



**Draft - Biodiversity Management Plan Report for El Ksar- 100 MW  
solar PV site, Gafsa - Tunisia**

**REPORT:** Draft – Biodiversity Management Plan Report for El Ksar– 100 MW solar PV site, Gafsa – Tunisia

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This report has been prepared in accordance with EAM's Integrated Management System.



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## ACRONYMS & ABBREVIATIONS

BFD	Bird Flight Diverters
BMP	Biodiversity Management Plan
CPG	Compagnie de Phosphate de Gafsa
CR	Critically Endangered
DD	Data Deficient
E&S	Environmental and Social
EAM	Environmental Assessment and Management
EBRD	European Bank for Reconstruction and Development
EIB	European Investment Bank
EN	Endangered
ESIA	Environmental and Social Impact Assessment
ESP	Environmental and Social Policy
ESPIU	Environmental and Social Project Implementation Unit
ESR	Environmental Social Requirements
EU	European Union
GCT	Groupe Chimique Tunisien
IBA	Important Bird Areas
IFC	International Finance Corporation
ILO	International Labor Organization
IND	Insufficient Data
IUCN	International Union for the Conservation of Nature
KBA	Key Biodiversity Area
KPI	Key Performance Indicator
KV	Kilovolt
LC	Least Concern
ME	Ministry for the Environment
MIME	Ministry of Industry, Mines and Energy
MW	Mega Watt
MWP	Mega Watt Peak
NE	Not Evaluated
NP	National Parks
NT	Near Threatened
OHTL	Overhead Transmission Line
PNN	non-breeding population in Tunisia
PPA	Power Purchase Agreement
PV	Photo Voltaic
REGNES	Registre national des espèces sauvages
SNCFT	Société Nationale des Chemins de Fer Tunisiens
STEG	Tunisian Company of Electricity and Gas
UN	United Nations
VPs	Vantage Points
VU	Vulnerable

## 1 INTRODUCTION

### 1.1 PROJECT CONTEXT

As part of its energy transition strategy, Tunisia has set itself the target of achieving a share of renewable energies in the electricity mix of 35% by 2030 and 50% by 2035. This will result in the installation of a total functional renewable capacity of 4,850 MW by 2030 and 8,350 MW by 2035 using photovoltaic and wind. Qair (hereafter referred to as "the Developer"), was awarded in December 2024, a 100 Mega Watt Peak (MWp) Photo Voltaic (PV) Solar power plant in the governorate of Gafsa referred to as "the Project" or 'El Ksar Solar PV Plant'. Qair was selected after an international competitive call of tenders launched by the Government of Tunisia under the reference AO-01-2022, represented by the Ministry of Industry, Energy and Mining (MIME). On 24 March 2025, Qair signed a concession agreement with the Ministry of Industry, Mines and Energy and a 25-year Power Purchase Agreement (PPA) with the Tunisian Company of Electricity and Gas (STEG).

This document is the Biodiversity Management Plan (BMP) for the 100 MWp Solar Photovoltaic (PV) plant and 225 kV overhead transmission line 10 km long. It has been prepared in accordance with the IFC Performance Standards (2012), Environmental and Social Policy (ESP - 2024) of the European Bank for Reconstruction and Development (EBRD) and the Environmental and Social Standard of the European Investment Bank (EIB).

### 1.2 PURPOSE OF BIODIVERSITY MANAGEMENT PLAN

This document constitutes the Biodiversity Management Plan (BMP) and will be updated following the results of additional field ecological surveys, which are required to:

- inform measures to avoid, reduce or compensate biodiversity impacts,
- demonstrate how biodiversity impacts have been avoided in the first instance and mitigated, as well as providing a clear strategy for no net loss/net gain where appropriate,
- confirm the absence of potential Critical Habitat species, and
- identify any additional technical mitigation measures related to the solar PV plant, the final OHTL alignment, and the configuration of cables and pylons.

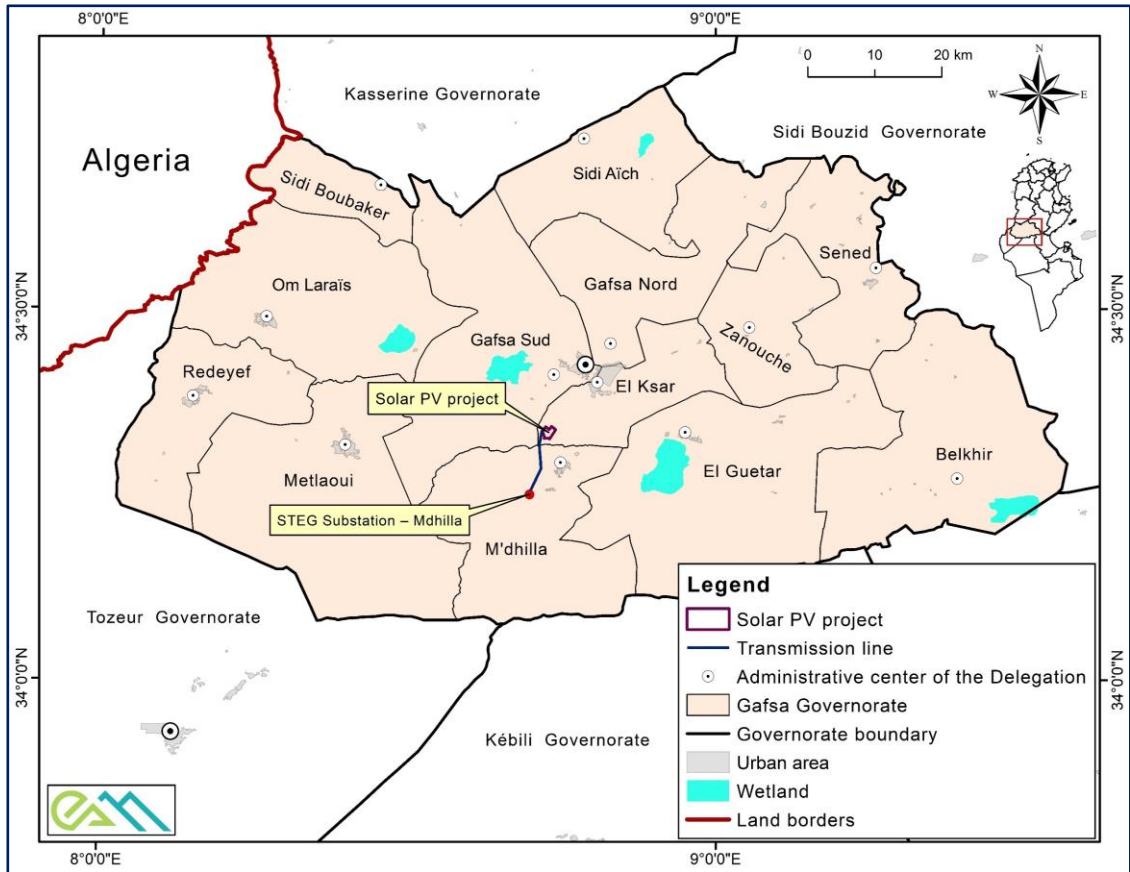
The BMP contains the management tool that provides the assurance that measures to manage risks to biodiversity are implemented and maintained throughout the project lifecycle. It provides details on how the BMP will be implemented by the Developer (Qair) and EPC Contractors during construction and operational phase.

The objective of this draft BMP includes the following:

- identify the mitigation and monitoring measures for biodiversity in compliance with:
  - IFC – Performance standard 6 (PS6): Biodiversity Conservation and Sustainable Management of Living Natural Resources
  - EBRD – Environmental and Social Requirement 6 (ES6): Biodiversity Conservation and Sustainable Management of Living Natural Resources
  - EIB – Standard 4: Biodiversity and ecosystems.
- adopt the mitigation hierarchy to anticipate and avoid, or where avoidance is not possible, reduce, mitigate, and restore impacts to biodiversity.
- develop and strictly implement policies, plans and procedures to integrate biodiversity management within the framework of the project's environmental and social management plans/procedures for the lifecycle of the project.
- establish a monitoring program to assess the effects of residual impacts on biodiversity.
- report the results of the periodic audits and provide for corrective actions, if necessary, in order to reach the plan objectives.

## 2 PROJECT DESCRIPTION

Tunisia is administratively divided into 24 Governorates, which are further subdivided into 264 delegations, and subsequently into sectors. The El Ksar photovoltaic (PV) Solar plant project is located in the Gafsa Governorate, within the Delegation of El Ksar. The Project involves the construction and operation of a 100 MW solar PV power plant and the installation of an associated 12 km OHTL connecting the El Ksar Solar PV plant to the Mdhilla Substation, operated by STEG. The OHTL crosses two delegations within Gafsa Governorate, namely El Ksar and Mdhilla.



**Figure 2.1 - Administrative Map of the Project**

The proposed PV solar plant site is situated on private land in El Ksar Delegation, Gafsa Governorate. It lies approximately 4 km west of the GCT–Mdhilla phosphate plant, 4 km northwest of the village of Mdhilla, and 7 km north of the village of El Borj. To the south of the site lies the sinuous bed of Oued Mlize. A railway line runs along the northern boundary of the site and forms part of the national phosphate transport network operated by the Société Nationale des Chemins de Fer Tunisiens (SNCFT), linking the mining centers of the Compagnie de Phosphate de Gafsa (CPG) to the processing plants of the Groupe Chimique Tunisien (GCT) in Gafsa, Gabès, Skhira, and Sfax.

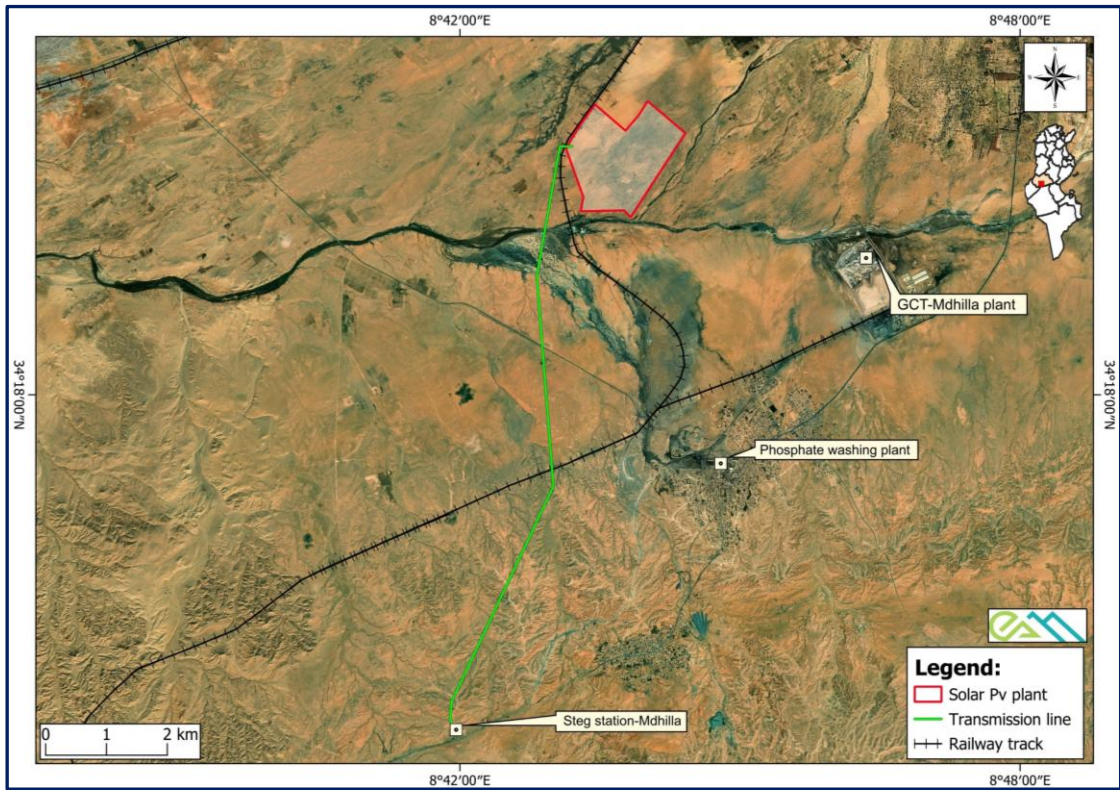


Figure 2.2 - Geographical location of the PV solar plant and the OHTL

### 3 NATIONAL LEGISLATION AND EBRD REQUIREMENTS

The Developer is committed to ensuring that the Project complies with applicable national legislation and IFC standards, EBRD requirements and EIB standards, a summary of which are outlined in this section. Additional information is provided in the ESIA.

#### 3.1 NATIONAL LEGISLATION

The legal framework established in Tunisia covers most aspects of environmental protection, pollution control and improvement of the living environment.

In addition to these conventions, a legal arsenal has been put in place to preserve and protect biodiversity, with the most important texts cited below: The local regulatory and legislative framework for biodiversity management includes the following main texts:

- ***Law No. 88-20 on the Forestry Code of 13 April 1988*** revising the Forestry Code, as amended and supplemented by Law no. 2005-13 of January 26, 2005. The Forestry Code covers all the special rules applying to forests, alfalfa beds, rangelands, forest land, national parks and nature reserves, and wild fauna and flora, with the aim of ensuring their protection, conservation and rational use, as well as guaranteeing users the legal exercise of their rights.
- ***Order of the Minister of Agriculture and Hydraulic Resources of 19 July 2006, establishing the list of rare and endangered wild fauna and flora.*** The present Order fixes the list of rare and endangered wild fauna and flora.
- ***Law No. 92-72 of 3 August 1992 on the revision of plant protection legislation***  
This law lays down the general provisions relating to plant protection and the organization of the pesticides sector for agricultural use. The law comprises 24 articles divided into 4 titles, namely General provisions and definitions (I); Quarantine, including provisions relating to the establishment of the list of quarantine pests against which control is compulsory and the list of plants whose entry into Tunisian territory is prohibited, provisions relating to the powers of phytosanitary inspectors, prevention and control measures within the territory (declarations, access and controls, possible compensation), phytosanitary control measures at points of entry (II) Control of the trade, distribution and use of pesticide products, which must be approved and whose manufacture, import, formulation, packaging, sale and distribution must be authorized in advance (III); Penal and final provisions (IV).
- ***The Minister of Agriculture and Hydraulic Resources of 29 June 2006 laying down the conditions for granting authorizations for temporary occupancy in the State forest estate***  
It prohibits the temporary authorization of any work that will have a negative impact and risk on the environment and natural resources in forest areas, national parks, nature parks and wildlife protection zones.

#### 3.2 NATIONAL BIODIVERSITY STRATEGY AND ACTION PLAN

Biodiversity in Tunisia is related to 69 sets of natural ecosystems and 12 sets of agro-systems. A total of 7212 species including 3749 terrestrial plant and animal species and 3463 marine and aquatic plant and animal species have been recorded.

The National Biodiversity Strategy and Action Plan 2018-2030 was drawn up in 2017 by the Ministry of Local Affairs and the Environment.

The document is structured into five chapters that deal successively with (1) Biodiversity; (2) the background to the strategy; (3) the strategy; (4) the action plan for implementing the strategy; and (5) financing the 2018-2030 action plan.

