REPORT

Mirny (Kazakhstan) 1GW Wind Farm Project

Active Turbine Management Framework

Submitted to:

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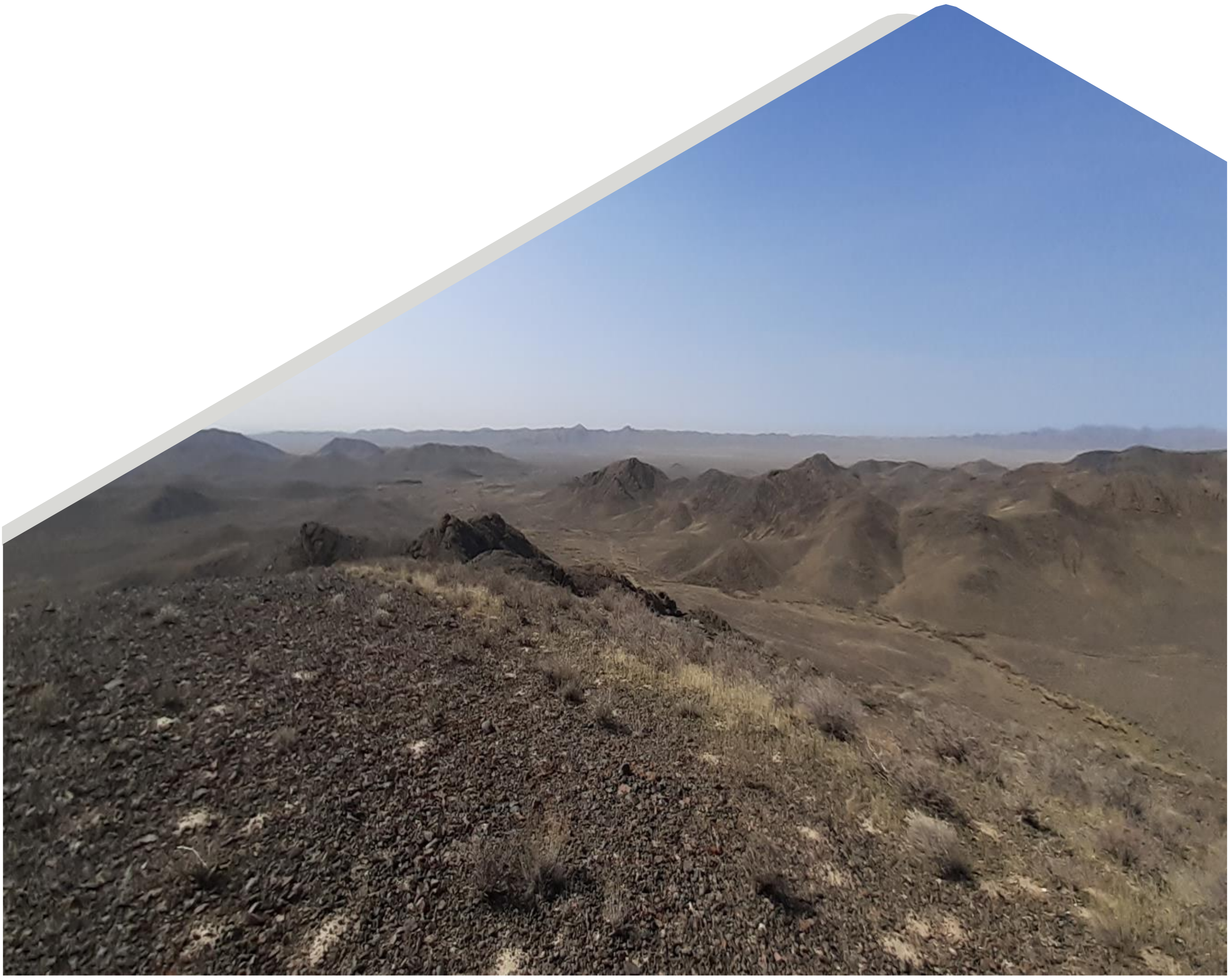

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1.0 INTRODUCTION

Wind farms present three main potential direct risks to birds:

1) Direct habitat loss during the construction phase. This generally consists of hardstanding around turbine bases, the access tracks linking each turbine within the project site, access roads to the site, OHTLs, construction camps and set down areas and sub-stations.

2) Displacement and disturbance (indirect habitat loss) if birds avoid the wind farm and its surrounding area due to construction and operation. This can include disturbance to nesting birds, specifically raptors of conservation concern and may also include barrier effects where birds are deterred from using normal routes to feeding or roosting areas or their migration is disrupted.

3) Death through collision or interaction with wind turbine generators (WTG) blades and other infrastructure (i.e. collision risk).

For each of these potential impacts a detailed understanding of bird distribution within the site throughout the year, and migratory and resident bird flight activity is necessary in order to predict the potential effects of the Project on birds. The survey methodology is primarily intended to allow a prediction of the likely ornithological impacts as well as ensuring the ability to allow a robust assessment of likely impacts of collision and active impacts to key species.

As avian mortality is one of the most significant potential negative impacts of wind power plants, techniques that effectively reduce avian collision rates are necessary. One such method is the turbine shut down on demand system (SDoD), a variant of which is being considered for the Mirny Wind Power Plant (WPP).

Shutdown on demand involves targeted shut down of wind turbine generators (WTGs) in the event that any individual priority target species or significant flock sizes of non-priority target species flies within a buffer distance of WTGs and is on a flight path that would bring the bird into close proximity of the turbine blades.

The application of a shutdown system for the project is considered on a spatial scale based on the variability of flight activity across the site during the survey period.

2.0 ACTIVE TURBINE MANAGEMENT PLAN

An Active Turbine Management Plan (ATMP) is a structure framework designed to minimise bird and bat collisions while optimising wind turbine operation and performance. This plan aims to outline the specific strategy to actively manage turbine activity to reduce the risk of collision for birds and bats identified as target species. A camera based SDoD system is determined to be the best option for the Mirny WPP project for birds and a turbine curtailment strategy for bats. This is to be implemented via the adjustment of turbine operations during specific conditions such as increased collision risk for birds and bat or adverse weather event, This strategy will apply throughout the whole operational phase of the project and will follow and Adaptive Management approach, incorporating data collected from ongoing bird and bat flight monitoring and post construction fatality monitoring (PCFM).

3.0 SHUT DOWN ON DEMAND TECHNOLOGY

The SDoD system that will be used during the active phase of the Mirny WPP will automatically trigger turbine shut down when a species of high conservation status is approaching the active turbines. There are several technologies available, including radar-based systems such as Robin Radar and DTBird, and the camera-based systems such as Protecbird Aveswind or IdentiFlight anti collision systems. AI-powered camera systems like these examples detect sensitive species and automatically shut down individual turbines when they approach.

A camera-based system for the Mirny WPP is the preferred option for SDoD as it has already been used at large scale WPPs in the Central Asian region such as the Zarafshan WPP in Uzbekistan. Although it has not been determined if Identiflight is the most suitable system for the project a summary of it's capability is summarised below.

3.1 System capabilities

3.1.1 ProtecBird Aveswind

The Aveswind system is actively being considered one of the camera-based systems to be used for SDoD. It is a camera-based system that can be attached to a turbine tower and has the ability to operate in extreme weather conditions (-40° / +55° C), wind speeds up to 245 km/h and can withstand dust storm conditions and rain by using a washing and windshield wiper system to keep the camera lenses clear. It is able to detect birds in low light conditions and has an identification range of up to 400m.

It is able to identify beat frequency measurements to help with species identification in low light/darkness and uses an AI algortithm based on real time training to identify pre selected species. It has a real time pre-zoom tracking of up to 250 birds per camera and precise measurement of a birds 3D position, speed, altitude, distance.

The company plans to have a dedicated Central Asia service team based in Tashkent.

The species for which the system is currently trained to identify includes:

- White-tailed Eagle, Golden Eagle
- Lesser-spotted Eagle
- Short-toed Snake Eagle
- Red Kite, Black Kite
- Marsh Harrier, Hen Harrier, Montagu's Harrier
- Common Buzzard, Honey Buzzard, Rough-legged Buzzard
- Eurasian Sparrowhawk, Eurasian goshawk
- Common Kestrel
- White Stork, Black Stork
- Common Crane

3.1.2 Identiflight

IdentiFlight can detect and classify species in real time with up to 99% accuracy. This is accomplished using a proprietary hybrid of machine vision and neural network technologies that allows users to specify which species of birds are protected – maximizing power generation. By detecting a bird as far as 1.3 km away and classifying it as a protected species, this system allows for time to slow the turbines to a safe speed allowing for the flight speeds of birds likely to be at risk of collision within the Mirny WPP turbine array.

IdentiFlight can be installed as a single station for monitoring and data collection or as multiple stations to provide full coverage of the Mirny WPP. The siting of the cameras will be informed by the spatial flight activity data collected during the survey programme between Spring 2023 and Summer 2025.

The Identiflight system is currently deployed at the Zarafshan WPP in Uzbekistan so has been trained to recognise the bird species that have been identified as target species at the Mirny WPP.

4.0 METHODOLOGY

4.1 Survey design and bird species selected for collision risk analysis

4.1.1 Survey Methods

To assess baseline bird biodiversity – including bird density and flight activity – vantage point (VP) surveys have been conducted by Association for the Conservation of Biodiversity of Kazakhstan (ACBK) since summer 2023. As the Proposed Development underwent several layout revisions, the final layout of turbines was provided by the Client in January 2025. Consequently, data from VP viewsheds relevant to the final layout were utilised for this analysis

All the data collection methods are fully described in WSP (2025)[1] but are summarised here with the key results. All surveys were designed by WSP and ACBK with reference to SNH (2017)[2] as amended in 2025 and also Jenkins *et al.* (2015)[3] which is better suited to surveying large project sites in arid environments. Surveys commenced in September 2023 covering two alternative sites and continued until August 2025 when the final surveys on the final layout were completed.

4.1.2 Vantage point surveys

The flight activity surveys to inform the collision risk assessment are described in WSP (2025) and also Appendix C to the ESIA, the collision risk modelling report (WSP 2025a)[4] . The project site was quite large at 26,764.93 ha and access to all of the final turbine locations was limited both by the remoteness of the site, topography, the capacity of the survey team and occasional extreme weather conditions which prohibited full coverage during the winter months due to snow cover and flooding.

The VP coverage of the final layout exceeded the recommended minimum of 75% recommended in Jenkins et al. (2015) and is as follows:

- 78.57% visibility of 121 out of 154 turbines included in the final layout
- 66.7% visibility for 17 out of 21 for the back up turbines.
- The overall VP coverage of the turbines was 77%.

The location of these final VPs is shown in Figure 6 of WSP (2025) and is given again here for clarity in Figure 1.

With reference to point 3.2 of Ramboll (2025)[5] which highlights the requirement for a comprehensive summary of the total number of hours for all VPs which cover the current turbine layout per season' this is provided in Table 1-1 of WSP (2025a) and is shown below for reference in Table 1.

