REPORT

Mirny (Kazakhstan) 1GW Wind Farm Project

ESIA Report Chapter 02 - Analysis of Alternatives

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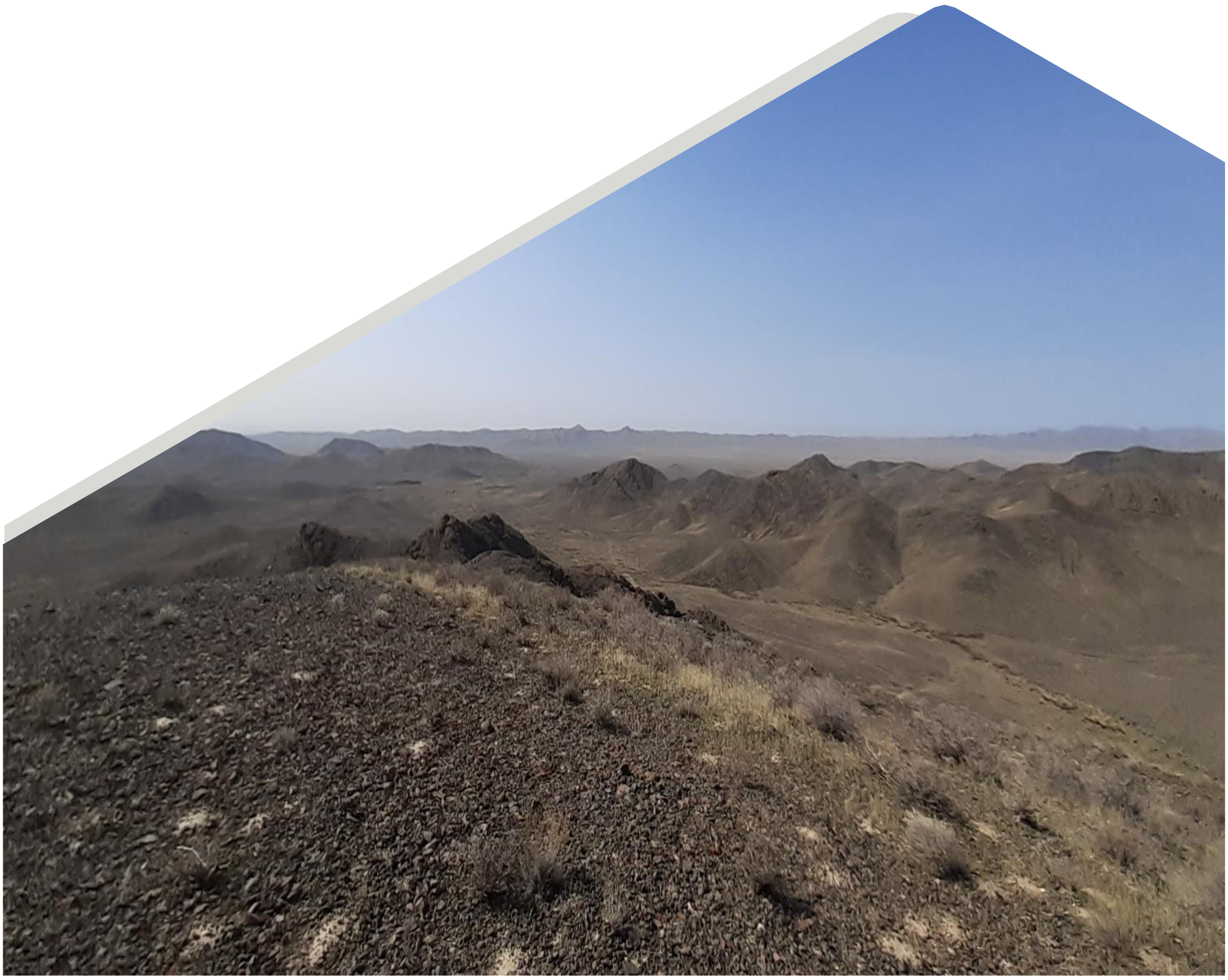

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2.0 ANALYSIS OF ALTERNATIVES

2.1 Introduction

This chapter presents the analysis of alternatives conducted to ensure that environmental, social and biological considerations are integrated into and aligned with the Project design.

This chapter systematically compares alternatives assessing their pros and cons, the suitability, the potential environmental, social and biological impacts and the feasibility of mitigations , and their conformity to existing policies, plans, laws and regulations.

2.2 Project Area Selection

Overall, several factors usually determine the suitability of a given area for wind power generation. The identification of the Project area was based on technical feasibility studies and on high level Environmental and Social (E&S) criteria. The Project area identification was carried out as part of the feasibility studies by the Client considering the following criteria:

- **Wind Resources:** the wind resource potential of an area is one of the main factors to be considered when choosing a location for a wind farm. Ideal wind conditions should be strong and consistent winds, with low turbulence, coming mainly from a single or prevailing direction. A wind measurement program is therefore imperative before a wind farm is installed. In September 2022, the Company carried out a windmeasurement campaign in the Project area[1], where it was confirmed its suitability in terms of wind resource potential.