The report:

- ✓ defines biodiversity, the benefits inherent in ecosystem services and the pressures on biodiversity in Tunisia;
- ✓ recalls the history and results of previous steps taken in this context;
- ✓ proposes the strategy to be adopted, its vision and priorities in 5 main actions aimed at (a) strengthening capacity and implementation of the strategy and its action plan; (b) integrating

biodiversity values into all policies; (c) developing traditional knowledge and know-how; (d) reducing pressures and threats to biodiversity and promoting its sustainable use; and (e) protecting and restoring biodiversity, improving ecosystem resilience and enhancing ecosystem services, taking into account the Aichi strategic goals and objectives.

- ✓ sets out the action plan for implementing the strategy;
- ✓ proposes and describes five federated actions in relation to the main priorities defined;
- ✓ draws up a financing plan for the 2018-2023 action plan.

The Biodiversity Management Plan for the OHTL considers the National Biodiversity Strategy and Action Plan 2018-2030 and responds to at least eight of its strategic actions and objectives directly related to biodiversity and ecosystem conservation:

1. Strategic objective 1.2: Set up a system for monitoring and evaluating the implementation of the National Biodiversity Strategy and Action Plan 2018-2030.
2. Strategic objective 2.1: Raise awareness, educate and communicate on the values of biodiversity.
3. Strategic objective 2.2: Integrate biodiversity into socio-economic development planning at various levels.
4. Strategic goal 3.1: Improve and integrate knowledge of changes in the state of biodiversity.
5. Strategic objective 4.1: Reduce the causes of biodiversity loss.
6. Strategic goal 4.2: Mitigate/prevent environmental threats to ecosystems.
7. Strategic goal 5.1: Protect and restore biodiversity.
8. Strategic goal 5.2: Improve ecosystem resilience and maintain/enhance ecosystem services.

### 3.3 INTERNATIONAL CONVENTIONS RATIFIED BY TUNISIA

Tunisia has ratified more than 60 international conventions and agreements concerning environmental protection. It has developed information systems as part of the implementation of the three RIO conventions to facilitate reporting to various organizations, including: (i) the information system developed as part of the implementation of the Convention on Biological Diversity; and (ii) the information system on the Clean Development Mechanism.

**Table 3.1** - The main texts regulating these international ratifications

International Conventions	Ratification text
Stockholm Convention on Persistent Organic Pollutants (POPs)	Decree No. 2004-918 of April 13, 2004
Cartagena Protocol on Biosafety.	Law n°2002-58 of June 25, 2002
Kyoto Protocol and Law 93-46 of May 3, 1993, ratifying the United Nations Framework Convention on Climate Change.	Law 2002-55 of June 19, 2002
Agreement Relating to the Establishment and Operation of the Observatory of the Sahara and Sahel	Law n°2000- 12 of February 7, 2000
Bern Convention on the Conservation of European Wildlife and Natural Habitats.	Law n° 95-75 of 07/08/95
Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal.	Law 95-63 of July 10, 1995
United Nations Convention to Combat Desertification in Those Countries Experiencing Serious Drought.	Law 95-52 of June 19, 1995
United Nations Convention on Biological Diversity.	Law 93-45 of May 3, 1993
United Nations Framework Convention on Climate Change.	Law 93-46 of May 3, 1993
Convention on the Conservation of Migratory Species of Wild Animals.	Law 86-63 of July 16, 1986
Convention on Wetlands of International Importance.	Law No. 80-9 of March 3, 1980
Protocol relating to the cooperation of North African States in the fight against desertification.	Law 71-1 of January 25, 1979

International Conventions	Ratification text
African Convention for the Conservation of Nature and Natural Resources.	Law 76-91 of November 4, 1976
Convention for the Protection of the World Cultural and Natural Heritage.	Law 74-89 of December 11, 1974
Convention on International Trade in Endangered Species of Wild Fauna and Flora	Law 74-12 of March 11, 1974

### 3.4 IFC REQUIREMENTS

The IFC of the World Bank provides a range of guidance documents related to the assessment and management of E&S issues in project development. Not only does IFC guidance provide a generally accepted basis for good practice, but it also provides the technical cornerstone for the Equator Principles which set out the E&S requirements of banks for project finance. The IFC requirements have become the de facto international E&S performance benchmark for project financing.

The IFC policy on E&S Sustainability puts into practice IFC's overall commitments to E&S sustainability. The policy seeks to: (i) enhance the predictability, transparency, and accountability of IFC's actions and decision making; (ii) help clients manage their environmental and social risks and impacts and improve their performance; and (iii) enhance positive development outcomes on the ground. In addition, the Policy identifies IFC's commitments, its roles and responsibilities and other as applicable.

The IFC Performance Standards (PS) on Social and Environmental Sustainability set out a framework for managing and improving project performance from planning and assessment, through construction and operations to closure. The Performance Standards requirements are summarized in the table below.

IFC PS	Key Points
PS1: Assessment and Management of Environmental and Social Risks and Impacts	<p>PS1 underscores the importance of managing social and environmental performance throughout the life of a project by using a dynamic social and environmental management system. Specific objectives of this Performance Standard are:</p> <ul style="list-style-type: none"> <li>• To identify and assess social and environment impacts, both adverse and beneficial, in the project's area of influence;</li> <li>• To avoid, or where avoidance is not possible, minimize, mitigate, or compensate for adverse impacts on workers, affected communities, and the environment;</li> <li>• To ensure that affected communities are appropriately engaged on issues that could potentially affect them; and</li> <li>• To promote improved social and environment performance of companies through the effective use of management systems.</li> </ul>
PS2: Labor and Working Conditions	<p>The requirements set out in this PS have been in part guided by a number of international conventions negotiated through the International Labor Organization (ILO) and the United Nations (UN). Specific objectives of this Performance Standard are:</p> <ul style="list-style-type: none"> <li>• To establish, maintain and improve the worker-management relationship;</li> <li>• To promote the fair treatment, non-discrimination and equal opportunity of workers and compliance with national labor and employment laws;</li> <li>• To protect the workforce by addressing child labor and forced labor; and</li> <li>• To promote safe and healthy working conditions, and to protect and promote the health of workers.</li> </ul>
PS 3: Resource Efficiency and Pollution Prevention	<p>This Performance Standard outlines a project approach to pollution prevention and abatement in line with international available technologies and practices. It promotes the private sector's ability to integrate such technologies and practices as far as their use is technically and financially feasible and cost-effective in the context of a project that relies on commercially available skills and resources. Specific objectives of this Performance Standard are:</p>

IFC PS	Key Points
	<ul style="list-style-type: none"> <li>To avoid or minimize adverse impacts on human health and the environment by avoiding or minimizing pollution from project activities; and</li> <li>To promote the reduction of emissions that contribute to climate change.</li> </ul>
PS 4: Community Health, Safety and Security	This PS recognizes that project activities, equipment, and infrastructure often bring benefits to communities including employment, services, and opportunities for economic development. However, projects can also increase risks arising from accidents, releases of hazardous materials, exposure to diseases, and the use of security personnel. While acknowledging the public authorities' role in promoting the health, safety and security of the public, this PS addresses the project sponsor's responsibility in respect of community health, safety and security.
PS 5: Land Acquisition and Involuntary Resettlement	Involuntary resettlement refers both to physical and economic displacement as a result of project-related land acquisition. Where involuntary resettlement is unavoidable, appropriate measures to mitigate adverse impacts on displaced persons and host communities should be carefully planned and implemented.
PS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources	This Performance Standard reflects the objectives of the Convention on Biological Diversity to conserve biological diversity and promote the use of renewable natural resources in a sustainable manner. This Performance Standard addresses how project sponsors can avoid or mitigate threats to biodiversity arising from their operations as well as sustainably manage renewable natural resources. Specific objectives of this Performance Standard are: <ul style="list-style-type: none"> <li>To protect and conserve biodiversity; and</li> <li>To promote the sustainable management and use of natural resources through the adoption of practices that integrate conservation needs and development priorities.</li> </ul>
PS 7: Indigenous Peoples	Indigenous peoples may be particularly vulnerable to the adverse impacts associated with project development, including risk of impoverishment and loss of identity, culture, and natural resource-based livelihoods. PS7 seeks to ensure that business activities minimize negative impacts, foster respect for human rights, dignity and culture of indigenous populations, and promote development benefits in culturally appropriate ways. PS 7 (Indigenous Peoples) is not considered to be applicable to this Project.
PS 8: Cultural Heritage	Consistent with the Convention Concerning the Protection of the World Cultural and Natural Heritage, this Performance Standard aims to protect irreplaceable cultural heritage and to guide project sponsors on protecting cultural heritage in the course of their business operations.

### 3.5 EBRD REQUIREMENTS

The applicability to the Project of EBRD's Environmental and Social Requirements is summarised below:

EBRD Performance Requirement	Applicability to the Project
EBRD ESR1 – Assessment and management of environmental and social risks and impacts	Applicable – this ESR always applies to an EBRD financed Project.
EBRD ESR2 – Labour and working conditions	Applicable – the Project will involve the use of a workforce consisting of direct employees and non-employee workers engaged through contractors and potentially other intermediaries. The Project will involve a supply chain where there is a risk of labour violations from occurring.
EBRD ESR3 – Resource efficiency and pollution prevention and control	Applicable – the Project will generate greenhouse emissions, use resources (such as gravel and water), has the potential to result in pollution, and must also respond and be resilient to climate impacts.

EBRD Performance Requirement	Applicability to the Project
EBRD ESR4 – Health, safety and security	Applicable – the Project will generate health and safety risks to local communities and the workforce, including workers who are non-employees and those involved in the supply chain. The Project will also use security personnel to ensure the safety of sites from equipment theft and unauthorised entry.
EBRD ESR5 – Land acquisition, restrictions on land use and involuntary resettlement	Applicable – the Project will involve land acquisition and restrictions on access to land-based assets from the physical presence of the transmission line pylons and the substation, and land use restrictions below the electrical wires.
EBRD ESR6 – Biodiversity conservation and sustainable management of living natural resources	Applicable – the Project may require the clearance of vegetation and soil to provide space for the transmission line pylons and substation, and there is a risk that flora and fauna will be affected. Most significantly, avifauna are likely to be impacted by habitat removal and the installation and operation of overhead electrical cables. Appropriate well tested mitigation measures will need to be developed and implemented.
EBRD ESR8 – Cultural heritage	Applicable – the Project involves ground-breaking, intrusive work during the construction stage that has the potential to damage physical cultural heritage resources that may be present below ground. A Chance find procedure will be applied although ESR8 may still apply as the proximity of cultural heritage receptors to the route of the transmission line is not yet known and will be clarified during later stages of the ESIA process.
EBRD ESR10 – Information disclosure and stakeholder engagement	Applicable – this ESR always applies to an EBRD financed Project.

### 3.6 EIB REQUIREMENTS

The European Investment Bank's (EIB) Standard 4: Biodiversity and Ecosystems (along with associated guidance note) requires project promoters to assess, manage, and monitor the impacts and risks to biodiversity and ecosystems in order to protect biodiversity, maintain ecosystem functions, and prevent significant harm. The standard is underpinned and aligned with relevant EU legislation especially the 'do no significant harm' principle and promoting a holistic, human rights-based approach. Key requirements of the Standard include assessing impacts, identifying and protecting high-value biodiversity, managing risks from invasive species, and applying the mitigation hierarchy (avoidance, minimization, restoration, and compensation) to achieve no net loss or a net positive impact on biodiversity.

## 4 EXISTING ENVIRONMENT

Ornithological surveys were undertaken between April and September 2025. Avifauna on the project site were monitored using transect methods, while surveys along the OHTL route were conducted from fixed vantage points (VPs). The OHTL route has undergone three successive modifications, resulting in three alternative alignments, with the third alignment representing the current route. A biodiversity survey focusing on flora and terrestrial fauna was also conducted on 15–16 May 2025 within the project site, the neighbouring Oued Mlize and along the OHTL route (alternative line 2). Habitats were assessed based on direct field observations, while species were recorded through visual detections and indirect signs of presence (tracks, burrows, footprints, droppings), supplemented by information from scientific literature.

The three OHTL alignments traverse areas characterized by similar ecological habitats, therefore, the biodiversity survey results and the avifaunal observations obtained along Alternative Lines 1 and 2 remain applicable to the final alignment.

This section presents the key findings on flora, fauna, and avifauna based on field surveys conducted as described.