[1] WSP (2025) Mirny (Kazakhstan) 1GW Wind Farm Project ESBS Report Chapter 06 - Baseline conditions, Biological and biodiversity resources.

[2] Scottish Natural Heritage (2017) Recommended bird survey methods to inform impact assessment of onshore wind farms, ver. 2.

[3] A.R. Jenkins, C.S. van Rooyen, J.J. Smallie, J.A. Harrison, M. Diamond, H.A. Smit-Robinson and S. Ralston (2015) Birds and Wind-Energy Best-Practice Guidelines

[4] MIRNY 1GW WIND POWER PROJECT – KAZAKHSTAN Appendix C: Bird Collision Risk Modelling Report

[5] Ramboll (2025) Summary on critical issues required attention before the disclosure

Table 1: VPs retained for CRM analysis and the survey effort in hours.

Relevant VP	Summer 2023 (hr)	Autumn 2023 (hr)	Spring 2024 (hr)	Autumn 2024 (hr)	Winter 2024-25 (hr)	Spring 2025 (hr)	Summer 2025 (hr)
S01 / M19	12	12	12	12	3	12	18
S04 / M17	12	12	12	12	3	12	18
S05 / M15	12	12	12	18	3	12	18
S09 / M08	12	12	12	18	3	12	18
S10 / M10	12	12	12	15		12	18
S12 / M32	12	12	12	15		12	18
S13 / M06	12	12	12	18	3	12	18
S16 / M04	12	12	12	18	3	12	18
S18 / M03	12	12	12	15		12	18
S20 / M01	12	12	12	15		12	18
S11 / M07	12	12		15	2	12	18
M02			12	18		12	18
M05			12	18	3	12	18
M09			12	15	3	12	18
M11			12	18	3	12	18
M12			12	15	3	12	18
M13			12	18	2	12	18

Relevant VP	Summer 2023 (hr)	Autumn 2023 (hr)	Spring 2024 (hr)	Autumn 2024 (hr)	Winter 2024-25 (hr)	Spring 2025 (hr)	Summer 2025 (hr)
M14			12	12	3	12	18
M16			12	15		12	18
M21			12	18		12	18
P02				12		12	18
P24				12		12	18
P17				12		12	18
X04				12		12	18
X05				12		12	18
P06				12		12	18
No. of relevant VPs	**11**	**11**	**19**	**26**	**13**	**26**	**26**
Total effective survey effort per season	**132**	**132**	**228**	**342**	**37**	**312**	**468**

4.1.2.1 Data limitations

The survey coverage of the site for the period Autumn 2024 to Summer 2025 i.e. September 2024 to August 2025 inclusive is representative but short of the full standard hours required. Autumn is defined as September/October/November, Winter as December to March, Spring as April and May and Summer as June/July/August. For Autumn 2025 VP coverage on average was 4.38 hours per month with some data missing for September. For the Winter of 2024/5 data is sparse due to access and weather conditions. For Spring and Summer 2025 each VP was observed for 6 hours per month. Further data from Summer 2023, Autumn 2023 and Spring 2024 is available for 11, 11 and 19 of the 26 VPs respectively.

Eleven of the VPs that were retained since the beginning of the surveys and were still relevant for covering the final revised layout have good temporal coverage.

4.1.3 Target Species for collision risk modelling

The thirteen bird species selected for Collision Risk Modelling (CRM)[6] are given in Table 2.

Table 2: Bird species included in CRM assessment.

Common Name	Scientific Name	Raptor/Non-raptor	Migratory/Local
Black-bellied Sandgrouse	*Pterocles orientalis*	Non-raptor	Migratory
Black Kite	*Milvus migrans*	Raptor	Migratory
Common Kestrel	*Falco tinnunculus*	Raptor	Local
Eurasian Hobby	*Falco subbuteo*	Raptor	Migratory
Eurasian Sparrowhawk	*Accipiter nisus*	Raptor	Migratory
Golden Eagle	*Aquila chrysaetos*	Raptor	Local
Lesser Kestrel	*Falco naumanni*	Raptor	Migratory
Little Bustard	*Tetrax tetrax*	Non-raptor	Migratory
Long legged Buzzard	*Buteo rufinus*	Raptor	Migratory
Rough Legged Buzzard	*Buteo lagopus*	Raptor	Migratory
Short Toed Snake Eagle	*Circaetus gallicus*	Raptor	Migratory
Steppe Eagle	*Aquila nipalensis*	Raptor	Migratory
White tailed Eagle	*Haliaeetus albicilla*	Raptor	Migratory

Complete details on the survey design and how data was filtered for the analysis is given in Appendix C[7] of ESBS Report Chapter 06[8].

4.2 Identification of high-risk turbine locations

When identifying turbine locations posing the highest risk to bird species and which may then require a SDoD system, turbine locations within a single VP viewshed were grouped together. Areal bird density was calculated for all flights at PCH within each VP, by dividing the flying time (in bird-seconds) by the period of watch (in seconds) and the area watched (in kilometre^2) to give the average density of birds at PCH per kilometre^2 watched. Calculated density was also plotted to give a visual representation of which areas of the project pose the highest risk.

Areal bird density was calculated for the following species/groups of species:

- All species listed in Table 2;
- All raptor species;
- Steppe Eagle (Globally Endangered);

[6] WSP Italia, (2025) ESBS Report Chapter 06 – Baseline conditions, biological and biodiversity resources. Mirny (Kazakhstan) 1GW Wind Farm Project.

[7] WSP Italia, (2025) ESBS Report Chapter 06 – Baseline conditions, biological and biodiversity resources. Mirny (Kazakhstan) 1GW Wind Farm Project.

[8] WSP Italia, (2025) ESBS Report Chapter 06 – Baseline conditions, biological and biodiversity resources. Mirny (Kazakhstan) 1GW Wind Farm Project.

- Black-bellied Sandgrouse (Endangered at a European level);
- Little Bustard (Near threatened at the global level and Vulnerable at the European level);
- All migratory species – Spring migration period; and
- All migratory species – Autumn migration period.

Among the 13 species assessed, only Common Kestrel and Golden Eagle are considered non-migratory; all other species are classified as migratory.

5.0 RESULTS

5.1 Areal bird density and high-risk turbine locations

Areal bird density at PCH was calculated for various species/species groups for each VP viewshed and results are discussed below.

5.1.1 Spatial distribution of bird activity

Average bird densities at PCH vary notably across VPs, clearly indicating distinct activity hotspots as shown in Figure 1 below and Figure 9. M02, M05, and M06 show the greatest bird densities, collectively representing about 53% of total activity at PCH. These three VPs are located along the southwestern boundary of the Proposed Development, marking these locations as areas of elevated collision risk. Moderate activity is seen near the centre of the Proposed Development at M12, M11, and M10. Most other VPs show minimal bird presence at PCH.

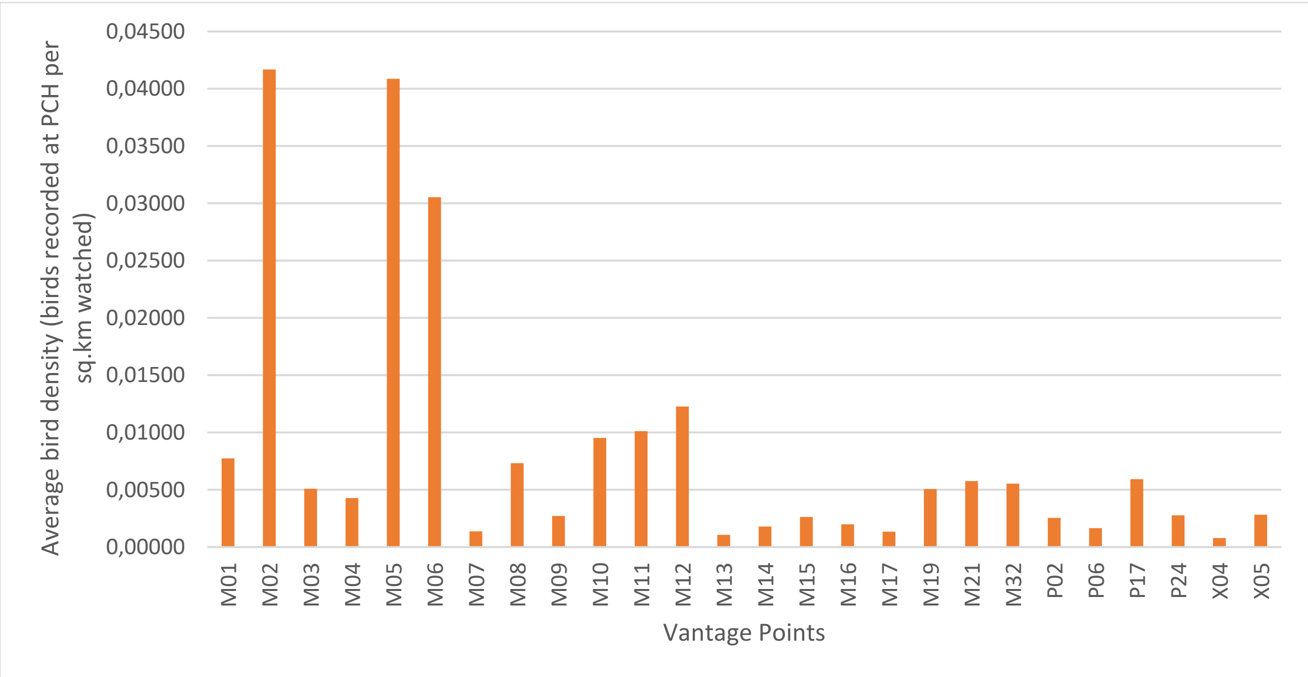

Figure 1: Average bird density for all species per VP viewshed

5.1.2 All raptor species

Areal bird density calculated for all raptor species combined show elevated density values at M05 and M02, followed by M06, highlighting these areas as raptor activity hotspots, as shown in Figure 2 below and Figure 10. VPs M10 and P17 located near the centre of the Proposed Development also show some degree of activity.