- **Land Use:** For the development of all the facilities required for wind power generation, a considerable area of land is required. The most relevant infrastructures in this case are wind turbines, where the spatial extent of a potential site is a parameter that will affect the potential yield of the **project** as a whole, taking into account the number of wind turbines needed to meet the required power capacity. The ideal area minimizes potential adverse impacts on land users and livelihoods, ultimately avoiding land relocation and acquisition. In the case of the Mirny Project, the area selected for the WPP and Over Head Transmission Lines ("OHTL") construction includes barren and bare land. Efforts were therefore made to locate the wind farm and OHTL in an area with relatively low-priority land use.

- **Geotechnical Conditions:** The **suitability** of a Project area also depends on the local geotechnical conditions, considering the implications of the subsurface environment on the stability, integrity and performance of the project's designed structures. Initial geotechnical and hydrological studies have confirmed the Project area has bearing capacity and soil resistivity, water table levels, drainage patterns, and flood risk that allow developing the Project.

- **Seismicity and Geohazards:** The assessment of the seismic risk is also an important factor when choosing the location to install a wind farm. Earthquakes have the potential to damage infrastructure and cause severe accidents, therefore wind energy developers in earthquake-prone regions shall understand the characteristics of the seismic risk in order to make informed decisions in terms of project design and mitigation measures to be applied. For the Mirny Project, although the Jambyl region is characterized by a significant risk of severe earthquakes (magnitude of up to 8.0 in the Ritcher scale could occur), the Project area and proposed OHTL are located on areas with lower seismic activity (magnitude of up to 6.0 or 7.0 in the Ritcher scale could occur). However, earthquakes of magnitude 6.0 and 7.0 are still considered moderate size earthquakes, and have the potential to cause damage to the wind farm infrastructure, and this **has been** considered in the wind farm infrastructure design, so that in the event of an earthquake,

[1] Source: Total Energies Site Visit to Mirny in September 2022.

operations and power generation can continue without issues. In addition, the choice of exact site location has also considered the potential for geohazards to occur (such as landslides and mudflows), which could also pose severe damage risk for infrastructure depending on their characteristics. Although an initial literature review indicates that the Project area has most likely low geologial risks, geotechnical investigations have helped assess the soil stability and gain a clearer understanding of the associated risks and were the basis for the final design.

- **Protected Areas and Habitats:** Early screening of risks and avoidance of areas of high biodiversity sensitivity **are** important aspects to be considered when choosing the Project area. In that sense, a full Project screening (Mott MacDonald 2023)[2] identified an initial Zone of Influence for the Biodiversity desk study and identified the designated sites and legally protected areas. In addition, a preliminary flora survey was also conducted in the summer and spring seasons of 2023, which aimed to determine the current state of vegetation and the presence of fauna species that need special consideration within the Project area to confirm its suitability.
- **Accessibility:** Accessibility of to the Project area is important for all types of transportation that will be carried out during the construction and operational phases. The Project area is located close to existing main and local roads, in relatively good conditions to support vehicles and heavy machinery. Ideally, the roads should also have connections to towns, commercial centres, and residential facilities. In September 2022, the Company conducted an access road study for the Mirny Project area (source: Mirny Wind Farm Road Report), where accessibility was addressed. The Project Area is accessible through existing paved and unpaved roads that originate from the national road A-358. In addition, other access roads will need to be built specifically for the Project. It has been also identified the need to upgrade some parts of the existent unpaved accesses and bridges, mainly for the passage of major structures during construction. Options for lifting operations to transpose large and heavy infrastructure over low-height bridges was also evaluated.
- **Grid connection:** Availability of grid connection is an important driver in determining the suitability of an area for wind farms. Projects should be located in relation to grids that offer adequate capacity, availability and proximity. In the case of the Mirny Project, two existing substations (SS) that can support the electrical load generated by the Project are located at distances considered economically viable, the Yukgres SS and the Shu SS, and therefore transmission lines can be connected to these SS so that the energy can later be distributed to the national grid.
- **Presence of Human Receptors:** Large WPPs are likely to cause impacts on communities' health, safety and security, with the severity of this based on proximity to the WPP. Shadow flicker occurs when the sun passes behind the wind turbine and casts a shadow and can become an issue when potentially sensitive receptors (e.g. residential areas and workplaces) are located near the WPP. Noise generated from the turbines can be a nuisance to nearby communities or residences. Any distance less than 500 m from residential areas may have an impact and the due diligence would need to include both specific noise modelling but also consideration of mitigation measures. The Mirny Project Area is remote with no presence of human receptors, excluding some occasional shepherds that cross the lands with their livestock.

More detailed and specific criteria where then considered to define the potential Project site within the Project area out of several alternatives. These are discussed in the following sections that present the analysis of alternatives carried out and the preferred alternative chosen for:

[2] Mott MacDonald (2023) Environmental and Social Screening, wind farm: Mirny Sites, Kazakhstan.

- Project site.
- Overhead Transmission Lines.
- Access Roads.
- Project structures and technology, such as wind turbines and Overhead lines.