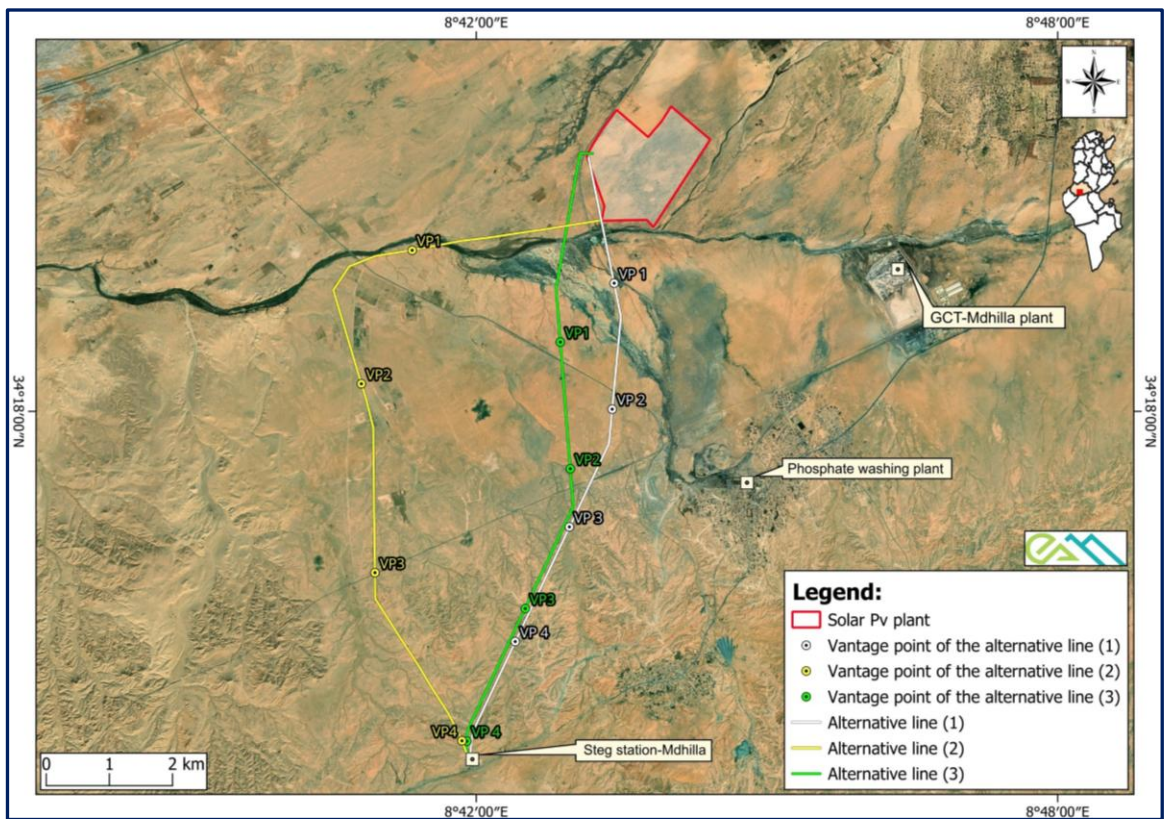


Figure 4.1 - Geographical location of the PV site and the OHTL routes

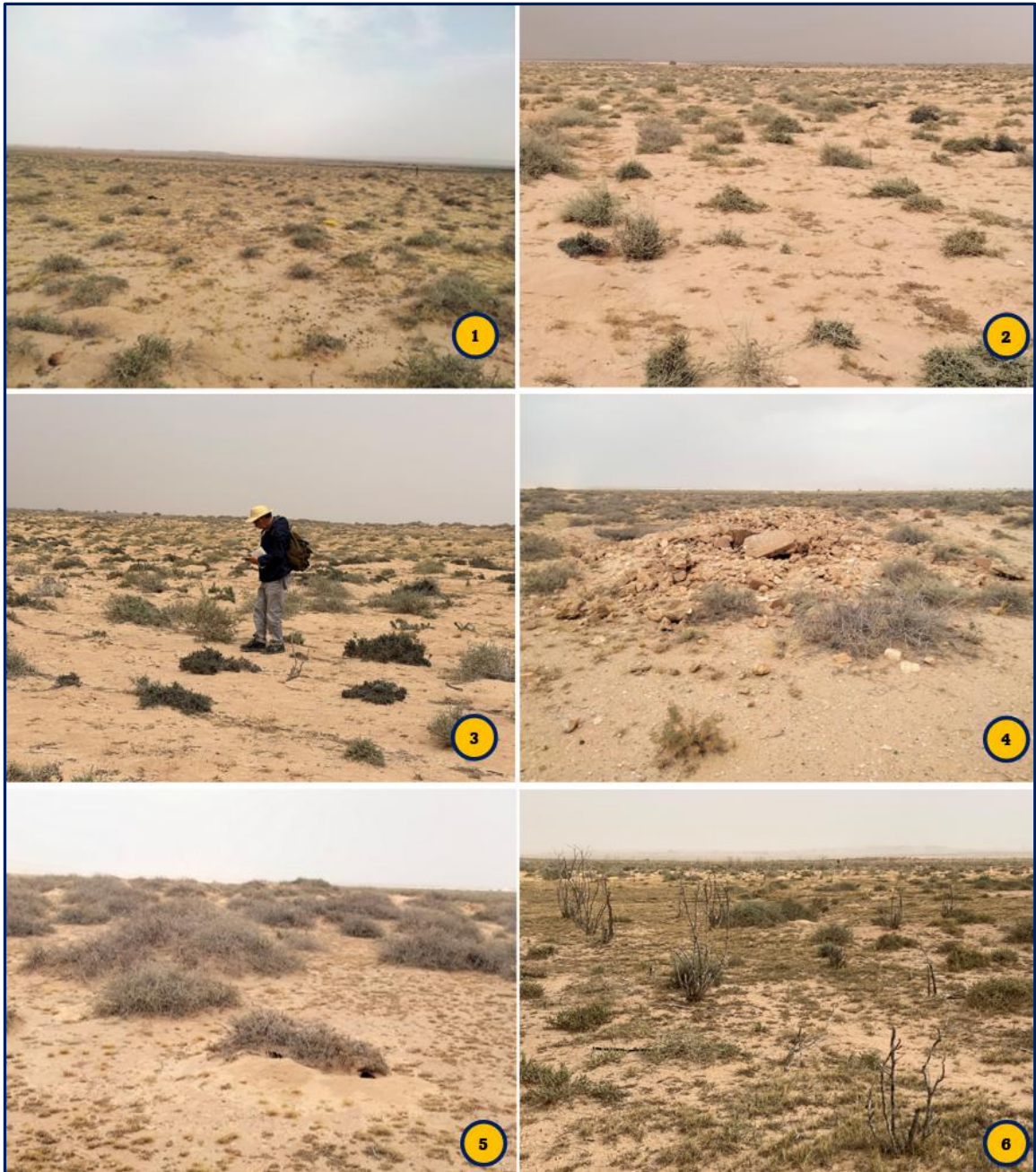
### 4.1 HABITATS AND FLORA

#### PV Solar Plant

The photovoltaic (PV) plant site lies within a pre-desert steppe ecosystem characterized by arid climatic conditions and sparse vegetation. The terrain is predominantly flat and homogeneous, consisting of sandy soils with a hardened surface crust, interspersed with occasional stony patches and small barkans formed by wind-driven sand movement. The site itself contains an abandoned castor (*Ricinus communis*) cultivation field, while the surrounding landscape is occupied by cereal and irrigated crops, along with scattered rural dwellings.

The vegetation within the PV solar Plant is typical of arid steppe ecosystems, dominated by low perennial shrubs such as *Suaeda vermiculata*, *Caroxylon vermiculatum*, and *Astragalus armatus*. The former castor field is colonized by *Thymelaea hirsuta* and *Peganum harmala*, while shrubby formations of *Retama raetam*, *Nitraria retusa*, and *Limoniastrum monopetalum* form dense, scattered clumps

across the steppe. Remnants and young shoots of castor occupy the area of the former cultivation.



**Figure 4.2 -** Steppe landscapes at the project site

The table below includes the full taxonomic list of plant species recorded at the project site, along with their conservation status according to the Global IUCN Red List (2025) and their national status based on REGNES and the National Red List of Threatened Flora in Tunisia (ME, 2025).

**Table 4.1** - Taxonomic list of plant species observed at the PV Solar Plant

Family	Species	French name	Status	
			IUCN (2025)	TUN
Amaranthaceae	<i>Suaeda vermiculata</i>	Soude vermiculée	NE	NE
	<i>Caroxylon vermiculatum</i>	Salicorne vermiculée	NE	NE
	<i>Haloxylon salicornicum</i>	Saligne blanche	NE	NE
	<i>Anabasis articulata</i>	Baguel	NE	NE
	<i>Traganum nudatum</i>	Damrane	NE	NE
	<i>Atriplex halimus</i>	Arroche	NE	NE
Fabaceae	<i>Astragalus armatus</i>	Astragale vulnérant	NE	NE
	<i>Retama raetam</i>	Rétame	NE	NE
Plumbaginaceae	<i>Limoniastrum monopetalum</i>	Grande Statice	NE	NE
	<i>Limonium tuberculatum</i>	Statice à tubercules	NE	NE
	<i>Limonium sinuatum</i>	Statice sinué	NE	NE
Thymeleaceae	<i>Thymelaea hirsuta</i>	Passerine	NE	NE
Nitrariaceae	<i>Nitraria retusa</i>	Nitraire	NE	NE
Zygophyllaceae	<i>Peganum harmala</i>	Rue sauvage	NE	NE
Euphorbiaceae	<i>Ricinus communis</i>	Ricin commun	LC	NE

NE: Not Evaluated, LC: Least Concern. Species indicated as NE are not listed in national (REGNES, ME 2025), regional, or international (IUCN 2025) references. They are common and widely distributed in arid regions. They may therefore be considered as Least Concern (LC).

### Oued Mlize

The sinuous bed of Oued Mlize and the adjacent humid areas lie to the south of the PV solar plant site, where the OHTL crosses marshy zones. This habitat supports a plant community dominated by hygrophilous and halophytic species, shaped by the combined influence of water availability and soil salinity. The floodplain is colonised by a dense reedbed of Common Reed (*Phragmites australis*), while the margins host African Tamarisk (*Tamarix africana*) and scattered clumps of other salt-tolerant species such as *Limoniastrum monopetalum* and *Nitraria retusa*. The saline, waterlogged soils are carpeted with halophytes, notably Glaucous Glasswort (*Arthrocnemum macrostachyum*) and Smooth Seaheath (*Frankenia laevis*), along with occasional *Suaeda* and *Atriplex* species.

The table below presents the complete taxonomic list of plant species recorded in the Oued Mlize floodplain and its surrounding area, together with their conservation status according to the Global IUCN Red List (2025) and their national status based on REGNES and the National Red List of Threatened Flora in Tunisia (ME, 2025).

**Table 4.2 - Taxonomic list of plant species recorded in Oued Mlize and its surrounding area**

Famille	Genre et espèce	Nom Français	Status	
			IUCN (2025)	TUN
Poaceae	<i>Phragmites australis</i>	Roseau commun	LC	NE
Tamaricaceae	<i>Tamarix africana</i>	Tamaris	LC	NE
Nitrariaceae	<i>Nitraria retusa</i>	Nitraire	NE	NE
Plumbaginaceae	<i>Limoniastrum monopetalum</i>	Grande Statice	NE	NE
Amaranthaceae	<i>Arthrocnemum macrostachyum</i>	Salicorne glauque	NE	NE
	<i>Suaeda vermiculata</i>	Soude vermiculée	NE	NE
	<i>Suaeda maritima</i>	Soude maritime	NE	NE
	<i>Atriplex halimus</i>	Arroche	NE	NE
Fankeniaceae	<i>Frankenia corymbosa</i>	Frankénie à corymbe	NE	NE
Fankeniaceae	<i>Frankenia laevis</i>	Frankénie lisse	NE	NE
Caryophyllaceae	<i>Spergularia marina</i>	Spergulaire marine	LC	NE
Zygophyllaceae	<i>Zygophyllum album</i>	Zygophyllum blanc	NE	NE

NE: Not Evaluated, LC: Least Concern. Species indicated as NE are not listed in national (REGNES, ME 2025), regional, or international (IUCN 2025) references. They are common and widely distributed in arid regions. They may therefore be considered as Least Concern (LC).



**Figure 4.3 - Landscapes and vegetation of the Oued Mlize floodplain**

**Along the OHTL route**

Botanical surveys were conducted along the alignment of the OHTL (alternative line 2), approximately 12 km in length, extending from the south-western edge of the site to the STEG substation in Mdhilla to the south, at and between the vantage points (VPs) established for bird observations (figure 4.1). Different habitat types were observed:

- VP1 (200 m altitude): A humid, marshy area located on the edge of Oued Mlize. The habitat and its vegetation have been described previously.
- Between VP2 and VP3 (233 m altitude; 34°17'19"N – 8°40'40"E): A stony steppe on calcareous crust, locally slightly sandy.
- VP3 (245 m altitude): A dry wadi bed crossed by a bridge and drainage channels.
- VP4 (300 m altitude): Located near the STEG substation of Mdhilla; a dry, stony terrain composed of hills and ravines.

The variation in habitat types along the OHTL alignment reflects differences in soil moisture, texture, and altitude, ranging from humid zones near Oued Mlize to dry, rocky hills near the STEG substation. Vegetation composition changes accordingly with these edaphic and microclimatic gradients. Along the alignment, several species already recorded on the PV site were observed, such as *Suaeda vermiculata*, *Astragalus armatus* and *Anabasis articulata*. The calcareous and stony steppe between VP2 and VP3 is dominated by *Haloxylon scoparium*, *Pituranthos chloranthus*, and *Astragalus armatus*. At VP3, the sandy oued bed and its encrusted banks support a distinct assemblage dominated by the grasses *Stipagrostis pungens* and *Cenchrus ciliaris*, together with typical arid-zone species such as *Artemisia campestris* and *Pergularia tomentosa*. Further south at VP4, the xerophilous steppe on the hills and ravines near the STEG substation hosts more desert adapted vegetation, including *Gymnocarpos decander*, and associated drought-tolerant shrubs.

**Table 4.3** - Taxonomic list of plant species recorded along the OHTL route  
(Alternative line 2)

Family	Species	French name	Status	
			IUCN (2025)	TUN
Amaranthaceae	<i>Suaeda vermiculata</i>	Soude vermiculée	NE	NE
	<i>Caroxylon vermiculatum</i>	Salicorne vermiculée	NE	NE
	<i>Anabasis articulata</i>	Baguel	NE	NE
	<i>Haloxylon salicornicum</i>	Saligne blanche	NE	NE
	<i>Haloxylon scoparium</i>	Saligne noire	NE	NE
	<i>Trganum nudatum</i>	Damrane	NE	NE
Apiaceae	<i>Pituranthos chloranthus</i>	Pituranthos à balai	NE	NE
Caryophyllaceae	<i>Gymnocarpos decander</i>	Gymnocarpe	NE	NE
Cistaceae	<i>Helianthemum lippii</i>	Fleur de Jade	NE	NE
Plumbaginaceae	<i>Limoniastrum monopetalum</i>	Grande Statice	NE	NE
Fabaceae	<i>Astragalus armatus</i>	Astragale vulnérant	NE	NE
	<i>Retama raetam</i>	Rétame	NE	NE
Apocynaceae	<i>Pergularia tomentosa</i>	Pergulaire	NE	NE
Lamiaceae	<i>Teucrium polium</i>	Germandrée	NE	NE
Asteraceae	<i>Artemisia campestris</i>	Armoise champêtre	NE	NE
	<i>Echinops spinosissimus</i>	Faux chardon	NE	NE
Poaceae	<i>Stipagrostis pungens</i>	Drinn	NE	NE
	<i>Cenchrus ciliaris</i>	Cenchrus cilié	LC	NE
Capparaceae	<i>Cleome arabica</i>	Cléome	NE	NE
Geraniaceae	<i>Erodium glaucophyllum</i>	Bec-de-grue	NE	NE
Thymeleaceae	<i>Thymelaea hirsuta</i>	Passerine	NE	NE
Zygophyllaceae	<i>Peganum harmala</i>	Rue sauvage	NE	NE

NE = Not Evaluated, LC = Least Concern, VU = Vulnerable. Species indicated as NE because they are not listed in national (REGNES, ME 2025), regional, or international (IUCN 2025) references. They are common and widely distributed in arid regions. They may therefore be considered as Least Concern (LC).



1: Sandy steppe near VP1 - 2 & 3: Stony, slightly sandy steppe between VP2 and VP3 - 4: Oued bed and culverts under the bridge, VP3 - 5 & 6: Ravines and rugged terrain near Mdhilla substation.

**Figure 4.4 -** Landscapes and vegetation along the OHTL line (Alternative line 2)

**Conclusion**

- All recorded plant species are common and widespread in the region, with no species of specific conservation interest or legal protection status identified within the PV site, Oued Mlize floodplain, or the OHTL alignment.

**4.2 FAUNA**

The species recorded across the different habitats surveyed—both within the PV power plant site and along the OHTL alignment—are presented without distinction by observation location. This approach is applied because, with few exceptions, most species are not strictly confined to a specific habitat and may move between sectors in search of food or shelter.

**a. Invertebrates**

The invertebrates recorded in the study area include gastropods, insects, and scorpions:

- Among the **molluscs**, the gastropod species *Sphincterochila candidissima* has been observed

- Among the **insects**, the following species were observed:
  - The Sand Mantis *Eremiaphila denticollis*;
  - Three species of beetles (Coleoptera): *Julodis* sp., *Adesmia montana* and *Blaps* sp.;
  - One orthopteran (Pamphagidae): *Pamphagus meridionalis*.
- Among the **scorpions**, two species belonging to the family Buthidae were recorded within the surveyed area:
  - *Buthus tunetanus*: High local density observed, with approximately one individual per 10 m detected along a 100 m transect using UV light.
  - *Androctonus australis*: The most venomous scorpion species in the region, found under a stone in rocky steppe habitat between VP2 and VP3.