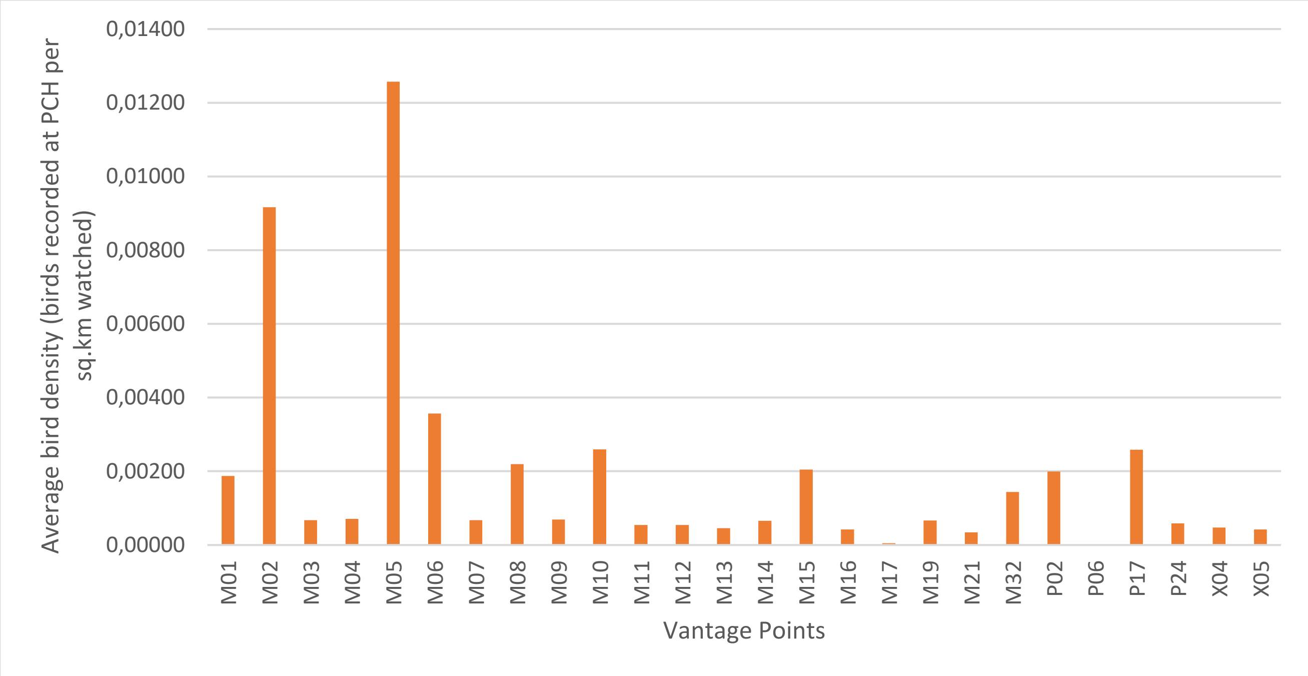

Figure 2: Average bird density for all raptor species per VP viewshed

5.1.3 Steppe Eagle

Steppe Eagles show highest densities at M05 and M02 (south-western boundary), and M12 (centre of the Proposed Development) as shown in Figure 3 below and Figure 11. Moderate activity is seen at M06, M10, P24, P06 and X05. Other VPs have negligible Steppe Eagle activity.

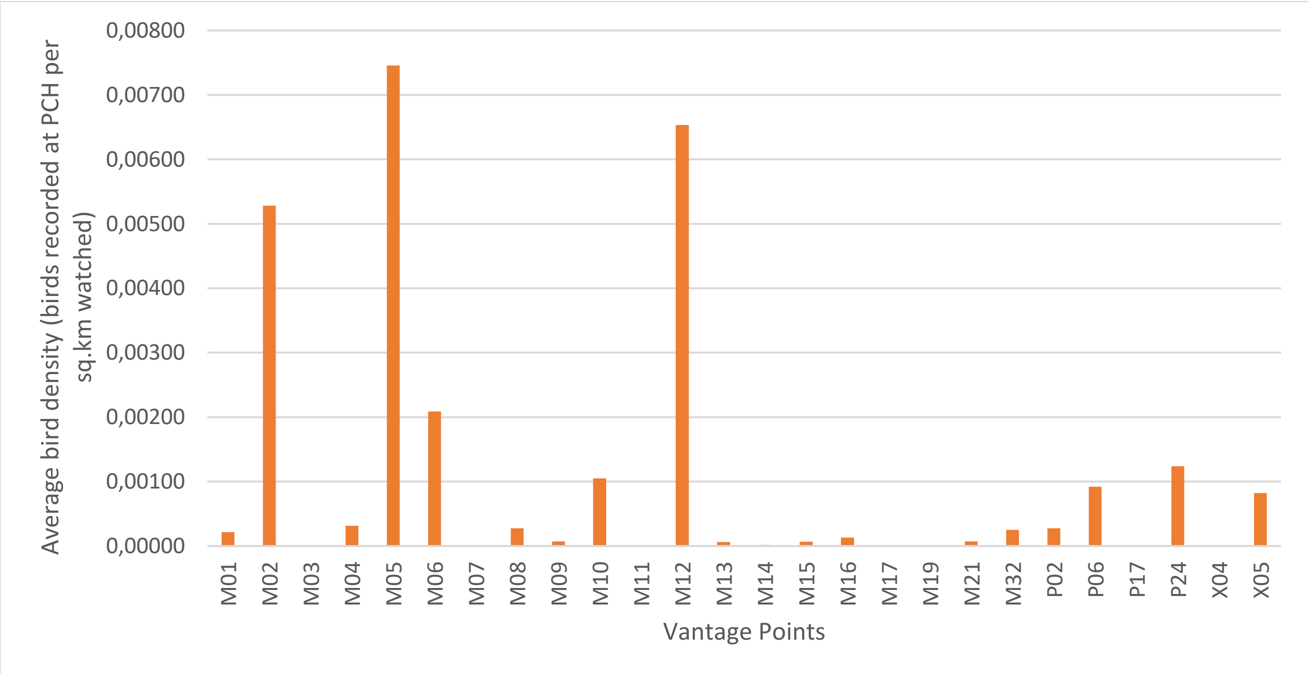

Figure 3: Average bird density for Steppe Eagle per VP viewshed

5.1.4 Non-raptor species

Black-bellied Sandgrouse: Activity peaks at M05, M02, and M06 as shown in Figure 4 below and Figure 12, indicating these are key areas for this species. There is also some activity near the centre of the Proposed Development at VPs P17 and M10.

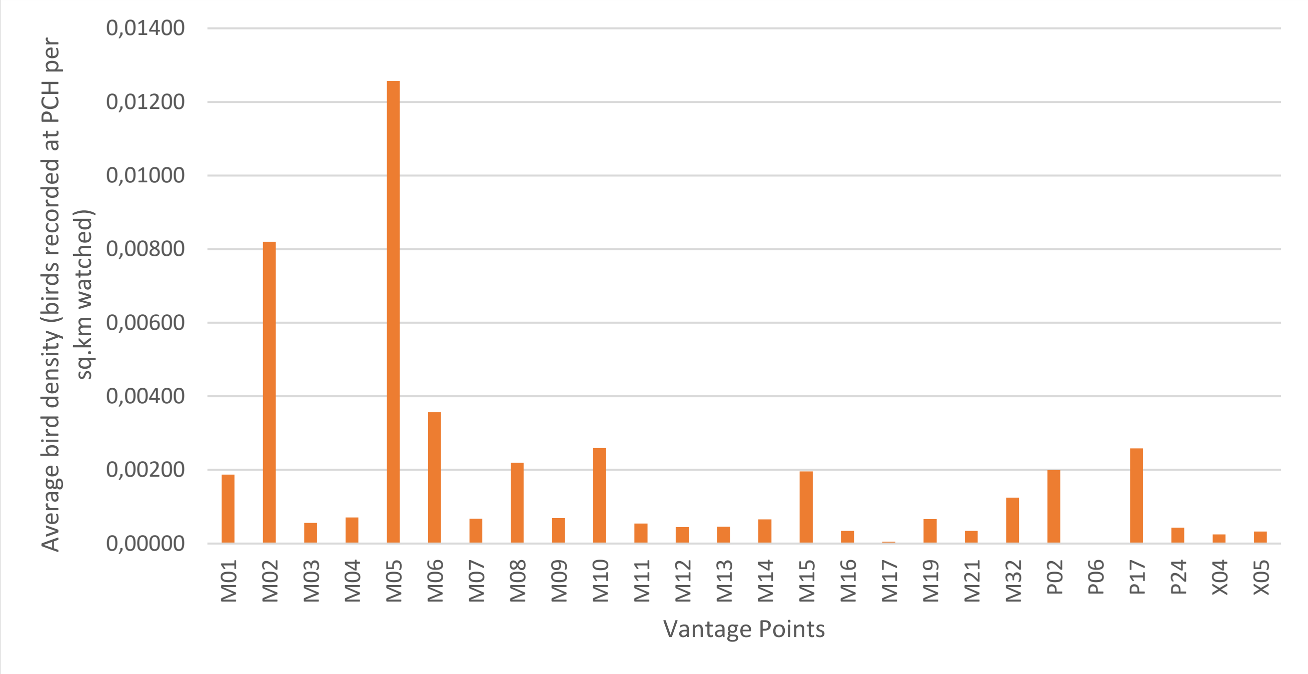

Figure 4: Average bird density for Black-bellied Sandgrouse per VP viewshed

Little Bustard: Little Bustard presence is minimal (~0.002 birds per km2 watched across the entire Proposed Development), as shown in Figure 5 below and Figure 13. Most density is recorded at M02.

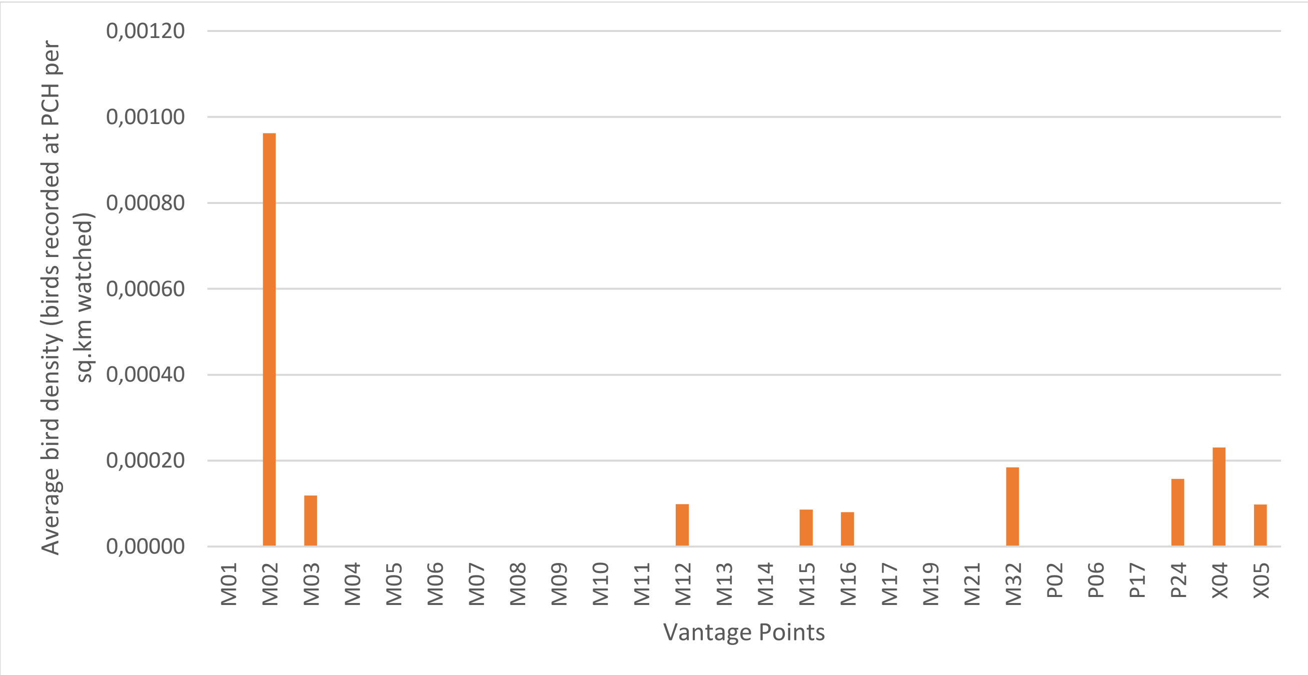

Figure 5: Average bird density for Little Bustard per VP viewshed

5.1.5 Migratory species

Spring migration period: High density was observed along the western boundary of the Proposed Development, particularly at M02, M05 and M08. VPs M21 and M19 at the northern tip of the Proposed Development also show notable migration activity. Other VPs too have some degree of activity, as shown in Figure 6 below and Figure14.