2.3 The Alternatives

2.3.1 Zero Alternative or No Project Alternative

A zero alternative, or "do nothing scenario", has been considered as a possible alternative to the Project. This option would imply that no construction activities will occur in any of the considered locations. The following considerations apply to this option:

- Short-term adverse impacts related to construction (e.g., noise and dust emission) would be absent.
- There would be no consumption of soil and no loss of natural habitat.
- In relation to biological resources, under the Zero Alternative, existing habitat would not be disturbed or fragmented by the Project activities, especially during the construction phase, considering earthmoving, building and transportation activities. In addition, the risk of collision of flying animals against the wind turbines would be inexistent, considering this is one of the main threats to biodiversity related to this Project.
- Under the Zero Alternative, the Project site remains in its current condition and no new construction of any infrastructure would occur. As such, this would not result in any new sources or increased risk of loss, injury, or death involving liquefaction, landslides, or ground failure on-site. When compared to the Proposed Project, the Zero Alternative would have a reduced impact upon potential geotechnical hazards.
- Under the Zero Alternative, the generation of waste for construction would be inexistent, just as the need to find appropriate landfills and recycling facilities for the waste that will be generated after the end-of-life of Project structures, considering that Kazakhstan has not yet a circular economy dedicated to that issue, although the country is massively investing in renewable energy developments.
- There would be no effect (both positive and negative) on the national or local economy.
- The Zero Alternative would cause no positive effects on the community's job's prospects (i.e., increasing the employment rates).
- There would be no contribution to the Kazakh Government's goal of increasing renewable energy as well as realizing the Paris Agreement commitments.
- There would be no further contribution to the country's energy security, with the reduced dependence on fossil fuel resources and diversity of energy sources.
- The traffic circulation would remain the same, however, the existing roadways would continue to work with the same capacity and conditions and would not be renewed.
- There would be no increase of human capital, the local youth would not have the possibility to gain a professional qualification and be adequately trained to exercise a specific profession.
- There would be no improvement on the local and national training systems.
- There would be no contribution to improving local/regional/national electricity supply and reliability and as a result will contribute to economic development in the region.

Summarizing, the Zero Alternative implies not proceeding with the Project and leaving the area in its current state. Although this means that some E&S environmental impacts would not occur, especially during the construction phase, proceeding with the Project development will, ultimately, largely contribute to reducing current E&S impacts that are associated to fuel-burning power plants, providing economic and social benefits, enhancing energy security and creating new opportunities for sustainable development in the country.

Considering that i) the growth of the local and national economy is a priority for the state authorities, ii) that, overall, the expected positive impacts outweigh the negative ones on the environmental, socio-economic, health and biological components, and that iii) the Project plans to implement several robust mitigation measures to avoid and/or minimize potential adverse E&S impacts, the Zero Alternative is not considered suitable and will not be further assessed.

2.3.2 Project Site Alternatives

2.3.2.1 Initial Site Selection - Scoping phase analysis

During the scoping phase carried out in February 2024, WSP conducted an Analysis of Alternatives which was summarized in Chapter 04 of the Scoping Report (ref. doc. 22556989-R-001_Rev.0, Mirny 1GW Wind Power Project – Kazakhstan *Environmental and Social Scoping Report,* dated February 2024). As detailed there, the Company originally identified 3 sites in the Project Area, considered suitable for the Project implementation. The three sites, namely Site A, Site B and Site C, are presented in Figure 1 below.