**Figure 4.5 - Invertebrates observed within the project area**

## **b. Vertebrates**

### *i. Amphibians*

No amphibian species were recorded during the surveys, despite the presence of a small water point within the agricultural field on the site. In the Oued Mlize marshy areas, the water is too saline, making the habitat unsuitable for amphibians.

ii. Reptiles

Five reptile species were observed within the project area (the PV site and the OHTL route), four lizards and one snake. Two of these species *Tarentola fascicularis* and *Psammophis schokari*, were found inside an empty water reservoirs (majels) found near an abandoned house close to VP1. The Horned Viper (*Cerastes cerastes*) has been observed several times by local residents, while the stony steppe near VP4 provides suitable habitat for the Egyptian Cobra (*Naja haje*). A broader list of potential species, compiled from Nouira et al. (2002), indicates that all are classified as Least Concern (LC) by the IUCN Red List of Mediterranean Reptiles (2006).

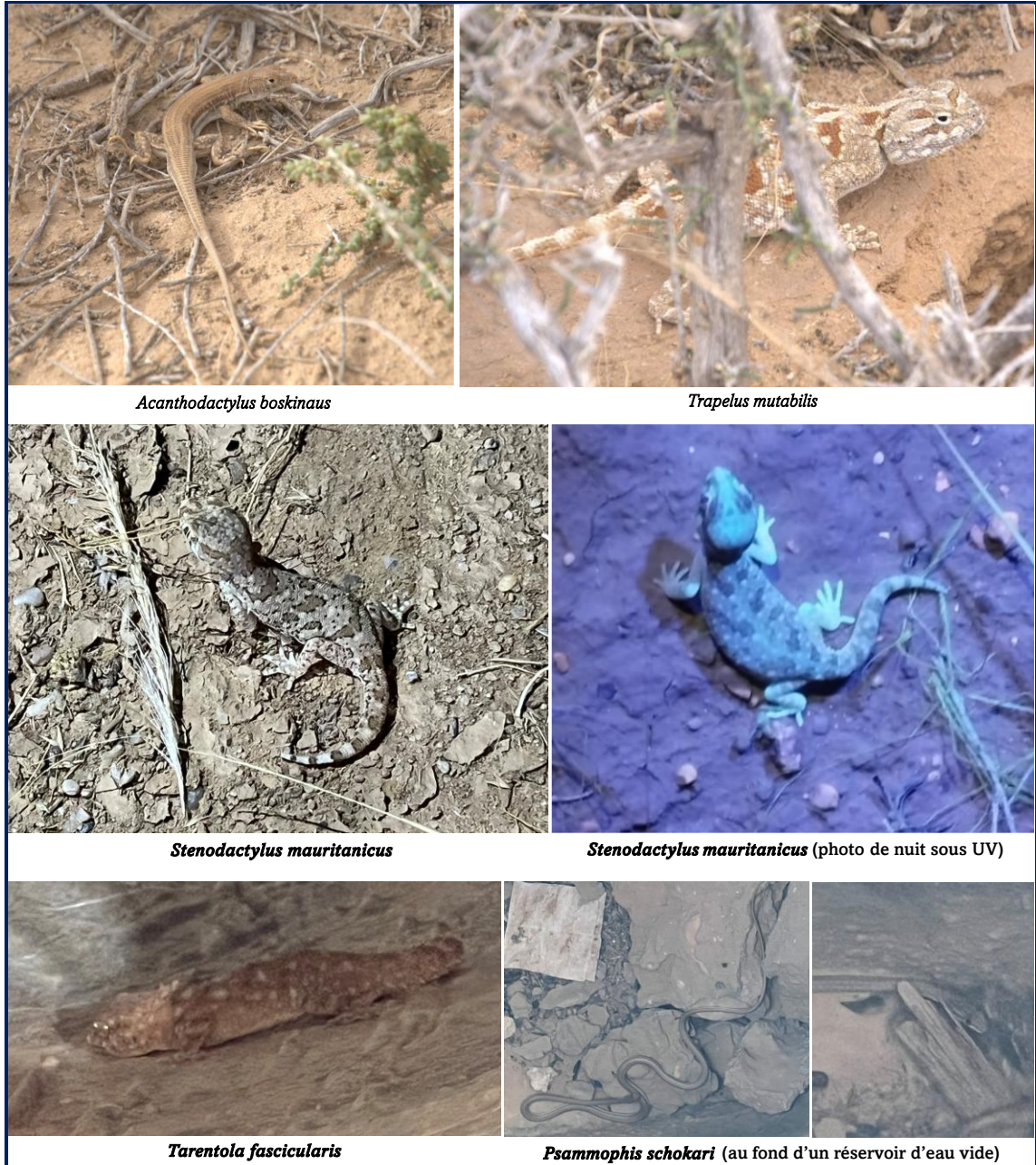


Figure 4.6 - Reptiles observed within the project area

Table 4.4 - List of reptiles observed/potentially present within the PV solar project

Ordre	Family	Species	Status UICN
Sauriens	Lacertidae	<i>Acanthodactylus boskianus</i> (Observed)	LC
		<i>Mesalina olivieri</i>	LC
	Agamidae	<i>Trapelus mutabilis</i> (Observed)	LC
	Gekkonidae	<i>Stenodactylus mauritanicus</i> (Observed)	LC
		<i>Tropicolotes tripolitanus</i>	LC

Ordre	Family	Species	Status IUCN
	Phyllodactylidae	<i>Tarentola fascicularis</i> (Observed)	LC
	Scincidae	<i>Chalcides boulengeri</i>	LC
Ophidiens	Lamprophiidae	<i>Psammophis schokari</i> (Observed)	LC
		<i>Malpolon moilensis</i>	LC
	Viperidae	<i>Cerastes cerastes</i>	LC
	Elapidae	<i>Naja haje</i>	LC

LC: Least concern, Status: IUCN, 2006. Conservation status and geographical distribution of reptiles and amphibians of the Mediterranean basin.

### iii. Mammals

Daytime surveys revealed burrows and droppings of small mammals such as jerboas, gerbils, Meriones, sand rats, and red fox. Two carcasses (a jerboa and a probable sand rat *Psammomys obesus*) were found in an empty reservoir where reptiles had previously been observed.

Night surveys recorded two active jerboas, while black rats (*Rattus rattus*) and house mice (*Mus musculus*) are likely present in nearby dwellings. The list of mammals likely to be found in the project area is based on the literature (CHETOUI, in press; EL-FARHATI et al., 2019). All these species are classified as LC according to the IUCN Red List of Mediterranean Mammals (2008).

**Table 4.5 - List of mammals potentially present within the PV solar project**

Ordre	Family	Species	Status IUCN
Lagomorphes	Leporidae	<i>Lepus capensis</i>	LC
Rongeurs	Muridae	<i>Gerbillus campestris</i>	LC
		<i>Gerbillus latastei</i>	LC
		<i>Gerbillus simoni</i>	LC
		<i>Meriones shawi</i>	LC
		<i>Psammomys obesus</i> (Burrows and probable carcass observed)	LC
	Dipodidae	<i>Jaculus orientalis</i> (Observed active at night and as a carcass)	LC
Insectivores	Erinaceidae	<i>Atelerix algirus</i>	LC
Carnivores	Canidae	<i>Vulpes vulpes</i> (Burrows and droppings)	LC
		<i>Canis anthus</i>	LC

LC: Least concern, DD: Data deficient; Status IUCN: IUCN Red List of Mediterranean Mammals (2008).



**Figure 4.7** - Mammal burrows and carcasses observed within the project area

The mammal group also includes bats. The order Chiroptera is represented in Tunisia by 22 species. Based on bibliographic syntheses by Dalhoumi et al. (2011) and Puechmaillé et al. (2012), 12 species, belonging to six different families, have been reported in the Gafsa region and the mining basin area in general.

**Table 4.6** - List of bat species recorded in the mining basin area of the Gafsa region

Family	Scientific name	IUCN (2025)
<b>Rhinolophidae</b>	<i>Rhinolophus euryale</i>	NT
	<i>Rhinolophus mehelyi</i>	VU
	<i>Rhinolophus ferrumequinum</i>	LC
<b>Hipposideridae</b>	<i>Asellia tridens</i>	LC
<b>Rhinopomatidae</b>	<i>Rhinopoma cystops</i>	LC
<b>Molossidae</b>	<i>Tadarida teniotis</i>	LC
<b>Miniopteridae</b>	<i>Miniopterus schreibersii</i>	VU
<b>Vespertilionidae</b>	<i>Eptesicus isabellinus</i>	LC
	<i>Pipistrellus kuhlii</i>	LC

Family	Scientific name	IUCN (2025)
	<i>Otonycteris hemprichii</i>	LC
	<i>Plecotus gaisleri</i>	NE
	<i>Myotis punicus</i>	DD

NT: Near Threatened, VU: Vulnerable, LC: Least concern, DD: Data deficient, NE: Not evaluated

Within the study area, Oued Mlize constitutes the main suitable foraging habitat for bats, offering abundant feeding opportunities associated with mosquito presence. The railway bridge, sheepfolds, and abandoned buildings provide potential roosting and resting sites, with bats likely commuting at night toward marshy areas in search of insects. To identify bat species, present in the study area, acoustic recordings were conducted after sunset on 15 May along Oued Mlize (34°19'34"N, 8°43'10"E) using an Eco Meter Touch 2 detector. The one-hour session yielded 75 acoustic contacts, corresponding to approximately 51 individual bats after accounting for repeated detections.

The Analysis of the ultrasonic spectrograms identified the following species:

1. *Pipistrellus kuhlii*: Only one individual recorded twice.
2. *Eptesicus isabellinus*: 22 individuals detected.
3. *Tadarida teniotis*: 15 individuals detected.
4. The remaining 13 recordings were of uncertain identification, but their frequencies likely correspond to *Otonycteris hemprichii*.

All four species (three confirmed and one probable) are classified as Least Concern (LC) on the Global IUCN Red List (2025). Additional investigations at different sites and seasons are recommended to establish a complete bat inventory for the project area.

**Table 4.7 - Bat species recorded at Oued Mlize bridge**

Family	Scientific name	IUCN (2025)
<b>Molossidae</b>	<i>Tadarida teniotis</i>	LC
<b>Vespertilionidae</b>	<i>Eptesicus isabellinus</i>	LC
	<i>Pipistrellus kuhlii</i>	LC
	<i>Otonycteris hemprichii</i> (probable)	LC

### **Conclusion**

- Surveys covered the PV site and OHTL alignment, identifying typical steppe and semi-arid fauna with no species of exceptional conservation concern.
- No endemic, restricted range, globally (IUCN, 2025) or nationally protected species were recorded within the project area. Most confirmed species are classified as Least Concern (LC).
- Two bat species reported in the Gafsa mining basin: *Rhinolophus mehelyi* and *Miniopterus schreibersii* are classified as Vulnerable (VU) on the IUCN Global Red List (2025), neither species was recorded within the project area.
- Additional bat surveys across potential roosting and foraging sites, and during different seasons, are recommended to establish a comprehensive bat inventory for the project area.

### **4.3 AVIFAUNA**

As part of the methodology established for ornithological investigations at the El Ksar – Gafsa PV power station and the associated OHTL line, survey campaigns were conducted 12-13 April, 15-16 Mai, 23-24 August and 18-19 September. The Avifauna within the project site was monitored using transect methods, while surveys along the OHTL route were carried out from fixed vantage points. It is important to note that bibliographic research indicates the near total absence of previous ornithological studies specifically focused on this area, available data are scattered and generally refer to southern Tunisia as a whole.

#### **At the PV plant**

To cover the footprint of the PV solar plant, the site was divided into three transects (T1–T3), each walked on foot by the ornithologist. Along each transect, stops were made every few meters to scan the surroundings and listen for bird activity, ensuring thorough coverage. During the surveys, all birds seen or heard were systematically recorded together with their behaviours, and all nests encountered were

documented. This approach enabled both the estimation of species abundance and density (ind/km) and the compilation of a near-exhaustive list of species using the site, including resident species, breeding migrants, and transient passage birds.

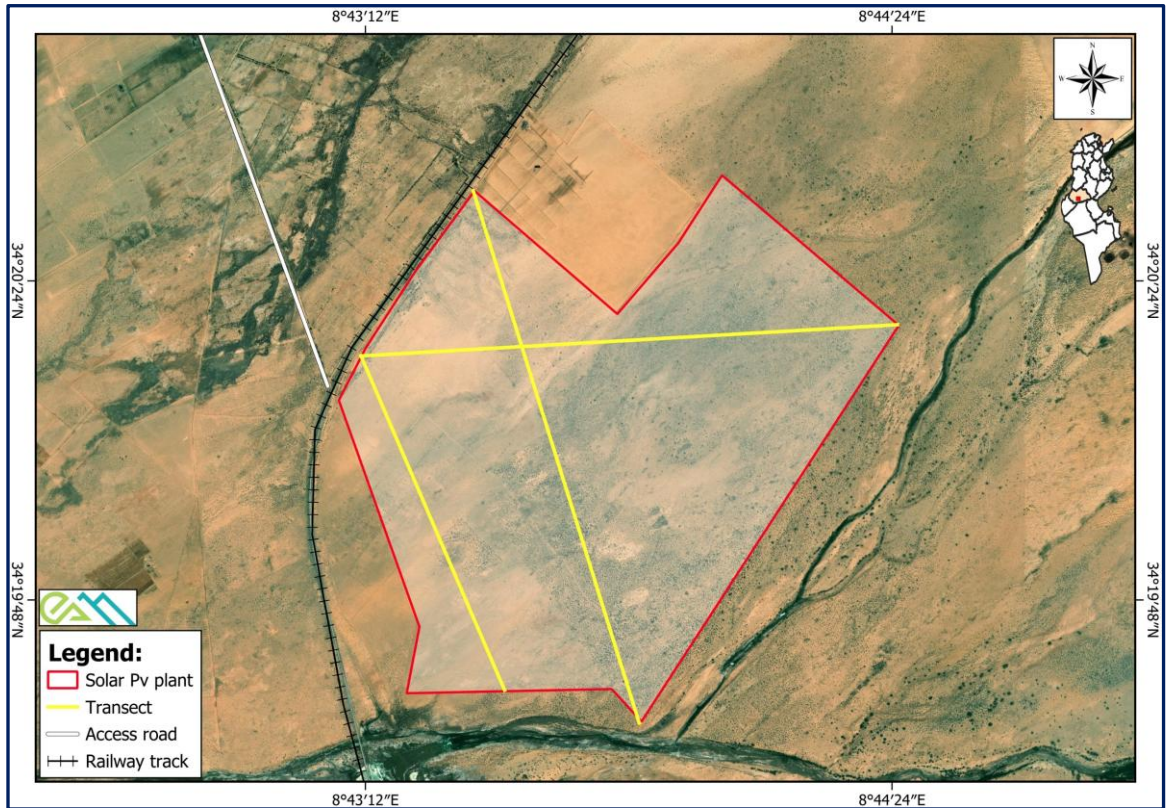


Figure 4.8 - Position of the transect at the PV Solar Project

**Along the OHTL route**

To monitor birds along the OHTL route, the survey applied vantage point (VP) methodology. VPs are fixed observation stations strategically positioned to provide a wide field of view over the transmission line and its surroundings. A total of four VPs were established, spaced approximately 2-3 km apart. At each VP, ornithologists remained stationary for 2 hours, scanning the sky and landscape with binoculars and telescopes to detect and record all bird movements and activity. The OHTL route has undergone three successive modifications. The April survey was conducted along Alternative Alignment 1, followed by the May survey along Alternative Alignment 2, and the August–September surveys along the Alternative Alignment 3 Figure 4.1 - The locations of the VPs were subsequently adjusted to correspond with the revised alignment. The three alignments traverse similar steppe-type habitats. Consequently, observations obtained along Alternatives 1 and 2 remain applicable to the final alignment.