Chart 1 Average bird density for all migratory species, spring migration period, per VP viewshed

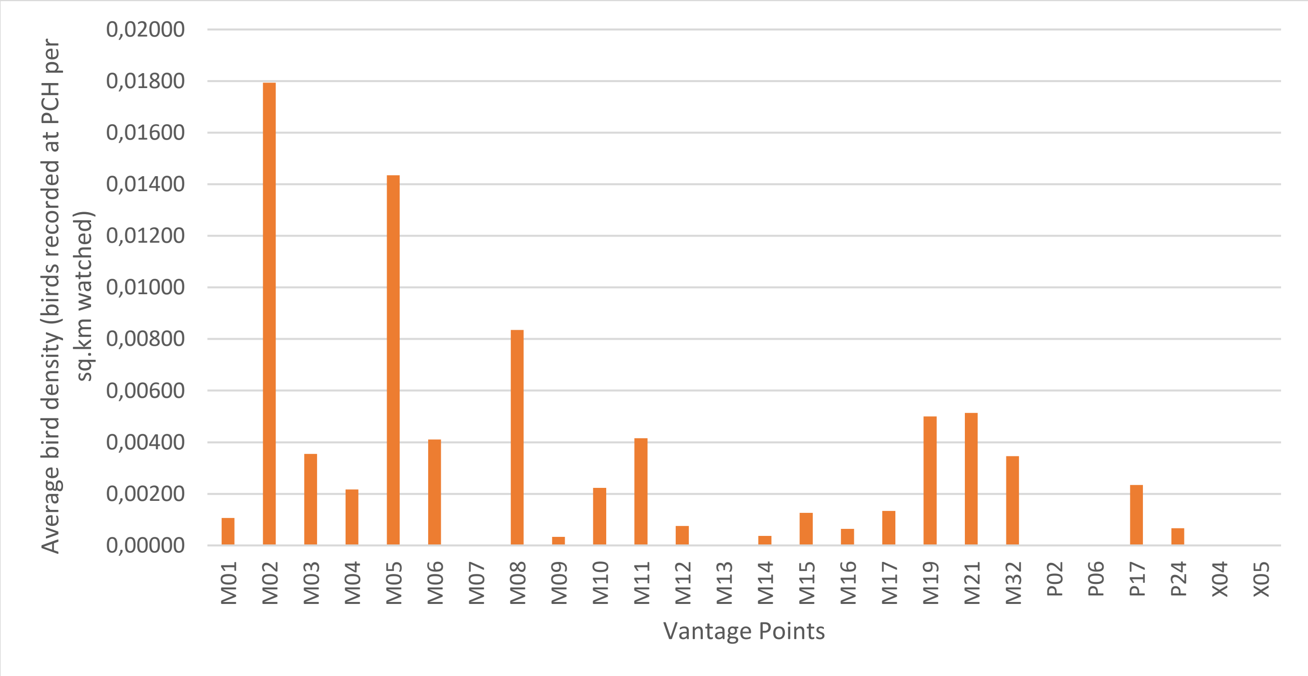

Figure 6: Average bird density for all migratory species, spring migration period, per VP viewshed

Autumn migration period: Bird activity is recorded highest at M06, as shown in Figure 7 below and Figure 15. M11 and M10 near the centre of the Proposed Development show some degree of bird activity.

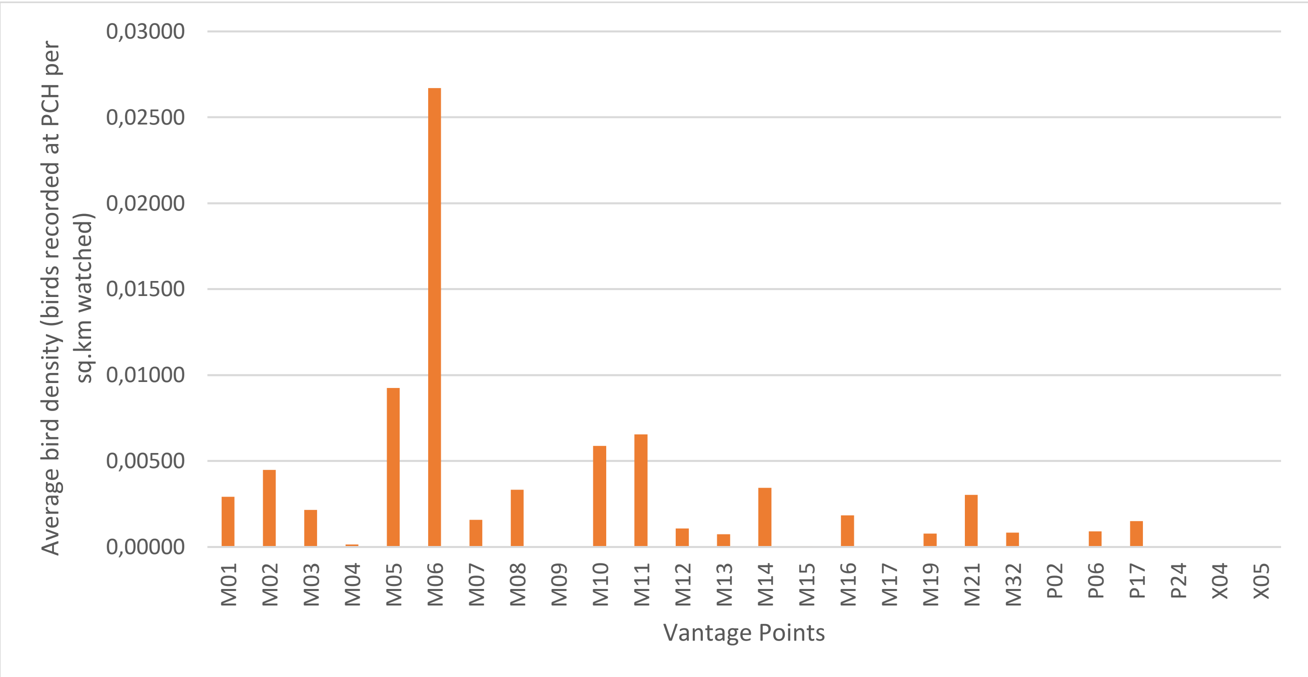

Figure 7: Average bird density for all migratory species, autumn migration period, per VP viewshed

5.2 Turbines with limited coverage

Nine VPs were only surveyed from Spring 2024 onwards i.e. M02, M05, M09, M11, M12, M13, M14, M16 and M21. Within these viewsheds there were a total of 37 turbines.

The VPs with the least coverage i.e. only Autumn and Spring 2024 were P02, P24, P17, X04, X05 and P06. Within these viewsheds there were a total of 32 turbines considering some overlap between viewsheds i.e. VP X04 partially overlaps with M10 where three turbines received coverage from both VPs and X05 which partially overlapped with M12 and M15 where 5 turbines received extra coverage.

As a precaution turbines within these viewsheds will be considered for coverage by a shutdown on demand system along with other turbines that were not covered during the surveys due to lack of access and surveyor limitations.

5.3 Turbines with no coverage

For the final turbine layout as of January 2025 the 26 VP viewsheds were able to cover 119 of the turbines with an extra 31 not visible from the VPs.

6.0 DISCUSSION

6.1 Birds: spatial coverage of SDoD

Across species and seasons, activity at PCH is spatially clustered rather than evenly distributed. M02, M05, and M06 consistently emerge as multi-species, multi-season hotspots, making turbines within these and nearby viewsheds priority areas for potential curtailment assessment, targeted monitoring, anti-bird collision systems or cameras. To support this, the turbines associated with these priority VPs are summarised in the **Table *3*Table *3*** below.

For migratory species, both spring and autumn patterns reveal increased bird densities at M05 and M06. This pattern, particularly the higher autumn densities, supports the need for targeted seasonal curtailment measures or enhanced monitoring during migration periods. During the spring migration period, SDoD mitigation measures should also be focused on turbines along the western boundary of the Proposed Development. During the autumn migration period, focus should also be placed on turbines near the centre of the Proposed Development.

Table 3 Turbines within viewsheds relevant to priority VPs based on flight activity of target species

Vantage Point	Turbine numbers within viewshed	Notes
M02	95, 96, 97, 98, 99	Consistent hotspot, high multi-species activity, low VP temporal coverage.
M05	100, 101, 102, 103, 165	Consistent hotspot, high multi-species activity, low VP temporal coverage.
M06	111, 112, 113	Consistent hotspot, high multi-species activity, elevated activity during autumn migration period
M12	43, 44, 50, 118, 186, 187, 190	High Steppe Eagle activity, low VP temporal coverage
M11	120, 121	High Golden Eagle activity, low temporal VP coverage
M08	116, 117, 119	Elevated activity during spring migration period

Due to the low temporal coverage of some of the VPs and the lack of any coverage of some of the turbine there are a number of other turbines that will be considered for SDoD on a precautionary basis. These viewsheds and the number of turbines involved are considered in sections 4.1 and 4.2. These are as follows and will be prioritised in this order:

- Turbines with no coverage = 31
- Turbines with the least coverage i.e. Autumn and Spring 2024 = 32 turbines
- Turbines that were only covered from Spring 2024 onwards = 37 turbines

Including these extra turbines on a precautionary basis should ensure that low coverage and blind spots in the data will be accounted for in the SDoD mitigation.

The actual turbine curtailment rules will need to be detailed in a protocol with the ActiveTurbine Management Plan (OTMP). This may also consider the relation between migration intensity and wind speed and depending on the results explore whether curtailment rules can be optimised by minimizing the lost energy generation for varying percentages of collisions avoided. Generally, curtailments during low wind speeds yield the largest gain in the percentage of avoided bird collisions and a relative low loss in power yield (see van Bemmelen *et al.* (2022)[9]).