Figure 1

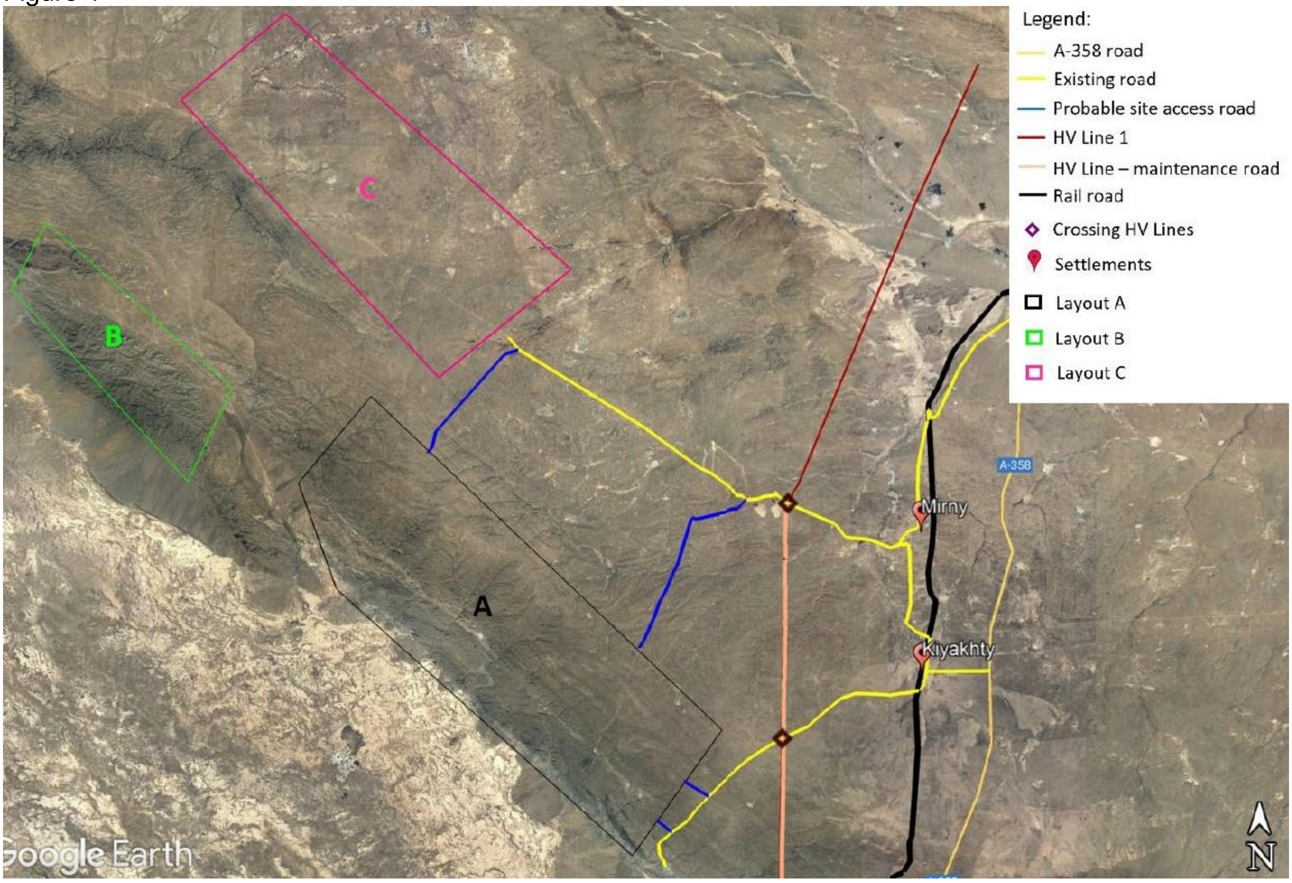

Figure 1: Initial Project sites layout with the three alternative sites A, B and C

The three sites were identified on the basis of technical characteristics relating wind intensity and direction; the preferred site was then chosen incorporating E&S criteria as well.

Site B was excluded in the early phase of the site selection process as anemometric studies indicated worst wind conditions with respect to the other two sites considered. Additionally, the proximity of the *Andasay State Nature Sanctuary* definitely contributed to the exclusion of this land plot.

Site A resulted to be favorable based on wind conditions; however, the first biological survey carried out in April - May 2023, raised the following concerns on biodiversity:

- The presence of the Regels tulip (*Tulipa regelii)*, globally endangered and also classified as rare and endangered in the Kazakhstan Red Data Book, northwest of Site A and on its southern boundaries.
- The presence of an Argali population (*Ovis ammon collium*), the world largest wild sheep, listed on the IUCN Red List as Near Threatened, because populations are declining due to poaching and competition with livestock.
- The presence of active nests, including five Golden Eagle (*Aquila chrysaetos*), two Saker Falcon (*Falco cherrug*) and two Steppe Eagle (*Aquila nipalensis),* all of which are Red Data Book species for Kazahkstan.

- Site A partially overlapped the Zhusandala State Reserved Zone, a legally Protected area, as shown in the following figure.

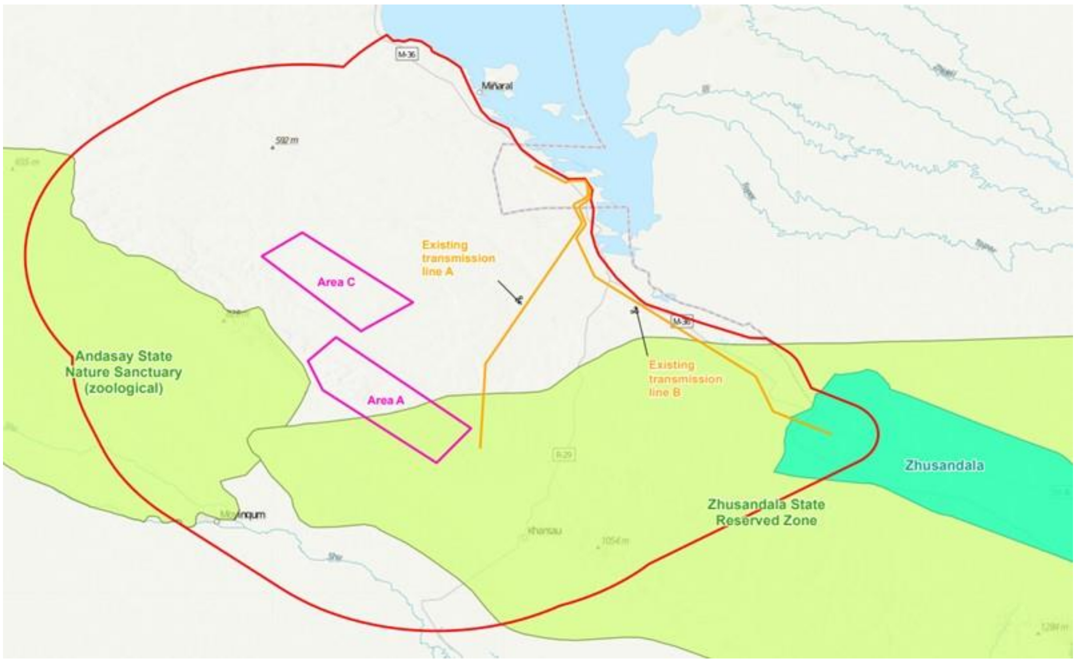

Figure 2: Internationally recognised and legally protected areas within the Biodiversity Screening Area in 2023 (MottMacDonald, 2023)

Because of this, the Company redefined the perimeter of **Site A** (**Site A extended**) to reduce the Project footprint on the Zhusandala State Reserved Zone area and to avoid/reduce biodiversity impacts (Figure 3). This was discussed with and communicated to the Government and official response received from the Ministry of Ecology of Kazakhstan (dated September 2024) regarding the location in Zhusandala State Reserved Zone. The Ministry also recommended engaging with Okhotzooprom and signing a Memorandum of Understanding (MoU) to reinforce joint cooperation in biodiversity preservation within the State Reserved Zone. MoU with Okhotzooprom was signed 18 June 2025, screening was performed and positive conclusion from State Env Expertise was received. Specifically Okhotzooprom has declared their willingness to:

- Provide access for employees and equipment of Aktas Energy to the Zhusandala State Reserved Zone of national importance to develop the Project;
- Facilitate the organization of working meetings during the course of the Project implementation;
- Provide with a list of environmental measures required during the Project implementation to minimize damage during the work;
- Inform Aktas Energy about urgent measures on wildlife preservation issues, caused by the Project activities; and
- Involve scientific organizations to monitor the state of biodiversity during Project implementation.