Table 4.8 - Coordinates of Vantage Points along Alternative Alignment 1

Vantage point	Geographic coordinates	
	Latitude	Longitude
VP1	34°19'5.59"N	8°43'25.45"E
VP2	34°18'1.17"N	8°43'24.24"
VP3	34°17'0.98"N	8°42'57.72"E
VP4	34°16'2.32"N	8°42'24.18"E

Table 4.9 - Coordinates of Vantage Points along Alternative Alignment 2

Vantage point	Geographic coordinates	
	Latitude	Longitude
VP1	34°19'23.50"N	8°41'20.28"E
VP2	34°18'14.25"N	8°40'48.96"E

Vantage point	Geographic coordinates	
	Latitude	Longitude
VP3	34°16'37.76"N	8°40'57.39"E
VP4	34°15'11.62"N	8°41'51.20"E

**Table 4.10 -** Coordinates of Vantage Points along Alternative Alignment 3

Vantage point	Geographic coordinates	
	Latitude	Longitude
VP1	34°19'23.50"N	8°41'20.28"E
VP2	34°18'14.25"N	8°40'48.96"E
VP3	34°16'37.76"N	8°40'57.39"E
VP4	34°15'11.62"N	8°41'51.20"E

## **RESULTS OF THE ORNITHOLOGICAL CAMPAIGNS**

A total of 45 bird species were recorded during the four ornithological surveys conducted between April and September 2025, covering both the El Ksar PV site and the associated OHTL routes.

At the PV site, 38 species belonging to 12 families, dominated by common passerines typical of Tunisia's pre-desert steppe habitats. No globally threatened species were recorded, and a few nationally sensitive taxa were identified, including *Cursorius cursor* (VU), and *Circaetus gallicus* (CR), in low abundance using the site mainly as foraging habitat and temporary stopover area. The site does not represent a key breeding or migratory concentration zone.

Along the OHTL route surveys were undertaken successively along three alternative alignments, total of 24 species from 15 families were recorded. Raptors and semi-aquatic birds were scarce and localized near VP1, an ecologically favourable area with a semi-permanent *Oued* bordered by *Phragmites* reedbeds. One globally threatened species was recorded during the August survey *Streptopelia turtur* (VU). Other nationally threatened species observed along the corridor including *Falco biarmicus* (EN), *Falco tinnunculus* (VU) and *Melanocorypha calandra* (VU). Overall, the species composition fluctuated seasonally across the PV site and along the OHTL alignments, reflecting the migration and breeding phenology of steppe birds that use the area primarily for foraging, resting, or local breeding. The majority of the observed taxa are widespread residents or passage migrants tolerant of anthropogenic landscapes.

The surveys conducted between April and September 2025 cover the three key biological periods: spring migration, the breeding season, and the early and peak autumn migration. These windows correspond to the highest expected levels of bird movement and therefore to the periods of greatest sensitivity. The campaigns completed to date capture clear seasonal variation in species richness and abundance, including the presence of spring passage migrants, locally breeding steppe species, and the main autumn passage movements. While the full monitoring programme will continue, the data collected so far already encompass the periods of highest ornithological activity. The remaining months will help refine rather than alter the overall risk profile established to date.

The following table presents the species recorded over April–September 2025 survey period, together with their global conservation status (IUCN 2025) and national status (Hamdi et al., 2021).

**Table 4.11** - List of Bird Species Observed within the PV Solar Project and Associated OHTL Alignments during the Four Field Surveys Conducted between April - September 2025

Latin Name	English Name	National (*)	IUCN Global
<i>Acrocephalus schoenobaenus</i>	Sedge Warbler	LC	LC
<i>Acrocephalus scirpaceus</i>	Common Reed Warbler	LC	LC
<i>Alaemon alaudipes</i>	Greater Hoopoe-Lark	LC	LC
<i>Alaudala rufescens</i>	Lesser Short-toed Lark	LC	LC
<i>Ammomanes deserti</i>	Desert Lark	LC	LC
<i>Ardea cinerea</i>	Grey heron	LC	LC
<i>Argya fulva</i>	Fulvous Babbler	NT	LC
<i>Athene noctua</i>	Little Owl	LC	LC
<i>Buteo rufinus</i>	Long-legged Buzzard	NT	LC
<i>Calandrella brachydactyla</i>	Greater Short-toed Lark	LC	LC
<i>Cercotrichas galactotes</i>	Rufous-tailed Scrub Robin	LC	LC
<i>Circaetus gallicus</i>	Short-toed Snake-Eagle	CR	LC
<i>Circus aeruginosus</i>	Western Marsh Harrier	NT	LC
<i>Circus pygargus</i>	Montagu's Harrier	IND	LC
<i>Cisticola juncidis</i>	Zitting Cisticola	LC	LC
<i>Columba livia</i>	Rock Pigeon	LC	LC
<i>Corvus corax</i>	Common Raven	LC	LC
<i>Curruca conspicillata</i>	Spectacled Warbler	LC	LC
<i>Cursorius cursor</i>	Cream-colored Courser	VU	LC
<i>Falco biarmicus</i>	Lanner Falcon	EN	LC
<i>Falco tinnunculus</i>	Common Kestrel	VU	LC
<i>Galerida cristata</i>	Crested Lark	LC	LC
<i>Galerida theklae</i>	Thekla's Lark	LC	LC
<i>Himantopus himantopus</i>	Black-winged Stilt	LC	LC
<i>Hirundo rustica</i>	Barn Swallow	LC	LC
<i>Lanius excubitor</i>	Great Grey Shrike	LC	LC
<i>Linaria cannabina</i>	Common Linnet	LC	LC
<i>Melanocorypha calandra</i>	Calandra Lark	VU	LC
<i>Merops apiaster</i>	European Bee-eater	LC	LC
<i>Motacilla flava</i>	Western Yellow Wagtail	LC	LC
<i>Muscicapa striata</i>	Spotted Flycatcher	LC	LC
<i>Oenanthe deserti</i>	Desert Wheatear	LC	LC
<i>Oenanthe halophila</i>	Black-throated Wheatear	LC	NE
<i>Oenanthe leucopyga</i>	White-crowned Wheatear	LC	LC
<i>Oenanthe leucura</i>	Black Wheatear	LC	LC
<i>Oenanthe moesta</i>	Mourning Wheatear	LC	LC
<i>Oenanthe oenanthe</i>	Northern Wheatear	IND	LC
<i>Passer hispaniolensis</i>	Spanish Sparrow	LC	LC
<i>Saxicola rubetra</i>	Whinchat	LC	LC
<i>Scotocerca inquieta</i>	Streaked Scrub Warbler	LC	LC
<i>Serinus serinus</i>	European Serin	LC	LC
<i>Spilopelia senegalensis</i>	Laughing Dove	LC	LC
<i>Streptopelia turtur</i>	European Turtle Dove	VU	VU
<i>Sturnus unicolor</i>	Spotless Starling	LC	LC
<i>Upupa epops</i>	Eurasian Hoopoe	LC	LC

LC = Least Concern; NT = Near Threatened; VU = Vulnerable; EN = Endangered; CR = Critically Endangered; NE = Not Evaluated; DD = Data Deficient; IND = Insufficient Data

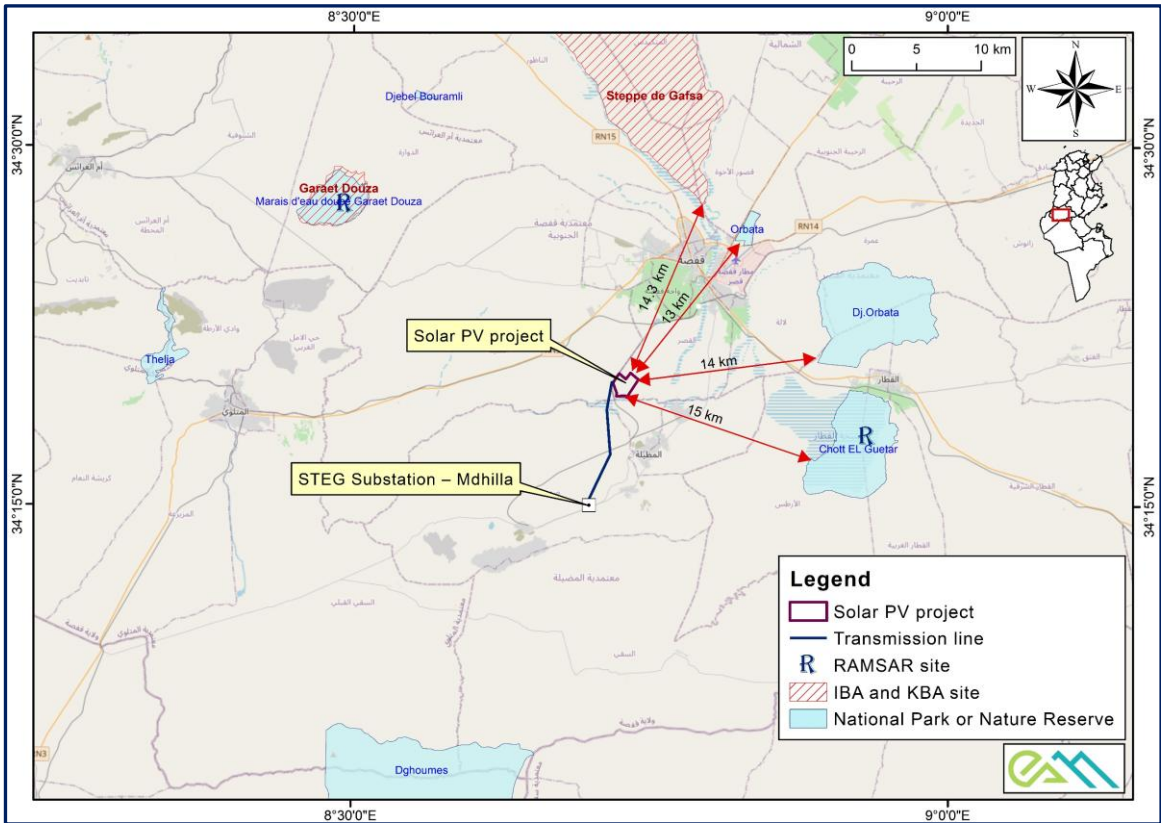
#### 4.4 PROTECTED NATURAL AREAS (NATIONAL PARKS, RAMSAR SITES)

A review of available geospatial and biodiversity data from international sources such as the IUCN Key Biodiversity Areas database (<http://www.keybiodiversityareas.org/kba-data>), BirdLife International (<http://datazone.birdlife.org/site/search>), and national institutions (Direction Générale des Forêts and the Ministry of Equipment and Housing), confirms the absence of any protected areas within a 10 km radius of the PV plant. The nearest site with a conservation interest is 13 km away it's the nature reserve of Orbata.

The full list of protected natural area near the project area and their designation is presented in the table below.

**Table 4.12 - Protected and Designated Natural Areas in the Vicinity of the Project Area**

Protected Area	Designation	Distance from the PV project
Orbata	Nature Reserve	13
Djebel Orbata	National Park	14
Steppe of Gafsa	IBA/KBA	14.3
Chott El Guetar	RAMSAR site	14,7



**Figure 4.9 - Map of Protected Natural Areas**

- The Steppe of Gafsa is designated as a Key Biodiversity Area (KBA) and an Important Bird Area (IBA). Recorded avifauna include several steppe and semi-arid species such as the Spotted Sandgrouse (*Pterocles senegallus*), Spotless Starling (*Sturnus unicolor*), Mourning Wheatear (*Oenanthe lugens*), Sardinian Warbler (*Sylvia melanocephala*), Bar-tailed Lark (*Ammomanes cinctura*), Trumpeter Finch (*Bucanetes githagineus*), Black-eared Wheatear (*Oenanthe hispanica*), Eastern Subalpine Warbler (*Sylvia cantillans*), Barbary Partridge (*Alectoris barbara*), Tristram’s Warbler (*Sylvia deserticola*), Pharaoh Eagle-owl (*Bubo ascalaphus*), Black Wheatear (*Oenanthe leucura*), White-tailed Wheatear (*Oenanthe leucopyga*), Moussier’s Redstart (*Phoenicurus moussieri*), and Buff-rumped Wheatear (*Oenanthe moesta*). All these species are listed as Least Concern (LC) on the IUCN Global Red List (2025), with the exception of Dupont’s Lark (*Chersophilus duponti*), which is classified as Vulnerable (VU).
- Chott El Guetar is a Ramsar Site considered a wintering area for certain bird species and serving as a nesting site for several waterbirds, including the Common Crane (*Grus grus*) and the Caspian Tern (*Sterna caspia*).
- According to the BirdLife Soaring Bird Sensitivity Mapping Tool (<https://maps.birdlife.org/msbtool/>), the emblematic and soaring bird species, including eleven raptors, that are likely to occur in this geographic area are primarily the Black Kite (*Milvus*

*migrans*), Bonelli's Eagle (*Aquila fasciata*), Booted Eagle (*Hieraaetus pennatus*), Common Kestrel (*Falco tinnunculus*), Egyptian Vulture (*Neophron percnopterus*), Golden Eagle (*Aquila chrysaetos*), Lanner Falcon (*Falco biarmicus*), Long-legged Buzzard (*Buteo rufinus*), Merlin (*Falco columbarius*), Pallid Harrier (*Circus macrourus*), and Peregrine Falcon (*Falco peregrinus*). The tracking system adopted by BirdLife has also identified two migratory species that pass through the region: the Black Stork (*Ciconia nigra*) and the White Stork (*Ciconia ciconia*). Among these species, a total of 3 are listed on the national Red List (Hamdi et al., 2021) one on the IUCN Global Red List (2025).

**Table 4.13 - Species recorded by BirdLife at the regional scale and likely to interact with the El Ksar PV Park and the OHTL line**

Species	IUCN Global	IUCN National (*)	Migration Status
<i>Milvus migrans</i>	LC	LC	VP
<i>Aquila fasciata</i>	LC	EN	NS
<i>Hieraaetus pennatus</i>	LC	PNN (**)	VP
<i>Falco tinnunculus</i>	LC	LC	NS VP HI
<i>Neophron percnopterus</i>	EN	PNN	VP
<i>Aquila chrysaetos</i>	LC	VU	NS
<i>Falco biarmicus</i>	LC	EN	NS
<i>Buteo rufinus</i>	LC	NT	NS VP HI
<i>Falco columbarius</i>	LC	PNN	HI rare
<i>Circus macrourus</i>	NT	PNN	VP et HI
<i>Falco peregrinus</i>	LC	IND (***)	NS VP HI
<i>Ciconia ciconia</i>	LC	LC	VP
<i>Ciconia nigra</i>	LC	PNN	VP

(\*) Refers only to species breeding in Tunisia; (PNN): non-breeding population in Tunisia; (IND): breeding species, but IUCN national status remains undetermined. CR = Critically Endangered; EN = Endangered; VU = Vulnerable; NT = Near Threatened; LC = Least Concern. Conservation status according to the National Red List of Birds (Hamdi et al., 2021) and the Global IUCN Red List (IUCN, 2017 – <https://www.iucn.org/resources/conservation-tools/iucn-red-list-threatened-species>). Phenological status: (VP) = Passage visitor; (NS) = Resident breeder; (HI) = Wintering migrant.