6.2 Shutdown criteria

Although collision prevention will be applied to individual birds throughout the operational phase, the systems will also be trained to account for flocks of 'at risk' birds flying towards the turbines as per the following protocol which is set out in Birdlife International (2015)[10]:

- Shutdown Condition A – Bird Species of Conservation Concern. WTGs shall be shut down whenever at least one Bird Species of Conservation Concern approaches the Facility at collision risk height. This is a preventive condition, and the precautionary principle will apply in doubt of identification. This condition will apply to all priority species identified during the flight activity surveys.
- Condition B – Flocks of Migratory Soaring Birds (MSB). WTGs shall be shut down whenever a flock or a stream of 10 or more individuals of any species of MSB approaches the Facility at collision risk height. This is a preventive condition. The risk will be evaluated taking into account the species, altitude, speed and behaviour, and the time it takes to shut down the turbines once the order is given.
- Condition C – Imminent risk of collision: Any WTG shall be shut down whenever it is detected an imminent risk of collision of a MSB with such WTG. This is a reactive condition. Typically this will be used for just one or a restricted number of turbines and for a very short period of time and it should be applied only when it is judged that there is still enough time to prevent the collision.There is no distance threshold defined a priori for the application of this condition, since the decision depends on the bird's speed and behaviour and the average time that it takes a turbine to shut down after the order was given
- Condition D – Adverse weather WTGS shall be shut down, when Adverse Weather increases risk of collision with a turbine either by reducing MSBs' flight manoeuvrability, flight height or visibility or by limiting bird protection efficiency from ATMS operation by reducing radar detectability or environmental, health, and

[9] WSP Italia, (2025) ESBS Report Chapter 06 – Baseline conditions, biological and biodiversity resources. Mirny (Kazakhstan) 1GW Wind Farm Project.

[10] Birdlife International, (2015). Review and guidance on use of "shutdown-on-demand" for wind turbines to conserve migrating soaring birds in the Rift Valley/Red Sea Flyway. Regional Flyway Facility. Amman, Jordan.

safety conditions at vantage points. This is a preventive condition which will apply only if Condition A and/or Condition B have also previously been applied in the preceding two hours.

6.2.1 Target species for SDoD

All species taken forward for collision risk modelling (See Table 2) will be included as target species however there are other species present within and around the site that were not included because of low flight activity such as Saker Falcon. The full and final list of priority species will be provided in the ATMP but will include all priority species of IUCN Vulnerable and above recorded during the pre-construction flight activity surveys.

6.3 Bats

Finally, although bats have not been specifically considered in this study there may be a requirement to consider bat flight activity in the OTMP. Increasing wind turbines' cut-in speed (the lowest wind speed at which blades start rotating) is an effective mitigation strategy for bats. This involves setting a higher threshold, often based on weather and bat activity, that prevents turbines from spinning during low wind speeds when bats are most active, significantly reducing fatalities with minimal energy loss. In a conventional turbine, blades can start to spin at a relatively low wind speed of about 3.0 m/s. but raising this to a higher, predetermined speed e.g., 5.0 m/s prevents the blades from rotating when bats are most active.

To minimise any impacts on migratory and resident bat species, there may be a requirement to enact active curtailment during the bat activity season. From the 15th April–31st May and 1st June–31st July. During the main autumn migration (1 August–30 September), turbines could be feathered between civil sunset and civil sunrise whenever hub-height wind speeds are below 6.5 m/s and ambient temperature is ≥8–10°C.

To identify the priority areas within the project that may require selective turbine curtailment for bats the spatial acoustic monitoring data will be further interrogated to identify areas of highest bat flight activity within the project site. Operational acoustic monitoring will also be applied and designed to complement the existing data and to inform the ongoing curtailment programme in an adaptive manner.

Any curtailment will be adaptively refined using acoustic monitoring and weather-based risk modelling and strengthened if post-construction monitoring indicates higher-than-expected mortality or conversely may be reduced if mortality levels are not experienced.

6.4 Commitment to shut down on demand

Based on the level of survey data collected so far, the assessment of flight activity across the site, the limitations of data coverage across the site at existing VPs and the lack of any data for some turbines the project will take a precautionary approach to SDoD. The turbines identified in Table 3 will be a priority for a camera-based system as these turbine locations have the highest level of flight activity for at risk sensitive species recorded during the surveys. Further turbines that have no or lower than standard coverage will also be identified and included in the final Active Turbine Management Plan.

The SDoD system will test for accuracy prior to operation and will be active annually for years one to three and the data used to determine the need for seasonal revision to the application of the SDoD system.

The turbine shutdown protocol will follow previous tested approaches to SDoD triggers and will follow the protocol given in Section 5.1.1

The Active Turbine Management Framework (ATMF) will be finalised into a Management Plan based on the feedback from consultation. The Active Turbine Management Plan (ATMP) will follow adaptive management and be flexible to change going forward depending on the results of the camera-based system shutdown log and the results of the Post Construction Fatality Monitoring Programme.

The ATMP will be finalised at least six months prior to the operational phase of the WPP and will have undergone a trial period where target species ID is tested against real-time observations in the field, which will serve to determine the fatality threshold for the Management Plan.

6.4.1 Implementation schedule

6.4.1.1 Birds

The main migration periods through the project site are March to May for the Spring and August to October for the Autumn, however flight activity on site has also been recorded for local breeding species such as Golden Eagle, Saker Falcon, Common Kestrel and Black bellied Sandgrouse so the operational period for the SDoD period will be extended to account for the breeding season and migratory seasons i.e. all months from March to October. Although activity is expected to be limited during the winter months from November through to February, robust flight activity data is not available for those months over the whole site due to extreme weather conditions and lack of access for the surveyors. As a precaution, Year 1 of the SDoD will be operational during all months to cover any elements of uncertainty and to inform the temporal coverage for future years.

6.4.1.2 Bats

The proposed schedule for reducing the risk of bat collision through the implementation of blanket curtailment focusses on periods when bats are expected to be most active i.e. early March to Mid-November.

The implementation of smart curtailment based on a site-specific bat activity model using real time data from bat activity monitoring and weather conditions will be expected to provide better bat protection, with lower production losses compared to blanket curtailment.

After the first year of bat activity monitoring during the wind farm operation period, a site-specific model will be developed based on the monitoring data. This model will serve as a basis for implementing smart curtailment. In subsequent years the model will be refined using additional data from ongoing monitoring programmes with results from post construction fatality monitoring taken into account. Based on the site-specific bat activity model, site specific criteria and thresholds will be defined to evaluate the efficiency of the model.

7.0 MONITORING AND ADAPTIVE MANAGEMENT

7.1 Monitoring plan: birds and bats

Bird and bat flight activity monitoring as well as bird and bat collision monitoring will evaluate the effectiveness of the ATMP strategy by:

- Evaluating bird fatalities in relation to the thresholds established in the ATMP
- Comparing these results with mortality estimates from the CRM report
- Collecting updated, site specific data on bird and bat activity and behaviour at Mirny

The monitoring will evaluate the ATMPs effectiveness and identify any issues that require to be addressed.

Monitoring will be conducted by a suitably qualified ecologist and focus on three core components:

1) Post Construction Fatality Monitoring during the first three years of operation to begin with.
2) Bird Activity and Behaviour Monitoring which will follow internationally recognised standards and will aim to document changes in species composition, abundance and behaviour near turbines to inform potential adjustments to the shutdown criteria.

3) Bat activity monitoring using passive acoustic bat detectors on wind turbines to measure the bat activity index for each turbine. Most bats can only be detected at distances of 40 to 50 m which precludes a SDoD system for bats. Data from bat activity monitoring will be valuable in assessing the impact on bats in conjunction with mortality monitoring results. These data will also support real time inputs to determine when operational curtailment should be applied.

7.2 Adaptive management

The ATMP is intended to be a dynamic document which will regularly reviewed and updated based on the results of the monitoring data and emerging best practice guidance. It is intended that the ATMP will be reviewed annually, aligned with the project ESMP, informed by the results of the PCFM programme and the bird and bat activity monitoring. This annual review process will support a proactive and responsive management of collision risk, allowing the plan to be adapted to evolving environmental conditions and bird and bat activity patterns. Each revision of the ATMP will assess whether adjustments are needed to the following components:

- The target species list, particularly if there are changes in species occurrence and/or conservation status.
- Implementation schedule, based on changes in migration timing or intensity.
- Shutdown criteria thresholds, informed by PCFM results v CRM predictions.
- Vantage point locations, to optimise coverage and detection capabilities.

The results from the first year of ATMP implementation, in combination with the PFMF results will provide the initial basis for assessing the effectiveness of the plan's performance and for making evidence-based adjustments to ensure that the ATMP's goals, including minimising collision risk, are being effectively met.

8.0 CONCLUSIONS

Site specific data from the Mirny Wind Power Plant obtained during the pre - construction phase indicate a relatively low risk of collision for bird species, despite some species being classified as globally, regional and nationally threatened.

Based on this information, the implementation of a suite of monitoring strategies is recommended, specifically targeted to further assess the bird and bat collision risk, and if and how this is required to be mitigated, in compliance with EBRD Environmental and Social Policy.

The shutdown on demand (SDoD) system will be used during the active phase of the Mirny WPP and automatically trigger turbine shutdown when a species of high conservation status is approaching the active turbines. It will test for accuracy prior to operation and will be active annually for years one to three and the data used to determine the need for seasonal revision to the application of the SDoD system.

For birds and bats, the key recommendation of this ATMF is to implement a robust and data -driven Post - Construction Monitoring Plan, aiming to inform the necessity of implementing turbine curtailment for birds at the Mirny WPP. The Post Construction Monitoring Plan shall encompass a IFI compliant Post Construction Fatality Monitoring Plan, established to regularly search for birds and bats carcasses that may result from collision induced mortality or injuries, to estimate the annual number of collisions at the turbine and project level, accounting for searcher and environmental biases. The Post Construction Monitoring Plan shall also include bird and bat activity monitoring, to further inform decision making at project - level, in particular respecting mitigation of collision risk, continuing the surveys implemented since Spring 2023 for birds, and commencing a new, robust and comprehensive bat activity monitoring plan during the operational phase.

For bats, it is recommended to adopt a precautionary and adaptive management approach to assess and characterise collision risk and bat activity patterns. Given the relatively low baseline bat activity and absence of roosts, the initial focus will be on implementing the Post Construction Monitoring Plan, including Fatality and Activity Monitoring. Monitoring results will inform both the need for site - specific mitigation and the design of Smart Curtailment, based on site specific bat activity gathered by acoustic monitoring and environmental data, ensuring effective reduction of bat collisions while minimising operational constraints.

To evaluate the effectiveness of the proposed mitigation measures during the operational phase, Post - Construction Fatality Monitoring will be implemented, in line with international best practices. This will be conducted in addition to ongoing bird and bat activity monitoring.

The results of these monitoring efforts will provide essential data to assess the performance of the ATMF and will serve as a key input for its review and potential adjustment under the Adaptive Management Framework.