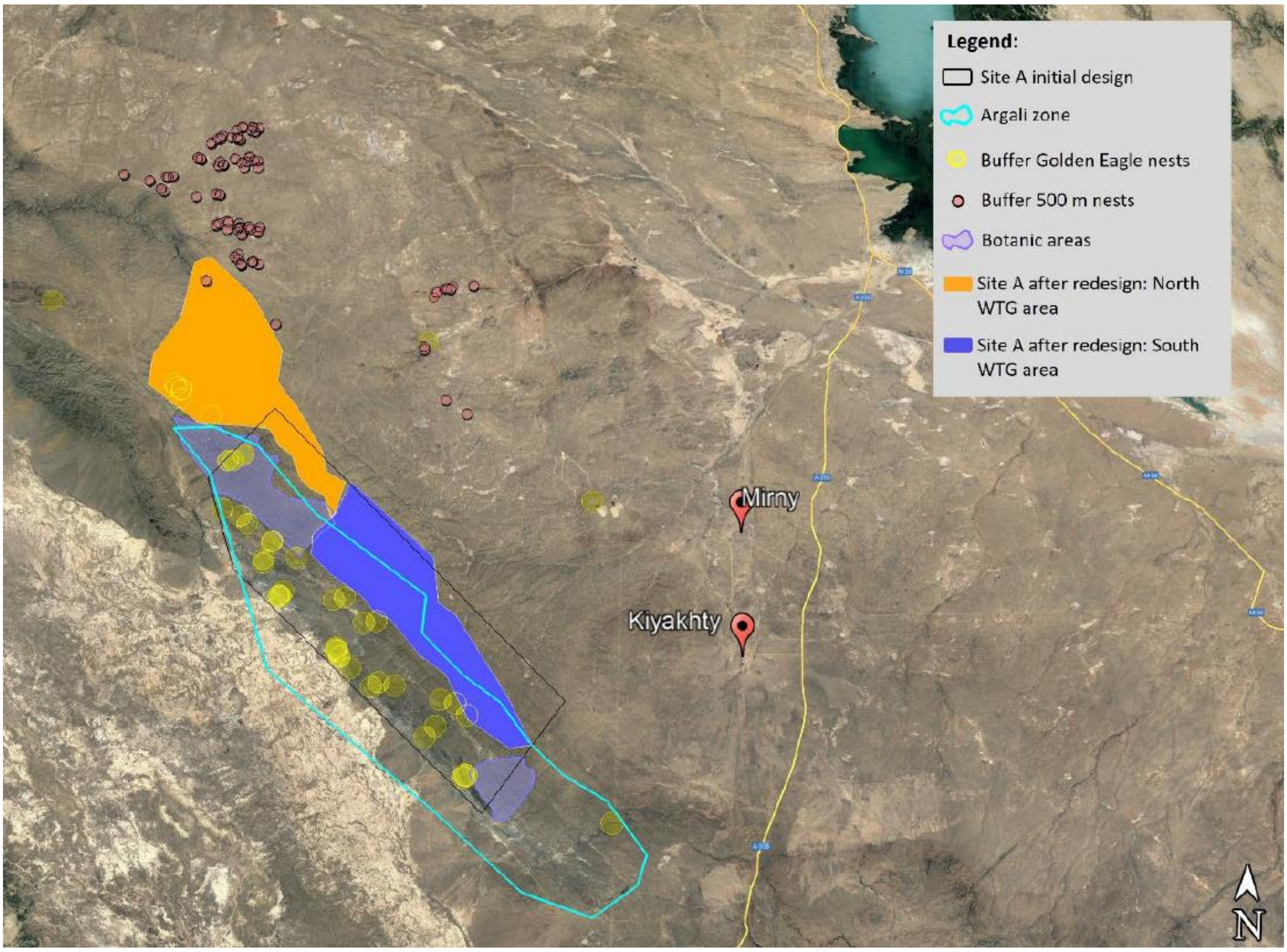

Figure 3: Boundaries of Site A and Site A extended (*shown as "Site A after redesign"*). The latter reduces footprint and reduce/avoid effects on fauna and flora and their habitats.

The boundaries of **Site C** did not undergo modifications as the site did not present any E&S issues.

The E&S criteria and the justification for determining the preferred site among A, A extended and C are presented in the following Table 1.

Table 1: Key E&S criteria evaluated for determining the preferred site during the Project's Scoping Phase.