#### 4.5 SPECIES OF CONSERVATION INTEREST

The assessment of species of conservation interest has been undertaken in accordance with the criteria defined under IFC Performance Standard 6 (PS 6), EBRD Environmental and Social Requirements 6 (ESR 6), and EIB Environmental and Social Standard 4 (Biodiversity and Ecosystems). These standards establish a framework for identifying Critical Habitat based on the presence of species that are globally or nationally significant, endemic, range-restricted, migratory, or congregatory, and for assessing whether the Project Area of Influence (AoI) meets the thresholds for determination of Critical Habitat.

**Table 4.14 - Critical Habitat Criteria as defined by IFC PS 6**

Critical Habitat Criteria as defined by IFC PS 6	PS 6 Criterion Number
Critically Endangered (CR) and/or Endangered (EN) species	1
Endemic or restricted-range species	2
Migratory or congregatory species	3
Highly threatened and/or unique ecosystems	4
Key evolutionary processes	5

**Table 4.15 - Critical Habitat Criteria as defined by EBRD ESR 6**

Critical Habitat Criteria as defined by EBRD ESR 6	ESR 6 Criterion Number
Highly threatened and/or unique ecosystems	i
Habitats of significant importance to Endangered or Critically Endangered species	ii
Habitats of significant importance to endemic or range restricted species	iii
Habitats supporting globally significant concentrations of migratory or congregatory species	iv

Critical Habitat Criteria as defined by EBRD ESR 6	ESR 6 Criterion Number
Areas associated with key evolutionary processes	v
Ecological functions that are vital in maintaining the viability of biodiversity features described (as critical habitat features)	vi

**Table 4.16 - Critical Habitat Criteria as defined by EIB Standard 4**

Critical Habitat Criteria as defined by EIB Standard 4 (Standard 3 GN, 2018)	Standard 3 Criterion Number
Highly threatened and/or unique ecosystems	1
Populations of Critically Endangered, Endangered or Vulnerable species, as defined by the IUCN Red List of threatened species and in relevant legislation	2
Population range or distribution of endemic or range restricted species, or highly distinctive assemblages of species	3
Habitat required for the survival of migratory species and / or congregatory species	4
Biodiversity and / or ecosystem with significant social, economic, or cultural importance to local communities and indigenous groups	5
Habitat of key scientific value and or associated with key evolutionary processes	6

- **Criterion 1: Threatened Species**

(PS 6 Criterion 1, ESR 6 Criterion ii – EIB ESS 4 Criterion 2)

The principal thresholds for triggering CH are:

- Support  $\geq 0.5$  % of the global population and/or  $\geq 5$  reproductive units of species listed as Critically Endangered (CR) or Endangered (EN) on the IUCN Red List.
- Under EIB ESS4, also includes areas hosting Vulnerable (VU) species where the loss of habitat would likely result in a deterioration of their conservation status (e.g. uplisting to EN or CR), or sites supporting significant concentrations of EN or CR species on national or regional Red Lists.

**Determination for Criterion 1:**

Based on the results of the baseline biodiversity surveys, the thresholds for determination of CH under Criterion 1 have not been met for any species of global or national conservation concern that could occur, or have been recorded, within the project AoI. Mainly three species of conservation concern were observed: *Falco biarmicus* (national EN), *Circaetus gallicus* (national CR), and *Streptopelia turtur* (global VU and national VU). However, all observations consisted of isolated or transient individuals, none were present in numbers approaching the quantitative thresholds required under Criterion 1, namely  $\geq 0.5\%$  of the global population or  $\geq 5$  reproductive units within the AoI or qualitative thresholds required for CH designation. Nevertheless, these species are designated as Priority Biodiversity Features (PBFs) under BERD ESR6.

- **Criterion 2: Endemic and/or Restricted-Range Species**

(PS 6 Criterion 2, ESR 6 Criterion iii – EIB ESS 4 Criterion 3)

The principal thresholds for triggering CH are:

- Regularly support  $\geq 10$  % of the global population and/or  $\geq 10$  reproductive units of endemic or restricted-range species, defined as those with a global distribution of less than 50,000 km<sup>2</sup>.
- Under EIB ESS 4, also includes sites supporting rare or unique species assemblages, even if individual species do not independently meet CH thresholds, where such assemblages contribute to the maintenance of locally significant biodiversity.

**Determination for Criterion 2:**

Surveys completed to date have not recorded any endemic or restricted-range species, nor is it considered likely that any such species occur within Project AoI at densities that would meet CH

thresholds. The habitats present are regionally widespread and do not support unique or irreplaceable ecological assemblages.

• **Criterion 3: Migratory and/or Congregatory Species**

(PS 6 Criterion 3, ESR 6 Criterion iv – EIB ESS 4 Criterion 4)

The principal thresholds for triggering CH are:

- Areas used by migratory and/or congregatory species during breeding, staging, roosting, foraging, or wintering, that regularly support  $\geq 1\%$  of the global population of the species at any point in its life cycle.
- Under EIB ESS 4, also includes areas that are essential to the survival of migratory or congregatory species during periods of environmental stress (e.g. drought refuges).

**Determination for Criterion 3:**

Surveys completed to date have not recorded any migratory or congregatory species or populations that meet the thresholds that would trigger this criterion. Consequently, CH under Criterion 3 has not been triggered. Future survey data will be reviewed; however, it is considered unlikely that subsequent results would alter this conclusion. The Project site does not provide functional habitat supporting populations exceeding the 1 % global population threshold.

**Conclusion**

At this stage, no Critical Habitat has been triggered for any species of global or national conservation concern likely to occur within the AoI. Survey data collected between April and September 2025 do not indicate the presence of species or populations meeting the thresholds defined under IFC PS6, EBRD ESR6, or EIB Standard 4. However, the surveys have confirmed the occurrence of several PBFs. In addition, some species were not directly recorded within the project area but are considered potentially present or are known to pass through the region. These species may therefore interact with the Project, particularly in relation to OHTL.

**Table 4.17 - List of Species considered to be Priority Biodiversity Features (PBFs)**

Receptor	Receptor	Conservation Status		Justification
		IUCN	National	
Bats	<i>Rhinolophus mehelyi</i>	VU	-	Likely Present in mining basin area of Gafsa. Possibly present in Ao.
	<i>Miniopterus schreibersii</i>	VU	-	Likely Present in mining basin area of Gafsa. Possibly present in AoI.
Birds	<i>Circaetus gallicus</i>	LC	CR	Observed in PV solar project during August Survey.
	<i>Cursorius cursor</i>	LC	VU	Observed in PV solar project and along OHTL route during August Survey.
	<i>Falco biarmicus</i>	LC	EN	Observed along OHTL route during Mai and September survey.
	<i>Falco tinnunculus</i>	LC	VU	Observed along OHTL route during Mai and September survey.
	<i>Melanocorypha calandra</i>	LC	VU	Observed along OHTL route during September survey.
	<i>Streptopelia turtur</i>	VU	VU	<b>Observed along OHTL line during August survey.</b>
	<i>Aquila fasciata</i>	LC	EN	Not recorded in AoI April to September. Likely to occur in this region.
	<i>Neophron percnopterus</i>	EN	LC	Not recorded in AoI April to September. Likely to occur in this region.
	<i>Aquila chrysaetos</i>	LC	VU	Not recorded in AoI April to September. Likely to occur in this region.
<i>Chersophilus duponti</i>	VU	LC	Likely Present in Steppe of Gafsa IBA/KBA. Not recorded in AoI April to September.	

## 5 ROLES AND RESPONSIBILITIES

Principal roles and responsibilities for the implementation of the BMP are outlined in the table below.

**Table 5.1 - Key Roles and Responsibilities**

Roles	Responsibilities
<b>Lender (IFC, EBRD and EIB)</b>	<p>The lender will be responsible for:</p> <ul style="list-style-type: none"> <li>▪ Receiving and reviewing regular reports from the Developer and the EPC contractor during pre-construction, construction, and operation regarding BMP implementation.</li> <li>▪ Verifying the BMP and related Plans are regularly updated.</li> <li>▪ Ensuring that the Developer and EPC contractors have sufficient and qualified resources to implement the plans.</li> <li>▪ auditing the implementation of BMP and related Plans.</li> </ul>
<b>Developer (Qair)</b>	<p>As the project proponent, the Developer will assume overall responsibility for implementing the BMP.</p> <p>The Environmental and Social Project Implementation Unit (ESPIU) will ensure that the provisions of this BMP are strictly followed during all phases of the project. The ESPIU should be staffed with competent biodiversity specialists, as applicable to:</p> <ul style="list-style-type: none"> <li>▪ Coordinate biodiversity aspects in project procurement, tender documents, and contracts.</li> <li>▪ Coordinate implementation of biodiversity mitigation and monitoring measures.</li> <li>▪ Audit the implementation of the BMP and identify corrective measures.</li> <li>▪ Update the BMP based on audit findings or as needed;</li> </ul>
<b>EPC contractor</b>	<p>The EPC contractor will be responsible for complying with all relevant national and international legislation and adhering to all mitigation and monitoring measures specified in this BMP. Prior to the commencement of construction works, the EPC contractor will be required to develop a Construction BMP, including an implementation schedule.</p> <p>During construction, the EPC contractor will assume overall responsibility for the implementation and monitoring of the BMP. They must have sufficient, adequate, and competent resources available to fulfill the BMP requirements. The EPC contractor is responsible for the ongoing management of potential biodiversity impacts of all contract activities, regardless of whether they are undertaken by themselves or by subcontractors. All subcontractors must meet all requirements.</p> <p>The EPC contractor shall appoint, for the entire duration of the works, the following key specialist.</p> <ul style="list-style-type: none"> <li>▪ HSE Manager.</li> <li>▪ Environmental Manager and</li> <li>▪ Biodiversity advisors</li> </ul> <p><i>HSE Manager</i></p> <ul style="list-style-type: none"> <li>▪ Ensure that the BMP is up to date and appropriate and ensuring that it is implemented effectively.</li> <li>▪ Ensure that action/measures and monitoring activities are carried out timely and adequately according to the BMP requirements.</li> <li>▪ Propose to Management, if necessary, amendments and/or updates to the BMP and issuing plan revisions.</li> <li>▪ Program inspections and audit activities to ensure the correct implementation of the BMP.</li> <li>▪ Address Non-Conformities through the definition of Preventive/ Corrective actions.</li> <li>▪ Bring major non-Conformities immediately to the attention of the developer's;</li> <li>▪ Collect, organize, and review monitoring data and monitoring reports and provide summary results of such reports to the Developer's Management, to stakeholders and to the Lenders.</li> </ul> <p><i>Environmental Manager</i></p>

Roles	Responsibilities
	<ul style="list-style-type: none"> <li>▪ Coordinate and supervise all site activities pertaining to the implementation of the BMP.</li> <li>▪ Keep track of monitoring results and other reporting mechanisms and ensure corrective measures are implemented.</li> <li>▪ interact with the Contractors and instruct them on the implementation of the measures described in the BMP.</li> <li>▪ Stop the work in case of significant incidents or violations of the measures described in the BMP.</li> <li>▪ Prepare “Non-Conformity Report” in case monitoring measures reveal that the relative Key Performance Indicator (KPI) are not met.</li> </ul> <p><i>Biodiversity Advisors</i></p> <p>The contractor’s biodiversity advisors shall:</p> <ul style="list-style-type: none"> <li>▪ Provide technical biodiversity guidance to the Environmental Manager and contractor’s personnel.</li> <li>▪ Conduct site visits and inspections to confirm implementation of mitigation measures.</li> <li>▪ Review monitoring reports and prepare BMP implementation reports.</li> <li>▪ Propose changes and integrations to the mitigation and monitoring activities as required, the proposed changes shall be evaluated and approved by the Developer’s Management.</li> </ul>
<b>Subcontractors</b>	All Sub-contractors must meet all requirements in relation to the Contractor’s discharge of their responsibilities in terms of ongoing management of potential biodiversity impacts of all contract activities.

## 6 ANALYSIS OF ALTERNATIVES – TRANSMISSION LINE ALIGNMENT

The OHTL connecting the El Ksa PV solar plant to the Mdhilla STEG substation has undergone three successive modifications since the initial design phase. The current Alternative Line 3 represents the final alignment, developed following the identification of social constraints during field investigations and stakeholder consultations. The principal revisions to the OHTL route were driven primarily by social considerations, notably the need to avoid privately owned and collectively managed lands in order to reduce potential land acquisition challenges and minimize the risk of disputes. From an ecological standpoint, these realignments do not introduce additional environmental risk. The final OHTL alignment remains located at least 15 km away from the nearest designated protected or biodiversity area, and no Critical Habitats, as defined under EBRD PR6 / IFC PS6 / EIB ESS4, have been identified along the route. Habitat types traversed by the alignment are typical of the regional steppe landscape. Although the final route runs parallel to an existing OHTL corridor, mitigation measures have been incorporated to minimize potential avifaunal collision risk. Bird Flight Diverters (BFDs) will be installed along the OHTL. In addition, where technically feasible, the towers of the new OHTL will be staggered relative to those of the existing line, with each new tower positioned approximately opposite the mid-span of the adjacent line. This configuration helps break up parallel mid-span sections, which represent the primary collision zones for large bird species such as raptors and storks.