Signature Page

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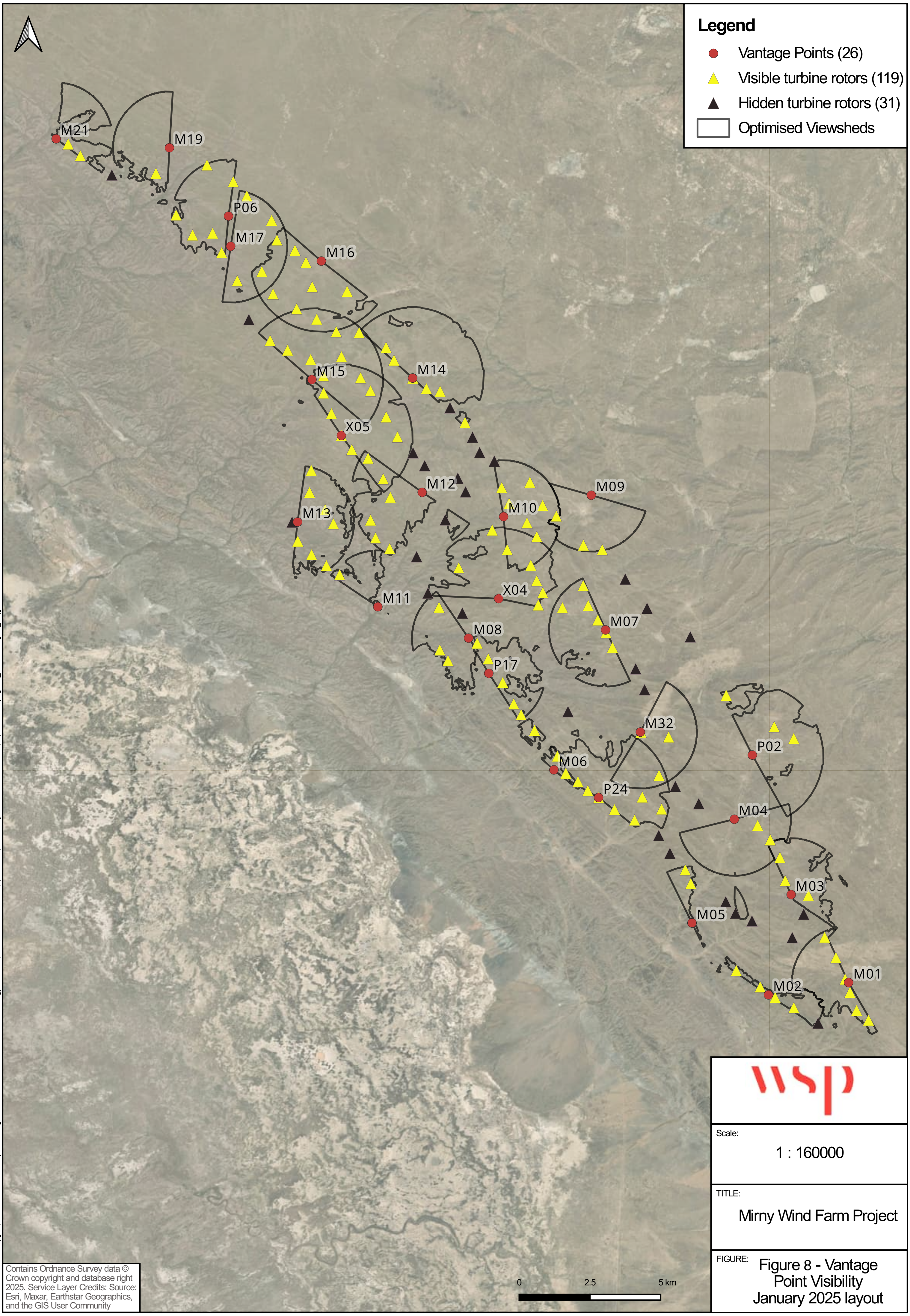
APPENDIX A – Figures (8 -15)



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TITLE:
Mirny Wind Farm Project

FIGURE:
Figure 8 - Vantage Point Visibility January 2025 layout

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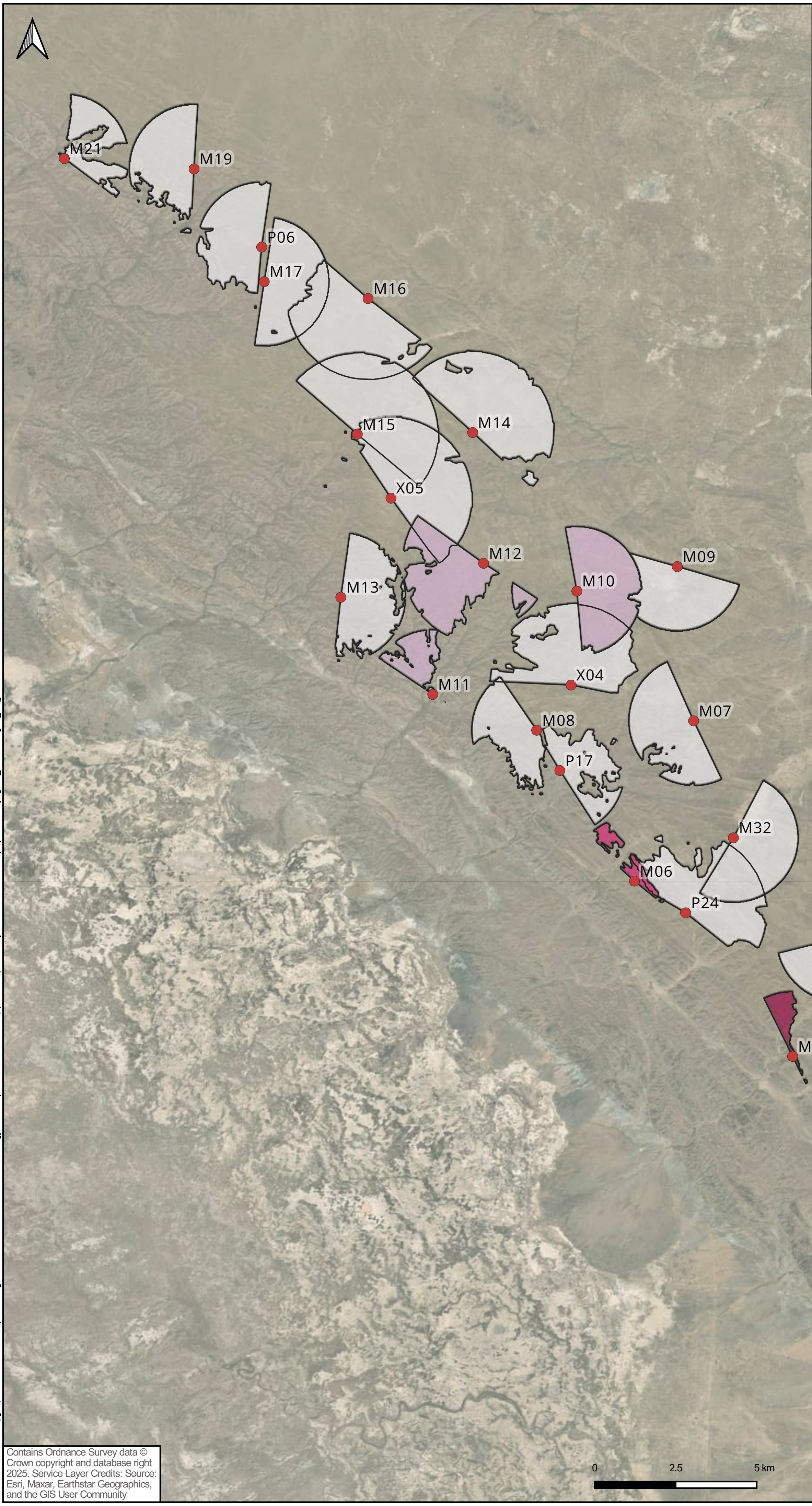

Legend

- Vantage Points
- Optimised Viewsheds

Bird Density (birds recorded at PCH per sq.km watched)

- 0.0000 - 0.0083
- 0.0083 - 0.0167
- 0.0167 - 0.0250
- 0.0250 - 0.0334
- 0.0334 - 0.0417

Highest areal bird density noted at M02, followed by M05 and M06

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TITLE:

Mirny Wind Farm Project

FIGURE:

Figure 9 - Spatial bird density for all 13 species taken for assessment

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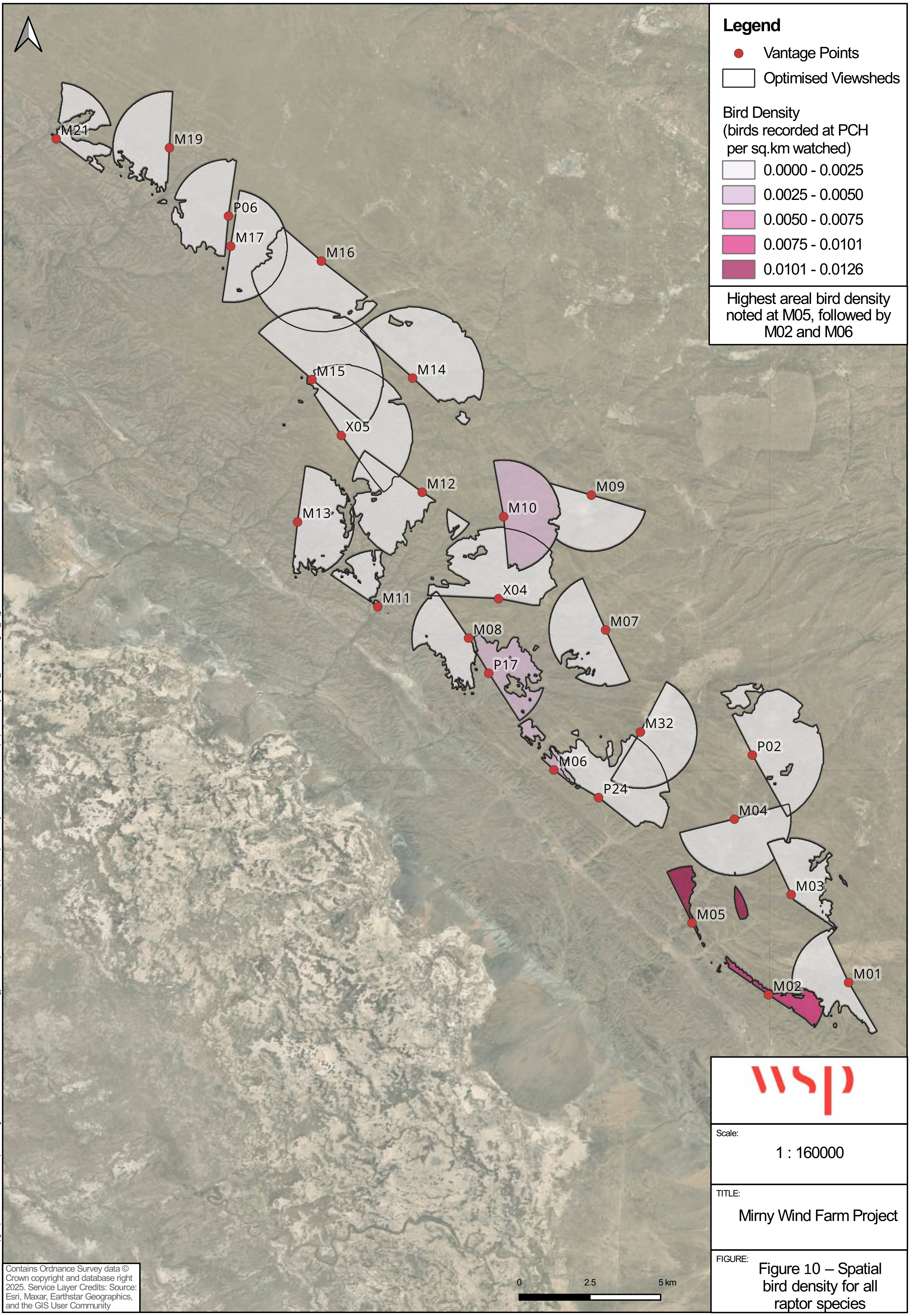