Criteria			
1	**Biodiversity**	**Protected areas**	Proximity of protected areas (i.e. Important Bird and Biodiversity Area ("IBA",) World Heritage Site, State Nature Protection Areas, etc.) to the proposed Project is an important factor for determine the level of risk. Depending on the distance from a protected area, the subsequent level of assessment will be commensurate to the potential exposure of the habitats, species or artefacts to be protected.
2		**Birds**	WPPs have the potential for significant negative impacts on resident and migratory birds. These include mortality via collision with rotating turbine blades and other infrastructure and disturbance or displacement of birds during construction and operation. The location of the WPP and the layout of the turbines may be crucial factors regarding the potential for future negative impacts on migratory and local bird populations. Another important issue to consider is the presence of overhead power lines connected to the WPPs as birds may collide with the wires or be electrocuted. WPP need to be assessed against known bird migration bottlenecks and well-defined flyways but also

Criteria			
			taking into account sensitive receptors breeding in the vicinity of a project, even outside of the migratory areas. A detailed and robust survey programme in line with international standards is required for a minimum period of one year.
3		**Bats and other Biodiversity**	Similar to birds, bats may be affected by a WPP. There are a number of bat CR, EN, and VU species on the IUCN Red List and a robust assessment of the presence of bats is required during the pre-construction phase of a project. Among the direct risks to which bats are exposed are: direct strikes with rotor blades, barotrauma, the disturbance or destruction of roosts and the disorientation in flight through emission of ultrasound noise. Direct and indirect habitat loss and disturbance related to the construction, operation and decommissioning phases of WPPs can also negatively impact other species groups such as flora, mammals, reptiles, amphibians and invertebrates.
4	**Socioeconomic aspects**	**Human Receptors**	Large WPPs are likely to cause impacts on communities' health, safety and security, with the severity of this based on proximity to the WPP. Noise generated from the turbines can be a nuisance to nearby communities or residences. Shadow flicker might impact anyone driving along the road. Other risk to communities relates to the presence of security guards/forces and influx of workforce, which can increase risks of gender-based violence and harassment, and general health and safety impacts especially for vulnerable communities.
5		**Historic and Archaeological Resources**	Projects may be located in an area with the potential for containing tangible property or sites having archaeological (prehistoric), paleontological, historical, cultural, artistic and religious value, as well as unique environmental features that embody cultural values, such as sacred groves.
6		**Land acquisition, resettlement and livelihood restoration**	Large WPPs require significant amount of land. Any project involving land acquisition can impact local communities and their livelihoods, current landowners and/or current land users. Land acquisition that results in involuntary resettlement can complicate the social impact of the Project. This is especially the case when projects are located in countries where land tenure and ownership laws are tenuous and/or situations where local communities or groups do not hold title to the land.
7		**Infrastructure - Aviation**	WPPs can pose a significant risk to aviation, including infringement of low-level airspace for climbing and descending aircraft, increased turbulence, radar interference/blinding, and requirements around night lighting can be in conflict with the visual mitigation measures required by communities. Aviation driven constraints may be in conflict with E&S considerations and early recognition of this is critical in the ability of the project to incorporate design mitigations to address E&S issues and impacts (e.g. visual from night light pollution).
8		**Transportation**	Due to the length of the turbine blades their transportation can lead to impacts on the local transport infrastructure. As a minimum there may be disruption due to slow moving vehicles, however these impacts are temporal in nature and easily managed. Of potential significance is any required realignment of curves on the local roads to accommodate the turning circle of the vehicles or need to strengthen bridges or adjust other road infrastructure.
9	**Physical Environment**		The physical environment encompasses geotechnical aspects, hydrology, hydrogeology, and contaminated land.

Criteria			
			Impacts of earthworks - The evaluation of the maturity of the project's geotechnical design and whether there is sufficient geotechnical data to prevent any exposure to risks during the construction phase. **Water availability -** Construction of WPP in remote area implies the use of significant amounts of water for preparing concrete and for managing the accommodation camp. It is important to assess the presence of good quality of water and the availability to avoid water subtraction to local community.
10		**Cumulative Impacts**	Cumulative impacts need to be considered where there are other wind power projects, and/or any other developments which could together result in a greater impact on one or more specific criteria than the project alone (IFC 2013, Good Practice Handbook, Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets). Each appraisal activity needs to consider whether cumulative impacts might apply to the project, and where these are identified undertaken an assessment of their extent and significance and develop appropriate mitigation measures into the design and/or management of the project. Sometime complexity of making cumulative impact assessments is due to the lack of data.

During the scoping phase (2024), WSP conducted a comparative analysis of the three sites **Site A**, **Site C** and **Site A extended** on the basis of these criteria. **Site B** was not considered because it had already been excluded based on technical considerations.

The comparative analysis outlined that, from a socioeconomic perspective, all locations considered present similar characteristics, (excluding transportation, see further below). No site would more significantly avoid or minimize socioeconomic impacts than the others for the following reasons:

- The Project area and therefore all sites have no communities or sparse dweller, except for some herders that have a very low density that is the same on all sites.
- There are no known archaeological or historic resources on either site.
- Land tenure and use are the same at the three sites, which implies the same (limited) impacts on owners and users.
- All sites are at significant distances from any airports or airfields.

Regarding the physical environment, **Site A** turned out to be a less favorable option in consideration of the ridge to the southwest of the site.

From a Cumulative impact perspective, all sites are at significant distance from other reasonably planned future projects, so the potential for cumulative impacts would be equal for all.