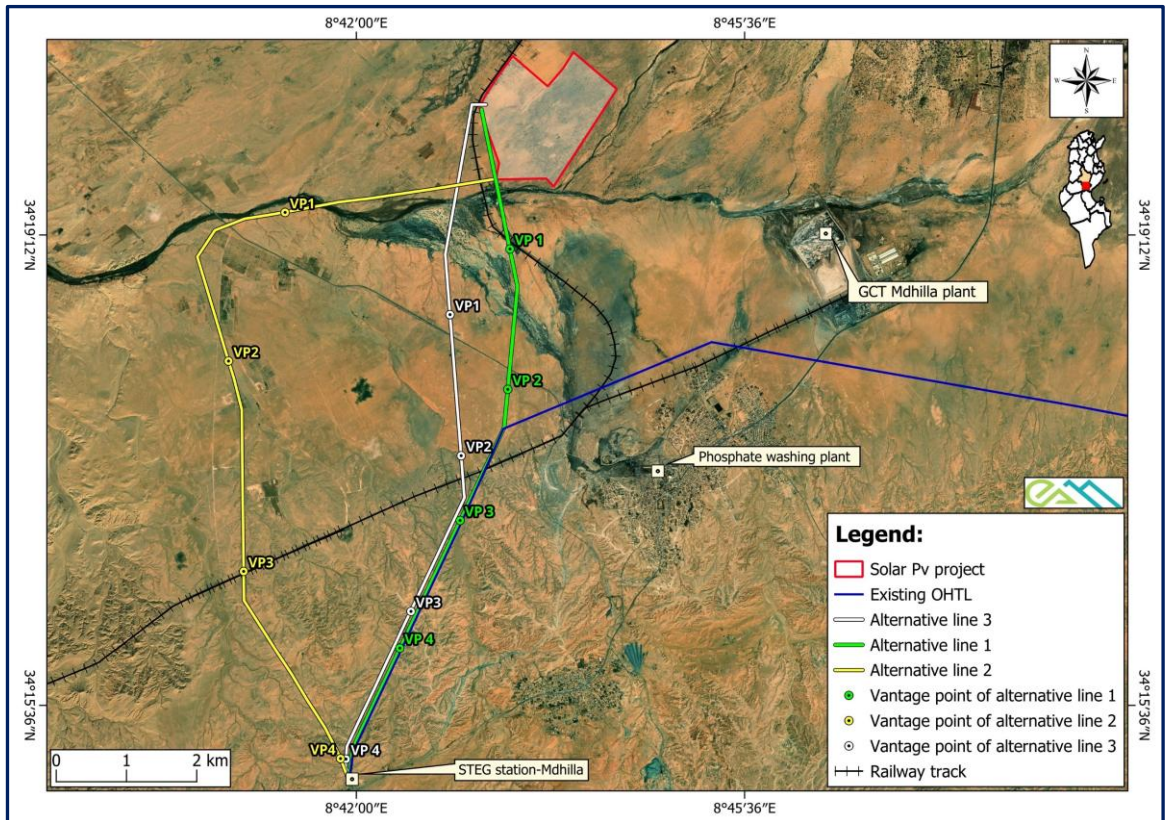


Figure 6.1 - OHTL Alignment Alternatives

## 7 BIODIVERSITY IMPACT ASSESSMENT

Activities undertaken during the construction and operation phases of the El Ksar PV solar Plant and the OHTL have the potential to cause impacts on flora, fauna and avifauna species.

In addition, construction activities can also alter the structure and function of the habitat (habitat values) within the project area, both directly and indirectly.

The risks posed by these activities to the existing biodiversity and habitat values can be determined by considering the likelihood of potential impacts and their consequences, as illustrated in the table below.

The construction and operational activities that could impact biodiversity and habitat, along with their associated risk ratings, are summarized in the table below.

**Table 7.1 - Risk Matrix**

Impact Magnitude	Receptor Sensitivity / Value			
	High	Medium	Low	Negligible
High	Major	Major	Moderate	Negligible
Medium	Major	Moderate	Minor	Negligible
Low	Moderate	Minor	Minor	Negligible
Negligible	Negligible	Negligible	Negligible	Negligible

An essential step in the ESIA process and also in the BMP is the identification of measures that can be taken to ensure that impacts are mitigated or reduced to acceptable levels. The BMP will first consider the significance of any impacts caused by the Project and then assign mitigation measures using the following hierarchy:

- Avoid or "design out" impacts wherever possible
- Consider alternatives or design modifications to reduce impacts wherever possible
- Apply measures to minimize and manage impacts on the receptor; then, as a last resort
- Identify fair compensation, remedial and compensatory measures to address any potentially significant residual effects.

Some negative impacts can be easily mitigated, while others cannot, or are too difficult and costly to mitigate. The various potential impacts will be described in the ESIA and in the BMP, together with a list of "feasible mitigation measures" that can be implemented. Furthermore, for positive impacts, it is not possible to identify mitigation measures, but rather recommendations aimed at reinforcing the positive impact. In addition, follow-up measures will be identified and developed to ensure that the identified mitigation measures are considered, implemented correctly, and are sufficient for the protection of environmental and social receptors.

The assessment of residual impacts during construction and operational phases is presented respectively in tables below:

**Table 7.2 - Assessment of residual impacts**

Impact Title	Initial impact significance	Management Plan linked to the mitigation measures	Residual impact	Justification
<i>Assessment of residual impacts during construction phase</i>				
Potential impacts on habitats and species of flora – PV and OHTL	Minor	<ul style="list-style-type: none"> <li>Biodiversity Management Plan</li> </ul>	Negligible / Minor	<p>Induction for all site workers where biodiversity will be discussed and all measures set out in the BMP will be presented.</p> <p>The physical extent of flora disturbed during construction will be minimised and then restored immediately afterwards, resulting in a minor residual impact. The disturbed land will restore habitat to pre-construction status to the extent possible. Some residual loss of modified habitats within the PV site where panels are present.</p> <p>No plant species of conservation concern globally and/or nationally or Priority Biodiversity Feature (PBF) species were identified along the OHTL route or within the PV site.</p>
Potential impacts on fauna (except birds) – PV and OHTL	Moderate	<ul style="list-style-type: none"> <li>Biodiversity Management Plan</li> </ul>	Minor	<p>See above – site induction and minimisation of working areas. Area of land supporting fauna will be restored as soon as possible. Working areas will be controlled.</p> <p>Other mitigation measures to include:</p> <ul style="list-style-type: none"> <li>- Conduct a pre-construction survey to identify presence of fauna species of conservation concern. Survey will also identify presence of venomous snakes which will be removed from the site by qualified and trained herpetologists. This is a Health and Safety measure to prevent harm to site workers but will also avoid impacts to the receptor.</li> <li>- Application of speed limits within the site to avoid / reduce animal / vehicle conflict. (40kph during the day and 20kph at night)</li> <li>- Ban on night-time working / driving within the working area unless strictly necessary.</li> <li>- Ban of hunting / poaching / collection of all ecological receptors and fines to be applied for breaching this measure.</li> <li>- Ban of all fires and or open incineration of waste</li> <li>- Standard safe storage of potential pollutants and materials harmful to the environment and standard pollution control measures (in-line with waste management protocols)</li> <li>- Removal of all carcasses (roads) to reduce attractants to the site.</li> <li>- Good housekeeping to prevent presence of invasive / non-native species including pest species and appropriate control if identified.</li> <li>- Ban on cats and dogs within the PV site and guard dogs are not to be used on site.</li> <li>- Limit other attractants to the site (e.g. creation of water bodies)</li> <li>- Gaps to be installed in site-wide fencing to allow small mammals and reptiles to move in to and out of the site (avoidance of barrier impact and effective habitat loss).</li> <li>- Application of chance find procedure and potential update to mitigation measures based on results of continual monitoring.</li> </ul>
Potential impacts on avifauna. – PV Site	Minor	<ul style="list-style-type: none"> <li>Biodiversity Management Plan</li> </ul>	Negligible / Minor	<p>Site is supporting an assemblage of widespread and commonly occurring species and low impacts are expected. Key measures include but are not limited to:</p> <ul style="list-style-type: none"> <li>- Conduct a pre-construction survey to identify any nesting birds within the working areas and if of conservation concern (TRDB / IUCN VU+) buffer zones will be applied.</li> <li>- Application of speed limits and limits on working areas</li> </ul>

Impact Title	Initial impact significance	Management Plan linked to the mitigation measures	Residual impact	Justification
				<ul style="list-style-type: none"> <li>- Ban on night-time working / driving within the working area unless strictly necessary.</li> <li>- Ban of hunting / poaching / collection of all ecological receptors and fines to be applied for breaching this measure.</li> <li>- Ban of all fires and or open incineration of waste</li> <li>- Standard safe storage of potential pollutants and materials harmful to the environment and standard pollution control measures (in-line with waste management protocols)</li> <li>- Removal of all carcasses (roads) to reduce attractants to the site.</li> <li>- Limit other attractants to the site (e.g. creation of water bodies).</li> <li>- Application of chance find procedure and potential update to mitigation measures based on results of continual monitoring.</li> </ul>
Potential impacts on avifauna. – OHTL	Minor	<ul style="list-style-type: none"> <li>• Biodiversity Management Plan</li> </ul>	Negligible / Minor	<ul style="list-style-type: none"> <li>- Bird Flight Diverters (BFD) will be installed along the OHTL following industry standard designs and spacing.</li> <li>- Where technically feasible, it is recommended to stagger the towers of the new transmission line so that each new tower is positioned opposite the mid-span of the existing line, thereby breaking up parallel mid-span sections—the primary collision zones for large, low-maneuvrability bird species.</li> </ul>
<b>Assessment of residual impacts during operation phase</b>				
Potential impacts on habitats and species of flora	Negligible	<ul style="list-style-type: none"> <li>• None as there are no mitigation measures for the operational stage for this impact.</li> </ul>	Negligible	None as there are no mitigation measures for the operational stage for this impact. Continual operational monitoring for invasive / non-native species for at least the first 3 years of operation. Appropriate control where necessary.
Potential impacts on fauna (except birds)	Minor	<ul style="list-style-type: none"> <li>• Biodiversity Management Plan</li> </ul>	Negligible / Minor	Limited operational activities are anticipated. Where essential maintenance is required, working areas will be strictly controlled and speed limits applied. Ban on hunting / collection of fauna. Limit other attractants to the site (e.g. creation of water bodies).
Potential impacts on avifauna – Collision with the OHTL	Major	<ul style="list-style-type: none"> <li>• Biodiversity Management Plan</li> </ul>	Moderate	<p>Implement and undertake a 2-year bird mortality monitoring programme which includes a survey to investigate bird mortality on the OHTL only. Surveys will be completed for at least one whole year (January to December) after which the monitoring protocol will be updated depending on the results. Any changes to the protocol will be agreed with the lenders prior to implementation. Surveys will follow the 2023 PCFM Guidelines (GIIP) and will include carcass persistence trials and searcher efficiency trials. Depending on the results of the PCFM surveys additional offsets will be completed if mortality of bird species of conservation concern is recorded. Offsets could include additional BFD installation on existing OHTL lines or burial of LV and MV distribution lines within the Project AoI.</p> <p>Regular (at least annual) monitoring of the transmission line for signs of bird nesting on the pylons. In the event of nesting, anti-perching and anti-nesting devices will be installed, if necessary to minimise regular visits by birds to these structures. These devices, if installed, will be replaced where necessary. Safe nesting platforms or other such structures could also be considered if the nesting species are those of conservation concern.</p>

## **8 MITIGATION MEASURES AND MANAGEMENT CONTROLS**

This section presents the mitigation measures and management methods that the BMP aims to implement. The BMP distinguishes measures to be implemented during the construction and operation phase. Relevant BMP actions for the construction phase, as listed in table 8.1 below, will need to be included in the tendering specifications for EPC contractors, and subsequently in the EPC contract.

8.1 CONSTRUCTION PHASE

Standard/ Benchmark	Potential Impacts	Management action / Mitigation measures	Monitoring actions	Frequency	Responsibility
<b>ESR 6 - Biodiversity conservation and sustainable management of living natural resources (STEG responsibilities)</b>	<p>Potential impacts on habitats and species of flora.</p> <p>Potential impacts on fauna (except birds).</p> <p>Potential impacts on avifauna.</p>	<ul style="list-style-type: none"> <li>- Qair to consult relevant authorities, including Ministry of Agriculture and the Forest Department (DGF), before undertaking any vegetation removal or clearing activities as this is essential to obtain all necessary permits and ensure compliance with environmental regulations.</li> </ul>	<p>Qair to review implementation of the PV plant and the pylon of the OHTL and the relevant requirements from the Biodiversity Management Plan that are under the responsibility of the EPC Contractor.</p>	<p>Ongoing during the construction stage.</p>	<p>EPC Contractor with Qair having an oversight role</p>
<b>ESR 6 - Biodiversity conservation and sustainable management of living natural resources (EPC Contractor responsibilities)</b>	<p>Potential impacts on habitats and species of flora.</p> <p>Potential impacts on fauna (except birds).</p> <p>Potential impacts on avifauna.</p>	<ul style="list-style-type: none"> <li>- Engage suitably qualified (bird) ecology expert(s) to undertake training, awareness-raising and monitoring of environmental measures.</li> <li>- During the pre-construction surveys of the working areas any venomous snakes identified will be removed by suitably trained and qualified herpetologists. Any animals caught will be moved to areas of alternative suitable habitat at least 2km from the working areas.</li> <li>- Identify (using signs) and restrict access to areas with sensitive habitats prior to construction, and detail designated construction areas to minimise habitat loss as much as possible (e.g control of working areas).</li> <li>- Limit vehicle movements on dirt/unpaved roads and enforce speed limit of 40 km/hour (daytime) and 20 km/hour (nighttime).</li> <li>- Optimise machine movement in earthworks, land clearance, construction/use of access roads, pylons installation, foundation work, cabling, transit of lorries and machinery, loading/unloading of lorries, etc., to limit impacts on flora and habitats.</li> <li>- Engage suitably qualified biodiversity expert(s) to conduct regular training and environmental awareness programmes for workers (all employees and sub-contractors) on protecting local flora, including identification of rare and protected species and how to minimize harm to these. Programmes will be at works start and once a month depending on workers' numbers.</li> <li>- Prohibit the use of pesticides and fire to clear vegetation.</li> <li>- Regularly conduct planning and monitoring of worksite phases to limit works duration.</li> <li>- Carefully remove and store topsoil for future site restoration activities.</li> <li>- Install fences around worker accommodation sites and equipment storage areas to limit encroachment on the surrounding area during the works phase.</li> <li>- Prevent introduction of invasive plant species during works by ensuring machinery is cleaned prior to arrival on site.</li> <li>- Undertake a comprehensive biodiversity survey (fauna and flora), prior to construction, to identify species distribution and conservation concerns and</li> </ul>	<p>Qair to conduct ongoing monitoring during the construction stage in accordance with the Biodiversity Management Plan (the Plan being the responsibility of the EPC Contractor)</p>	<p>Ongoing as defined in the Biodiversity Management Plan</p>	<p>EPC Contractor</p>

Standard/ Benchmark	Potential Impacts	Management action / Mitigation measures	Monitoring actions	Frequency	Responsibility
		<p>ensure habitats and endangered species are adequately protected during the project.</p> <ul style="list-style-type: none"> <li>- OHTL tower locations will be chosen to avoid PBF and other plant species of national conservation concern as detailed in the BMP. If these locations cannot be avoided, then local translocation will be completed where specimens will be removed from the working area and transplanted to areas of suitable alternative habitat.</li> <li>- Implement seasonal construction restrictions and monitor phases of site activities during sensitive seasons.</li> <li>- Develop deterrent campaigns, pre-earthworks, (using adequate, well tested equipment/methods) to enable snakes, rodents, etc. to flee work area.</li> <li>- Ensure site areas and living quarters are kept clean and good waste management practices are applied, eliminating sources of food attraction.</li> <li>- Inform on-site employees and contractors of protected species/habitats potentially present in the area, to ensure constant monitoring and promote mitigation measures or actions in when encountering wild animals. Prohibit hunting and causes of disturbance or trade in animals and report to Qair any acts of biodiversity disruption or vandalism committed by workforce. Educate workers and other stakeholders about environmental concerns, especially poaching and ban on bushmeat consumption. Fines to be applied to breaches of this measure.</li> <li>- Conduct deterrent activities prior to earthworks, (adequate and well tested equipment/methods) to enable birds likely to be present on the project site to flee.</li> <li>- Installation of gaps under any site wide fencing to allow small mammals and reptiles to move in to and out of the site. If this is not possible select a large mesh size that will allow movement of most receptors.</li> <li>- Locate powerlines &gt;500 m from wetlands, identified bird migration corridors and protected areas.</li> <li>- Equip OHTLs with Bird Flight Diverters (BFD), following industry standard designs and spacing (<i>Martin Martin, J., Garrido Lopez, J. R., Clavero Sousa, H. and Barrios, V. (eds.), 2022. Wildlife and Power lines. Guidelines for preventing and mitigating wildlife mortality associated with electricity distribution networks. Gland, Switzerland, IUCN.</i>). BFDs to be installed on all installed OHTL and OWL or Hawkeye devices to be used.</li> <li>- Where technically feasible, stagger the towers of the new transmission line so that each new tower is positioned opposite the mid-span of the existing line, thereby breaking up parallel mid-span sections, the primary collision zones for large, low-maneuvrability bird species. Field evidence from southern Africa (<i>Pallett, Simmons &amp; Brown, 2022. Staggered towers on parallel transmission lines: a new mitigation measure to reduce collisions of birds, especially bustards. Namibian Journal of Environment, 6(A):14–</i></li> </ul>			