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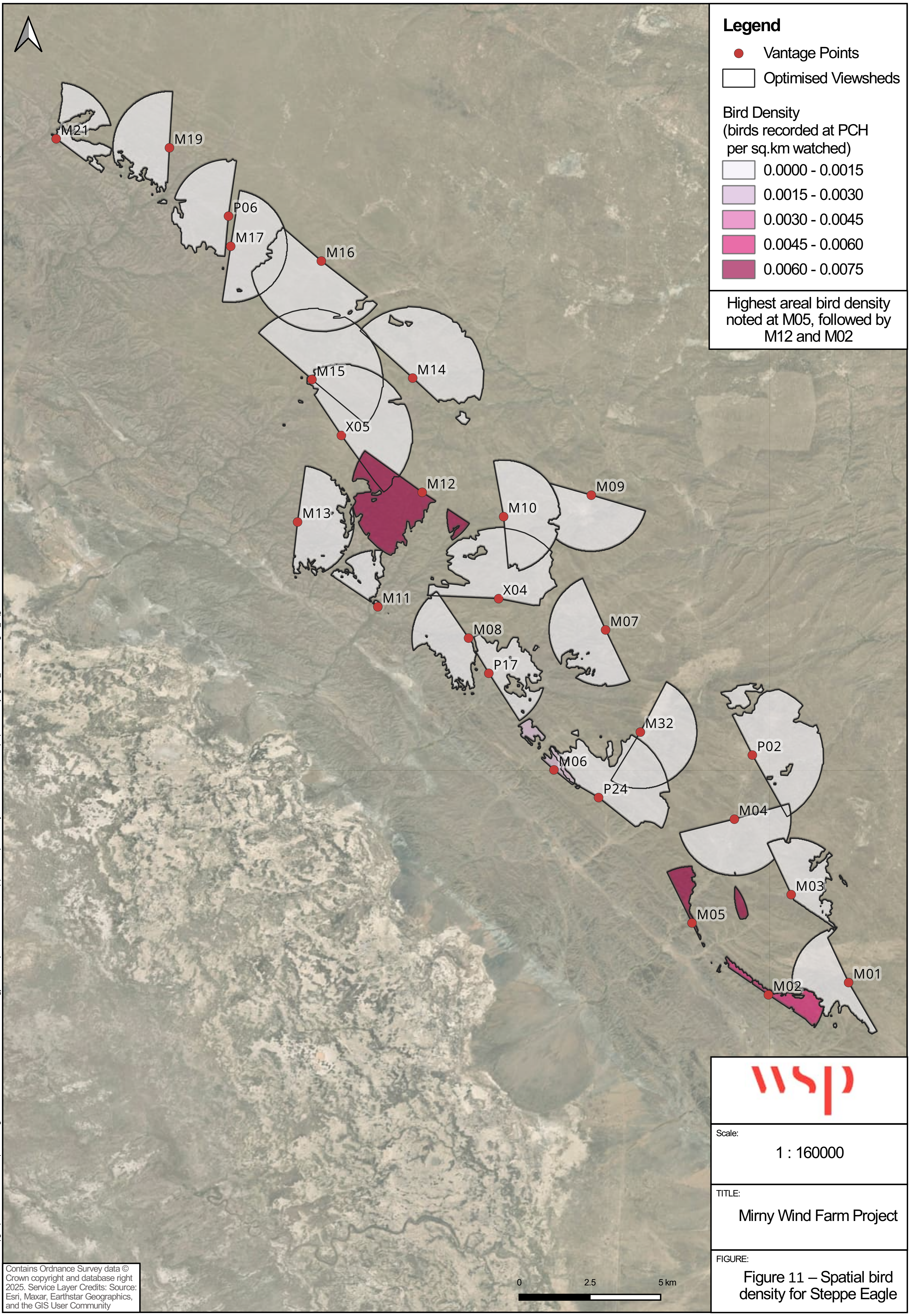

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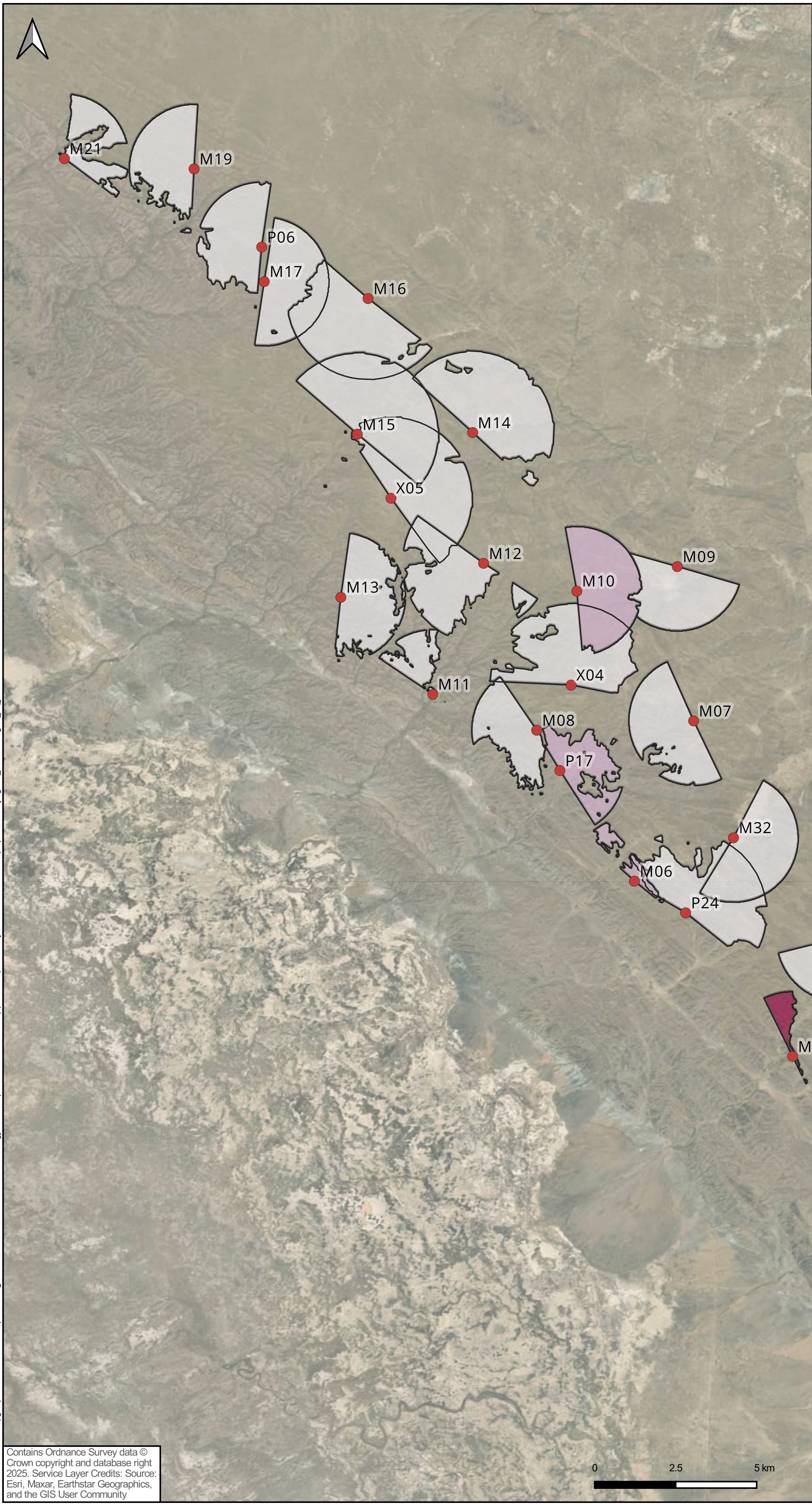
TITLE:

Mirny Wind Farm Project

FIGURE:

Figure 11 – Spatial bird density for Steppe Eagle



Legend

- Vantage Points
- Optimised Viewsheds

Bird Density (birds recorded at PCH per sq.km watched)

- 0.0000 - 0.0025
- 0.0025 - 0.0050
- 0.0050 - 0.0075
- 0.0075 - 0.0101
- 0.0101 - 0.0126

Highest areal bird density noted at M05, followed by M02 and M06

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TITLE: Mirny Wind Farm Project