Site A was considered the worst option in terms of morphology and impacts on biodiversity and transportation, which was the reason why the site was modified to site **A extended**. **Site A extended** appears a better option as it is in a flatter and more accessible area than **Site A**. Also, it would avoid or minimize certain impacts on biodiversity values (raptors nesting areas, endemic tulips, argali concentrations, etc.), as some turbines will be relocated and proximity to the existing road will be increased. Finally, **Site A extended** would reduce the footprint on the Zhusandala State Reserved Zone with respect to **Site A**. Therefore, when comparing **Site A** and **Site A extended**, the latter was preferred, especially considering **Site A** considerable biodiversity constraints.

When comparing **Site A extended** with **Site C**, it was observed that **Site C** would maximize impact avoidance and minimization, as it would be farther than **Site A extended** from any significant habitats and from the Zhusandala State Reserved Zone, therefore it would be a slightly better option than **Site A extended** in that sense; however, **Site C** was ultimately considered a much worse option than **Site A extended** from a technical and financial perspective, as energy generation would be much lower due to worst wind conditions. Therefore, **Site A extended** was chosen in 2024 as the preferred location for the Project development as it represented the best alternative available to reduce the effects on biodiversity with respect to **site A**, while ensuring the technical and financial viability that **Site C** would not allow.

The boundaries of the Zhusandala State Reserved Zone were modified in early 2025 (see the following figure). The reserve now fully overlaps all three sites **A**, **A extended** and **C** considered in 2024. However, **Site A extended** remains the preferred site as it is the one that has the smallest footprint on the State Reserved Zone.

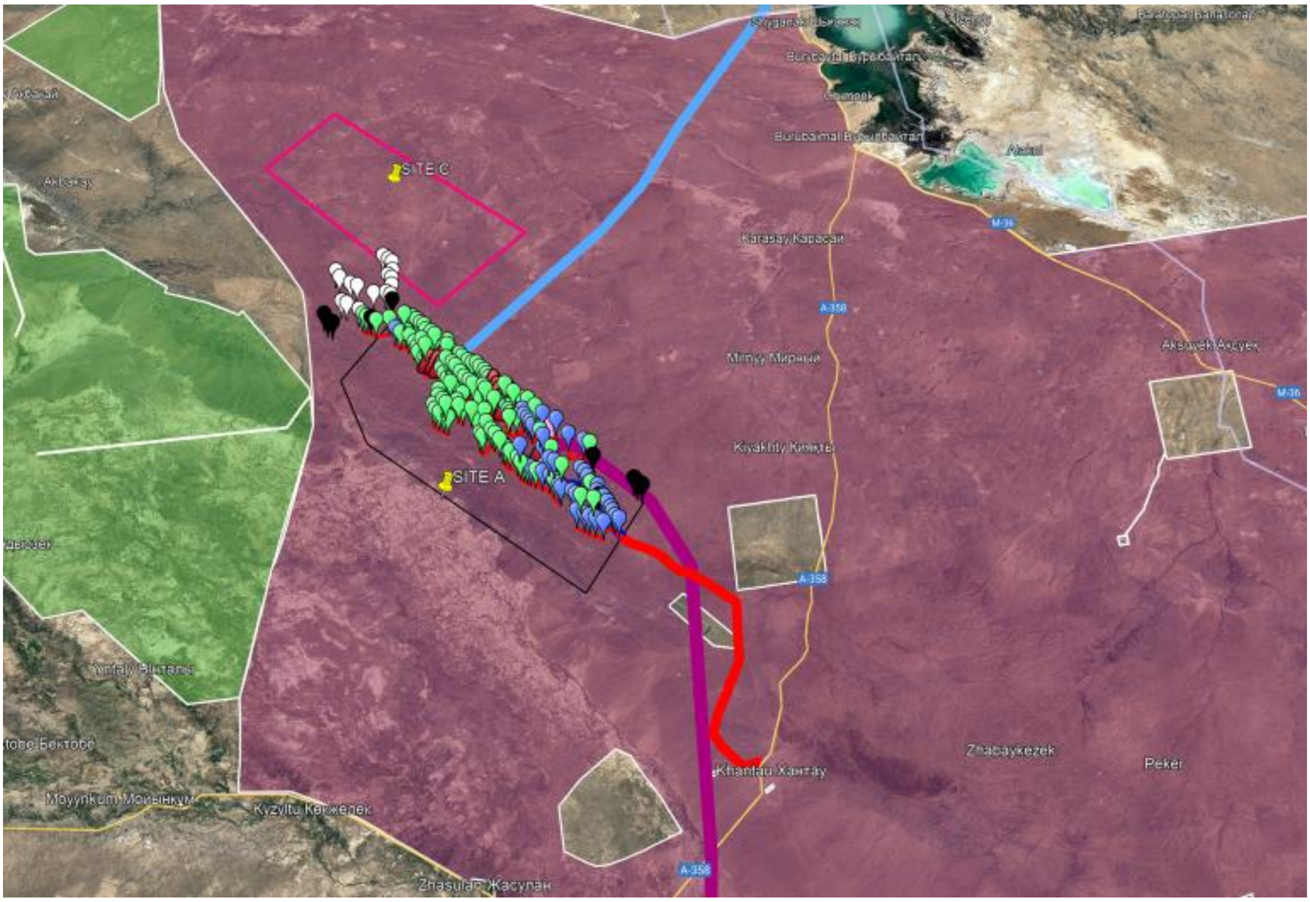

Figure 4: WTGs alternative sites (*Site C - pink; Site A - black; Site A extended - corresponding to the turbine footprint*) and OHTL corridors (*blue, pink and red lines*) in relation to the new boundaries of the Zhusandala State Reserve (*in pink – on the centre and right*) and the Andasay Santuary (*in green - on the left*).