Standard/ Benchmark	Potential Impacts	Management action / Mitigation measures	Monitoring actions	Frequency	Responsibility
		<p>21) indicates that this configuration reduces overlap of high-risk spans and can significantly lower avian collision risk.</p> <ul style="list-style-type: none"> <li>- Installed OHTL is HV so risk of electrocution is minimised however safe design should be implemented along with BFDs.               <ul style="list-style-type: none"> <li>• Construct crossings, insulators and other power lines components so no space for birds to perch and encounter live wires.</li> </ul> </li> <li>- A Biodiversity Action Plan (BAP) will be undertaken if CH and species are identified during the upcoming field surveys or if additional ecological receptors are identified during construction (e.g. chance find procedure).</li> <li>- A biodiversity action plan (BAP) is an internationally recognized program addressing threatened species and habitats and is designed to protect and restore biological systems. The original impetus for these plans derives from the 1992 Convention on Biological Diversity (CBD).</li> <li>- The principal elements of a BAP typically include (a) preparing inventories of biological information for selected species or habitats; (b) assessing the conservation status of species within specified ecosystems; (c) consideration of risk/impact/condition; (d) creation of targets for conservation and restoration; and (e) establishing timelines and institutional partnerships for implementing the BAP. A BAP therefore gives an overview of species and habitat in a particular area, identifies threats and sets out steps to be taken to protect and improve the area to preserve and enhance its biodiversity for the future. Importantly, a BAP is a valuable way of targeting conservation at a local level.</li> <li>- Moreover, BAPs should be regularly reviewed and updated as new information arises, project implementation progresses, and conservation context changes over time.</li> <li>- The principal objectives of a BAP include the following:               <ul style="list-style-type: none"> <li>▪ Review of existing biodiversity baseline information and legislative/policy framework in Tunisia.</li> <li>▪ Develop a new biodiversity baseline based on the 3 sets of surveys undertaken</li> <li>▪ Identification of priorities and actions for biodiversity conservation based on Critical Habitat Assessment, if applicable.</li> <li>▪ Identification of a list of opportunities aimed at improving overall biodiversity conservation.</li> <li>▪ Identification of a specific set of actions, timelines, and responsibilities to avoid, mitigate and compensate potential impacts associated with each facility.</li> <li>▪ List evaluation requirements to enable the success of the BAP to be assessed.</li> </ul> </li> </ul>			

8.2 OPERATIONAL PHASE

Standard/ Benchmark	Potential Impact identified in the ESIA	Management action / Mitigation measures	Monitoring actions	Frequency	Responsibility
ESR 6 - Biodiversity conservation and sustainable management of living natural resources	Potential impacts on fauna (except birds)	Application of control of working areas when undertaking maintenance / cleaning activities. Pre-works checks of vehicle routes to check for breeding birds (February – June) and also to check for presence of venomous snakes. Enforcement of speed limits and pollution control measures. Good housekeeping to ensure clean site areas. Continual monitoring of Project AoI for presence of non-native / invasive species. Monitoring bat mortality during monitoring programme for birds	Qair to conduct ongoing monitoring during the construction stage in accordance with the Biodiversity Management Plan (the Plan being the responsibility of the O&M Contractor)  Submit a monitoring protocol	During operation	<u>Qair / O&amp;M Contractor</u>
	Potential impacts on avifauna.	Implement and undertake a 2-year bird mortality monitoring programme which includes a survey to investigate bird mortality on the OHTL. Conduct regular bird mortality monitoring (Post-Construction Fatality Monitoring – PCFM) at the operational phase. Monitoring to include regular (approx. 15 days) surveys along the OHTL in Spring, Autumn and Winter seasons. Search frequency will be determined based on results of carcass persistence and searcher efficiency trials. Based on the findings of the monitoring, revise and update Biodiversity Management Plan, including additional mitigation measures if needed to ensure the applicable conservations objectives.  Any changes to the protocol in Year 2 (e.g. monitoring seasons, frequency of monitoring visits) will be agreed with the lenders prior to implementation. Surveys will follow the 2023 PCFM Guidelines (GIIP) and will include carcass persistence trials and searcher efficiency trials.  Depending on the results of the PCFM surveys additional offsets will be completed if mortality of bird species of conservation concern is recorded (IUCN VU, EN, CR or TRDB EN, CR). If offsets are required a BAP will be completed.  Engagement and coordination efforts with STEG and the other developers in the area to reduce pressure on biodiversity in the region. Offsets could include additional BFD installation on existing OHTL lines, burial of LV and MV distribution lines within the Project AoI or installation of anti-electrocution measures on existing LV and MV distribution lines within Project AoI.	Visual evidence and site inspection Submission of an annual bird mortality report	Annual	<u>Qair / O&amp;M Contractor</u>

Standard/ Benchmark	Potential Impact identified in the ESIA	Management action / Mitigation measures	Monitoring actions	Frequency	Responsibility
		Provision of safe nesting platforms / boxes could also be considered.			
		Regular (at least annual) monitoring of the transmission line for signs of bird nesting on the pylons. In the event of nesting, anti-perching and anti-nesting devices will be installed, if necessary to minimise regular visits by birds to these structures. These devices, if installed, will be replaced where necessary. Safe nesting platforms or other such structures could also be considered if the nesting species are those of conservation concern.	Visual evidence and site inspection		

9 MONITORING

Impact	Monitoring and Evaluation	Details	Biodiversity associated with the measure	Responsible party	Start time	End time	Frequency	Means of verification
Loss of vegetation habitat and species	Vegetation monitoring	A Vegetation Monitoring Program will be developed by the EPC Contractors' Biodiversity Expert and implemented by the STEG and EPC contractor. The programme will monitor the impacts of the project on priority vegetation and habitats.	Terrestrial flora habitats and associated species	Qair / EPC Contractor and Biodiversity Expert with the support of an external consultant	Prior to construction	End of construction	Continuously/ monthly	Monitoring report
Avifauna impacts	Minimize impacts to birds through monitoring	<p>An Avifauna Monitoring Programme will be developed by the O&amp;M Contractors Biodiversity Expert or Avifauna Specialist and implemented by Qair.</p> <p>The programme will monitor avifauna along the OHTL. It will assess the effectiveness of mitigation measures by recording actual mortality as a result of collision and or electrocution. Additionally, it will determine the need for adaptive management, including offsets.</p> <p>In Year 1 monitoring will be completed for a full year and will start immediately after line stringing. The monitoring will encompass:</p> <ul style="list-style-type: none"> <li>- Bird mortality, particularly along the OHTL (effectiveness assessment of bird deflectors) and potential collisions with OHTL.</li> <li>- BFD monitoring / checks to ensure they are still operational. Any defective BFDs will be replaced (by drone) within 4 weeks.</li> </ul>	Avifauna species and associated habitat	Qair / O&M Contractor and Biodiversity Expert with the support of an external consultant	Immediately after line stringing	At least two years of operation (to be reviewed afterwards)	<p>Year 1 PCFM – full year, review at end of year 1 and possible change to more seasonal monitoring (e.g. spring and autumn migration). Any changes from full year monitoring to be agreed with the Lenders.</p> <p>BFD monitoring to be completed at least twice per year (pre-spring and pre-autumn migration periods)</p>	Monitoring report
		Regular (at least annual) monitoring of the transmission line for signs of bird nesting on the pylons. In the event of nesting, anti-perching and anti-nesting devices will be installed to minimise regular visits by birds to these structures. These devices will be replaced if necessary.					Annual surveys for bird nesting (February to June)	

## 10 REPORTING

The reporting section is in line with the ELMED project's approach to BMP reporting.

### 10.1 BIODIVERSITY NON-CONFORMITY REPORTS

In case monitoring measures reveal that the Indicator and targets are not met, a “Non conformity report” will be prepared by the Environmental Engineer, communicated to the HSE Manager who will decide if support from a Specialized Contractor is needed in order to address the issue within 15 days from the monitoring.

The “Non conformity report” will clearly describe the issue(s) observed and provide all the relevant available information including:

- ID: unique identification code of the monitoring activity;
- topic/ aspect monitored;
- date and location(s) of the monitoring;
- location of the observation (with geographic coordinates if available);
- name and role of the observer(s);
- description of the non-conformity compared to the target;
- photographic documentation (if available);
- suggested corrective actions.

Developer’s HSE Manager will review the report and assess, also with the assistance Specialized Contractor, the need of implementing additional corrective action and/or eventual modifications to the BMP mitigation measures and monitoring activities.

### 10.2 ANNUAL BIODIVERSITY MANAGEMENT PLAN REPORTS

Evidence and results of mitigation measures and monitoring activities shall be included in an Annual Biodiversity Report to be prepared by the developer with the support of the Biodiversity Advisor. This report shall include, as a minimum, the following information/data:

#### Mitigation measures:

- list of the mitigation measures implemented, their aims and description;
- period of the measure application (start date and end date);
- achievement (or not) of the target/acceptance criteria for the indicators.

#### Monitoring activities:

- location of the monitoring stations (geographical coordinates and elevation);
- timing of the data collection (start date and end date);
- description of the methodology applied and of the equipment used;
- results of the observations conducted;
- any anomalies that could have affected partially or totally the indicators results;
- quality assurance and quality control procedures applied to ensure consistency and reliability of the results.
- the indicator results and their compliance with the target/acceptance criteria;
- The mitigation measures report will be prepared by the Developer with the support of the specialized contractor(s) on a yearly basis.

## 11 AUDIT AND REVIEW

The current BMP is to be monitored through either internal or external audit on a regular basis (preferably yearly) and the audit report submitted to the lenders. The following is a non-exhaustive list of areas that may be checked during the audit process:

- Monitoring of achievement of targets set within the BMP.
- Utilization of funds for the implementation of the BMP.
- Assess whether efforts invested in mitigating threats to biodiversity were successful.
- Adherence to national applicable laws and to internationally signed agreements, protocols and treaties.
- Any sub-contracting undertaken for the implementation of the BMP. In such cases, standard audit procedures on contracts may be performed.
- Gaps in human resources for the proper implementation of the BMP in terms of enforcement activities, availability of scientists, taxonomists, etc.
- Roles of the different entities involved in the implementation of the BMP and their performance.
- Records of non-adherence to applicable rules and regulations and means taken to address non-adherence.
- Assess whether the monitoring and evaluation mechanism helped in effective implementation of the BMP.

Revision of the BMP is the responsibility of Developer's HSE Manager, who is in charge of this Plan. During operational phase, the BMP will be reviewed on an annual basis and any necessary revisions will be made to reflect the changing circumstances, operational needs or monitoring results.

*ANNEXES*

***ANNEX I - BIODIVERSITY REPORT, INVENTORY OF HABITATS, FAUNA AND  
FLORA OF A PHOTOVOLTAIC POWER PLANT PROJECT IN EL KSAR - GAFSA -  
TUNISIA***

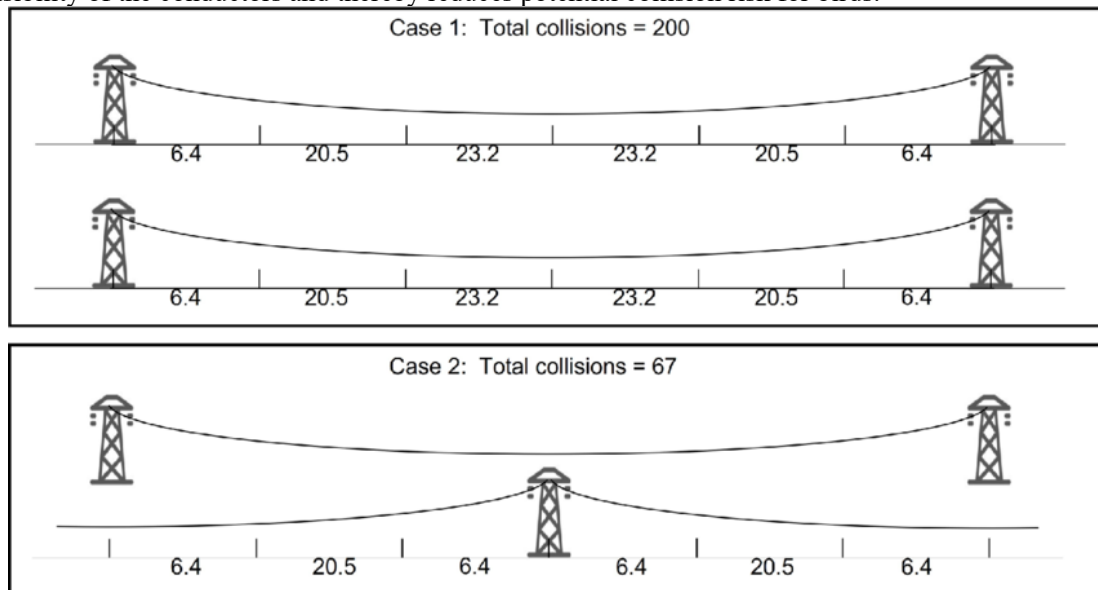
***ANNEX II - ORNITHOLOGICAL SURVEY REPORT OF A PHOTOVOLTAIC POWER  
PLANT PROJECT IN EL KSAR – GAFSA - TUNISIA***

### ***ANNEX III - ILLUSTRATION OF STAGGERED TOWER CONFIGURATION AND THEORETICAL COLLISION REDUCTION***



**Figure 1.** Example of 400 kV and 220 kV transmission lines constructed in parallel with staggered towers.

An example of 400 kV and 220 kV transmission lines constructed in parallel with staggered towers, illustrating how positioning each tower opposite the mid-span of the adjacent line enhances the overall visibility of the conductors and thereby reduces potential collision risk for birds.



**Figure 2.** Theoretical reduction in collision rates achievable by bundling power lines and staggering towers.

Collision counts shown per span section are based on field proportions recorded from power-line surveys in Namibia and South Africa. **Case 1:** two separate, non-staggered power lines (~200 collisions). **Case 2:** two bundled and staggered lines, showing a substantial reduction in mid-span collisions. The model demonstrates how staggering redistributes risk away from mid-spans, reducing overall collision frequency.

**Reference:** Pallett, J., Simmons, R. E., & Brown, C. J. (2022). *Staggered towers on parallel transmission lines: a new mitigation measure to reduce collisions of birds, especially bustards.* Namibian Journal of Environment, 6(A), 14–21.