FIGURE: Figure 12 – Spatial bird density for Black-bellied Sandgrouse

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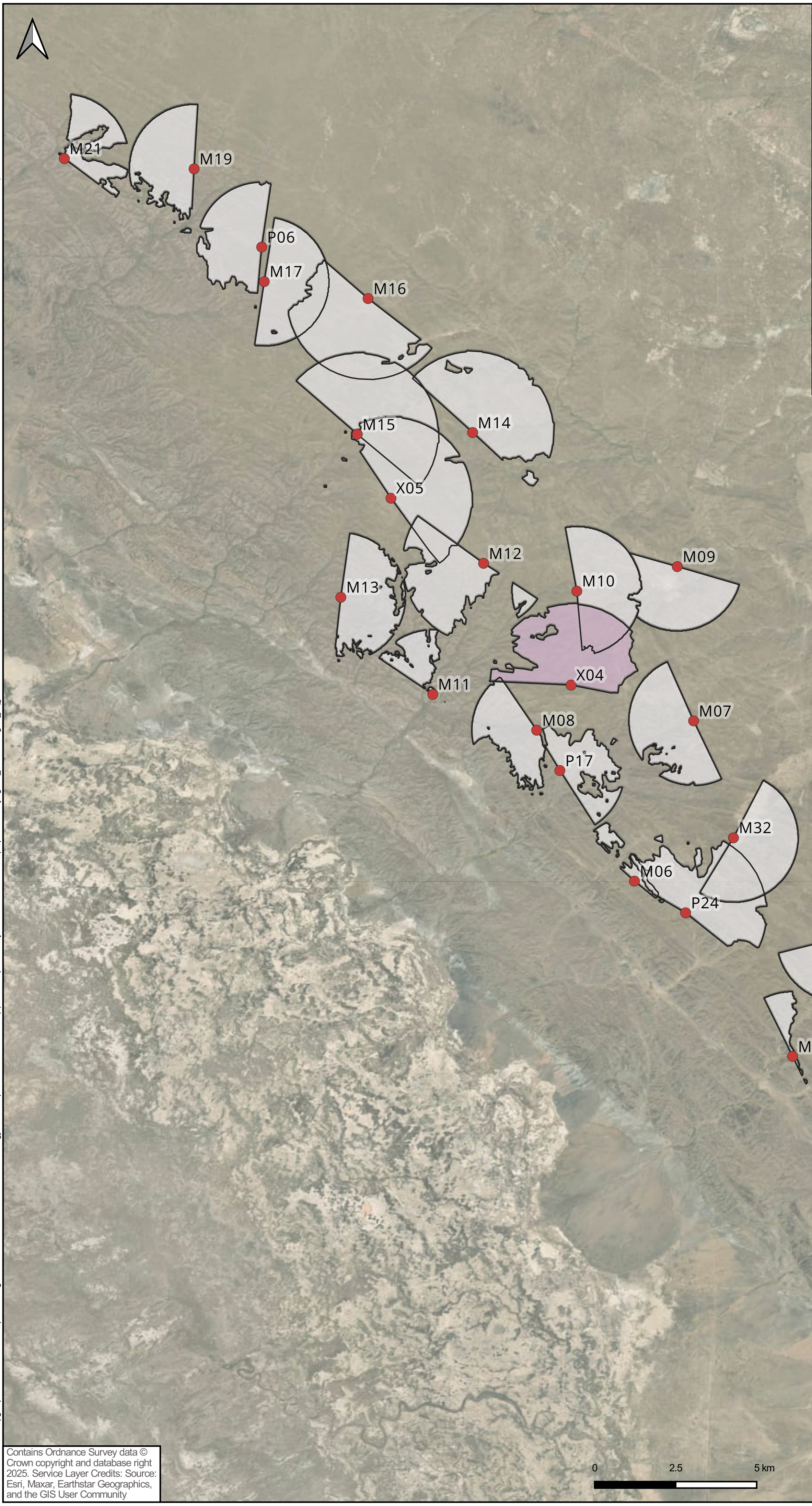

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- Vantage Points
- Optimised Viewsheds

Bird Density
(birds recorded at PCH per sq.km watched)

- 0.00000 - 0.00019
- 0.00019 - 0.00038
- 0.00038 - 0.00058
- 0.00058 - 0.00077
- 0.00077 - 0.00096

Highest areal bird density noted at M02, followed by X04 and M32

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TITLE:
Mirny Wind Farm Project

FIGURE:
Figure 13 – Spatial bird density for Little Bustard

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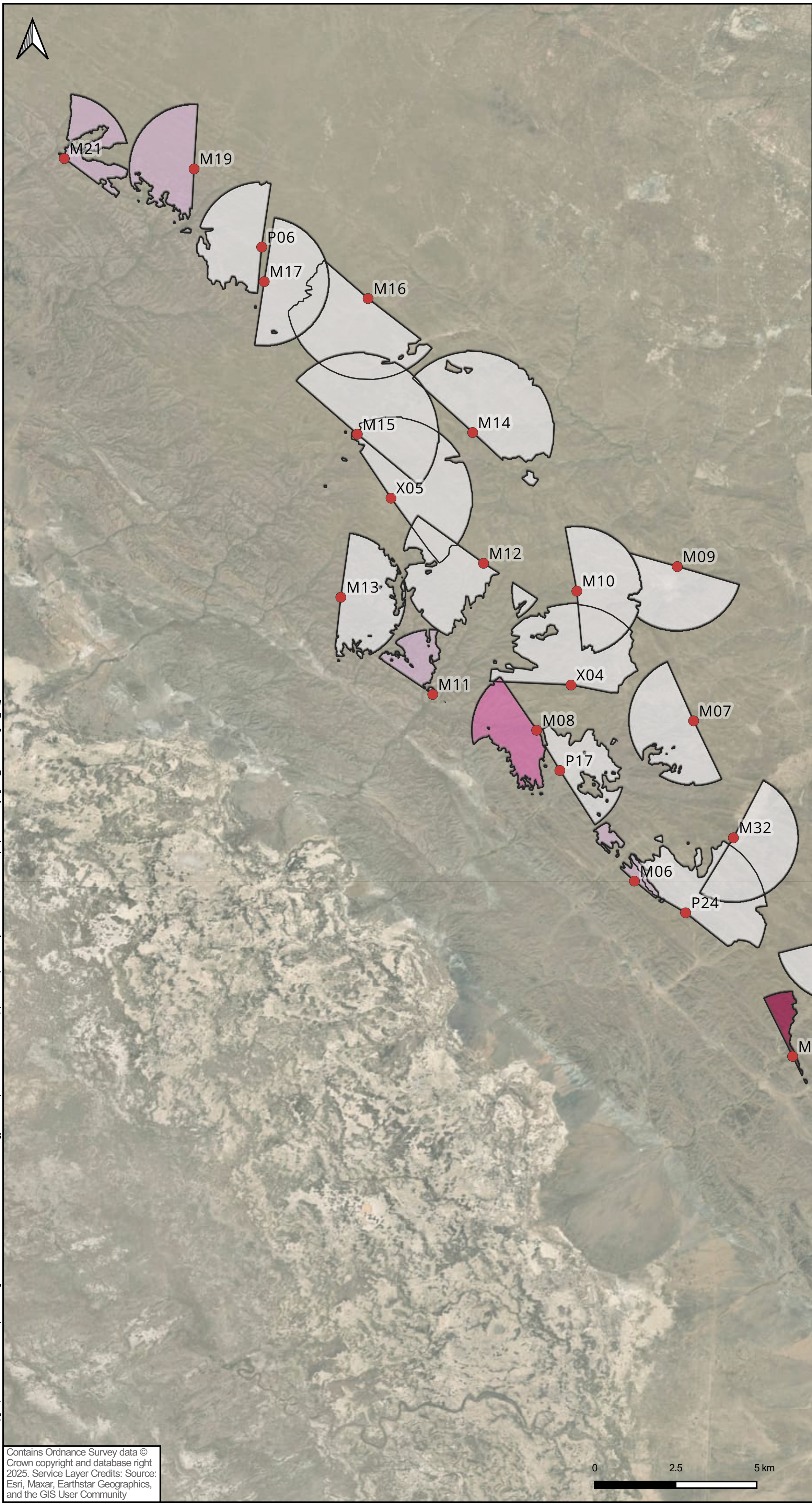

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TITLE: Mirny Wind Farm Project

FIGURE: Figure 14 - Spatial bird density for migratory species, Spring passage

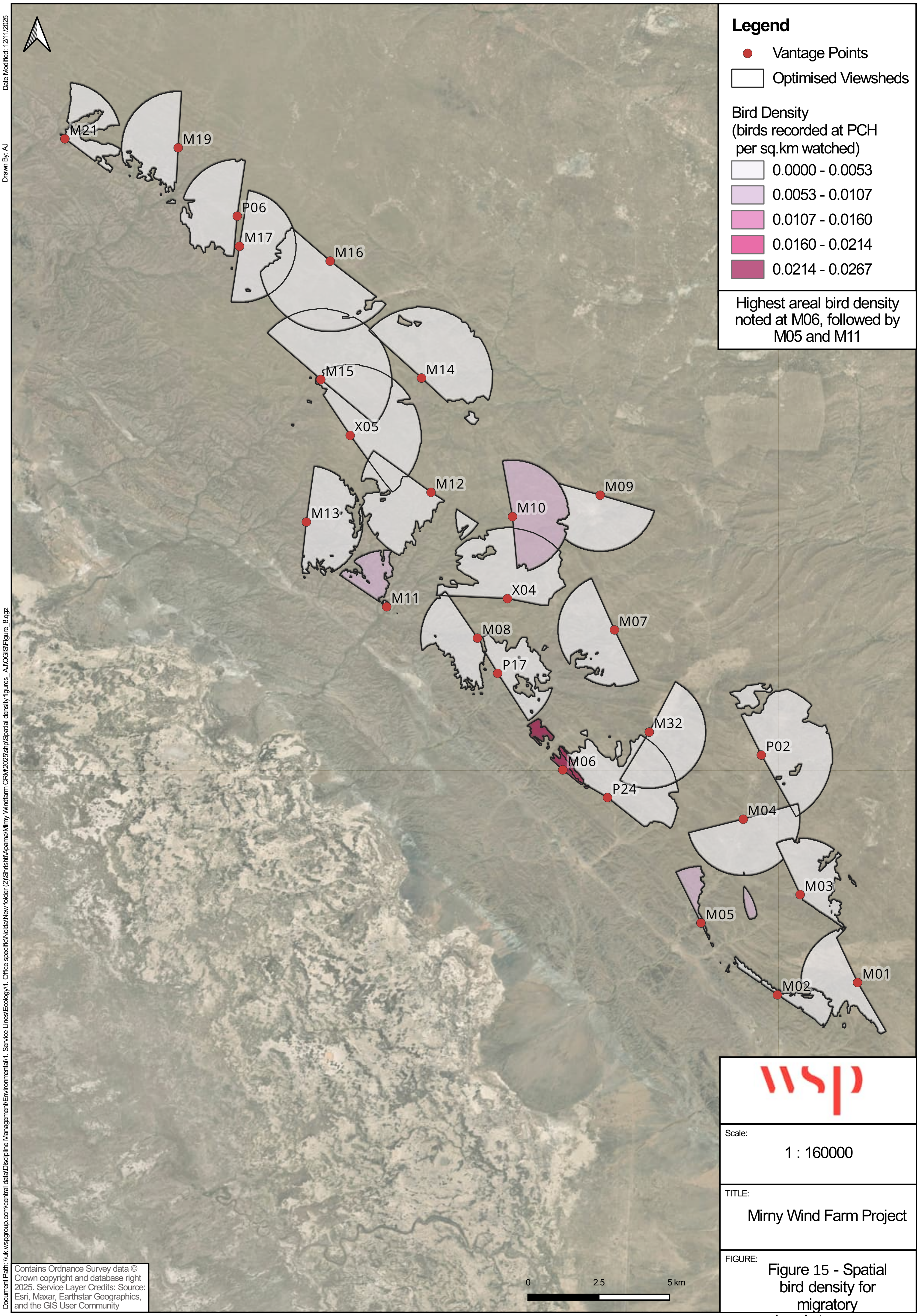

Figure 15 - Spatial bird density for migratory species, Autumn passage

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