be collected and stored before disposal at a suitably licensed facility

Mitigation measures associated with maintenance and use of oils and other chemicals include:

- Establish a designated storage area with an impervious base and impermeable bund walls and protected from precipitation. Capacity must be sufficient to contain 110% of the full volume within a bund and secured area.
- Store all fuel, oil and chemical storage in the designated secure area.
- Do not leave vehicle unattended during refuelling, never leave open a delivery valve.
- Check hoses and valves regularly for signs of wear and ensure that they are turned off and securely locked when not in use.
- Place diesel pumps and similar on drip trays to collect minor spillages. Check trays regularly and remove any accumulated oil.

8.5 Hydrology and Hydrogeology

8.5.1 Site Preparation

To reduce the potential for erosion of drainage channels during road construction, routes will be selected to avoid ephemeral drainage channels where possible. Culverts or other drainage control features will be installed where crossings of drainage routes are unavoidable. Stormwater run-off onto roads and uncontrolled flow from roads will be minimized.

8.5.2 Construction Phase

The risk of contamination through temporary storage facilities will be reduced through the storage of all materials within designated areas. Supplies will also be provided for the clean-up of minor spills. A Water Management Plan will be prepared to prevent accidental spillage of fuels, chemicals or other substances.

To reduce the risk of soil and water pollution from leaks and spills through storage of oil the following will be implemented:

- A designated storage area is established with an impervious base and impermeable bund walls. Capacity must be sufficient to contain 110% of the full volume within a bund and secured area.
- All fuel, oil and chemical storage is stored in a designated secure area.
- Hoses and valves are checked regularly for signs of wear and ensure that they are turned off and securely locked when not in use.
- Diesel pumps and similar items are placed on drip trays to collect minor spillages. Trays will be checked regularly and accumulated oil removed.

With regards to potential impacts associated with the construction workforce, it is proposed that sanitary waste is collected in containers below portable toilets and transported for disposal. The waste will be disposed at a location to be agreed with Local Government respective officer or environmental officer.

8.5.2.1 Utilities

The source of water for the project has not yet been confirmed but is subject to ongoing consultation with the Water Authority, EPC and Masdar. At this stage it is proposed that the project purchase water direct from a suitably licensed utility company, which will be delivered by tanker.

The EPC Contractor will investigate the potential to segregate and reuse grey water on-site where practical.

8.5.2.2 Discharge of Surface Water

Discharges of process wastewater, sanitary wastewater, wastewater from utility operations or stormwater to surface water should not result in contaminant concentrations in excess of local ambient water quality criteria or, in the absence of local criteria, other sources of ambient water quality.

During construction, there will be no pre-planned direct discharges to areas potentially holding surface water, including ephemeral streams. No pathways have been identified where releases to effluent systems could be made. However, construction activities have the potential to pollute through accidents from the escape of:

- Silty and contaminated water from de-watering of excavations, exposed ground, earth stockpiles, and muddy roads.
- Leakage or accidental spillage of fuels, oils, chemicals etc., especially on the construction lay-down area.
- Washing down concrete mixing and delivery equipment.
- Sanitary wastewater from the welfare facilities.

Measures to mitigate the impacts of pollution incidents will be provided in the Wastewater Management Plan.

8.5.2.3 General Mitigation

To prevent impacts from runoff during land preparation and construction the EPC shall carry out the following measures:

- Construction debris will be stored in proper designated areas and at least 50m from seasonal surface water courses.
- Refuelling shall not be permitted within 50m of the seasonal water courses.
- Fuel shall be stored in suitably bunded areas, containing at least 110% of the total volume stored and at least 50m from seasonal surface water courses.
- Site office, temporary facility, worker accommodation and other similar site infrastructure shall not be permitted within 50m of the seasonal water courses.

To reduce the risk of potentially polluting materials such as oils, fuels and chemicals leaking, use dedicated storage areas with secondary containment and spillage protection and working procedures, which ensure that these materials are handled correctly. Waste oil and grease from the construction site shall be collected in suitable drums and transported out for proper disposal. Records of disposal of such material will be kept.

This is detailed in the Water Management Plan (REF 09) and Hazardous Material and Waste Management Plan (REF 08).

8.5.2.4 Tracks

Tracks within the site will have a 2% camber allowing surface water to run off into adjacent compacted soil ditches. If necessary, soil ditches will collect rainfall and channel it to the lowest point of the site on the boundaries. Surface water will be discharged into surface water drainage system. Details of the drainage system will be provided by the EPC Contractor as part of detailed design. Surface Water Drainage System

The EPC Contractor will develop an appropriate surface water drainage system as part of detailed design. It is proposed that surface water would discharge to the ephemeral watercourse to the east side of the PV site. Where possible, clean surface water will be redirected around the site rather than risk contamination within the site.

8.5.2.5 Wastewater

Wastewater from toilets in the workers accommodation and office/admin buildings will be piped to a central storage tank. The wastewater would be collected and disposed of by a suitable licensed contractor.

8.5.2.6 Liquid Wastes

Waste oil and grease from the construction site shall be collected in suitable drums, stored on a segregated concrete area and transported for proper disposal. Records of disposal of such material will be kept. The location of a suitable waste recycling/disposal facility has yet to be confirmed. Currently all waste would be landfilled.

8.5.3 Operational Phase

The potential for soils and groundwater contamination associated with waste disposal will be reduced through the reduction of wastes to the extent possible whilst maximising the re-use and recycling of materials. All waste and rubbish will be collected and stored before disposal in at a suitably licensed site.

Mitigation measures associated with maintenance and use of oils and other chemicals include:

- Establish a designated storage area with an impervious base and impermeable bund walls and protected from precipitation. Capacity must be sufficient to contain 100% of the full volume within a bund and secured area.
- Store all fuel, oil and chemical storage in the designated secure area.
- Do not leave vehicle unattended during refuelling, never leave open a delivery valve.
- Check hoses and valves regularly for signs of wear and ensure that they are turned off and securely locked when not in use.
- Place diesel pumps and similar on drip trays to collect minor spillages. Check trays regularly and remove any accumulated oil.

8.6 Labour and Working Conditions

The implementation of the actions necessary to meet these requirements will be managed through the Project's Environmental and Social Management System (ESMS).

The requirements apply to workers directly engaged by the client (direct workers) and workers engaged through third parties to perform work related to the Project. Both the Developer and all its contractors shall commission an independent Labour Assessment undertaken by a qualified labour specialist, which shall include a corrective action plan with appropriate mitigation and remediation measures as well as monitoring requirements that will be implemented by the Project and its subcontractors. The Project will develop appropriate policies on labour and working conditions that will:

- Promote the fair treatment, non-discrimination, and equal opportunity of workers.
- Establish, maintain, and improve the worker-management relationship.
- Promote compliance with national employment and labor laws.
- Protect workers, including vulnerable categories of workers such as children, migrant workers, workers engaged by third parties, and workers in the client's supply chain.
- Promote safe and healthy working conditions, and the health of workers.
- Avoid the use of forced labor and child labor.