2.3.2.2 Final Site Selection - Additional analysis during ESIA studies

While conducting the Environmental and Social Baseline Study, the Client continued working on the **Site A extended** and went through some additional boundary modifications as a consequence of more advanced biodiversity studies conducted in Spring and Autumn 2024.

As a result, the new selected plot excludes sensitive areas, especially the portion where the presence of Argali and the Golden Eagle nesting sites are documented, making the modified Site **A extended** an even better option than before.

Another important modification was the total number of wind turbines to be installed for serving the Project that was reduced from 160 to 154, with two different types of turbines, which implies fewer risks for birds and bats.

The layout of the preferred site (i.e., **Site A extended** with modified boundaries and fewer wind turbines generators ("WTGs")) is presented in Figure 5.

The blue and orange colors of the WTGs indicate two different types of turbine to be installed, according to the biological and physical properties of the locations. The locations in grey represent backup locations to be used in case of new installations.

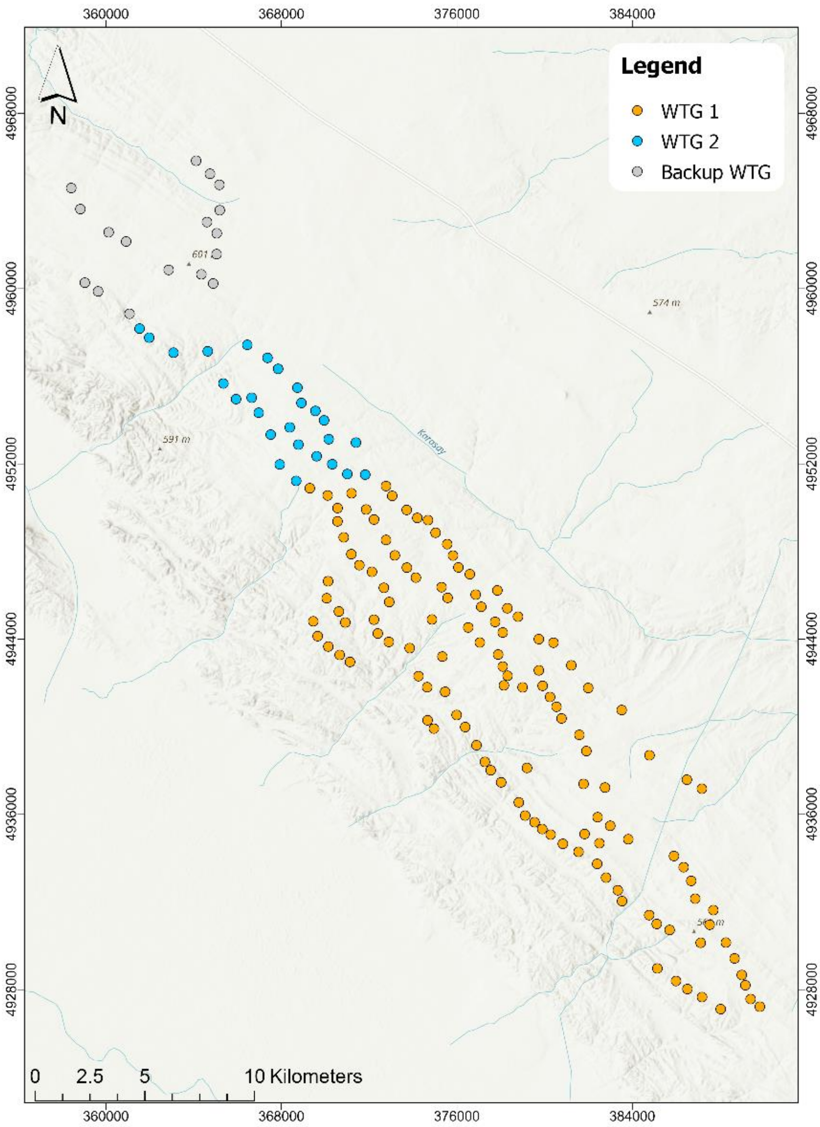

Figure 5: Selected layout and location of the WTGs (*modified Extended Site A*) redefined after the exclusion of sensitive areas identified in the baseline studies (*WTG1, Sany turbines, 7.7 MW; WTG2, Envision turbines, 6.4 MW*)

2.3.3 Overhead Transmission Line Alternatives

The Project will be served by three OHTLs:

- (1) OHTL installed to connect the Project site, to the existing Yukgres SS in Ulken.
- (2) OHTL connecting the new Project northern Substation (South Mirny SS) and the Project Southern power substation (i.e., South Mirny SS).
- (3) OHTL connecting the South Mirny SS and the existing Shu SS.

The three OHTLs will have a capacity of 500 kV each.

For OHTL (1), two route alternatives where considered, while for OHTL (2) and (3) a few criteria were considered prevailing on all other and immediately pointed to the preferred alternative with respect to any other options available.

The E&S criteria considered for the preferred route selection were as follows:

- Presence of existing OHTL corridors, or corridors from other linear facilities, which would reduce habitat fragmentation and the overall footprint, and would not significantly increase the collision risks posed by existing facilities on birds and bats. This criterion had to be balanced with other financial considerations that pointed to preferring routes following the shortest line between the start and end points.
- Presence of significant environmental constraints such as wetlands, rivers, slopes, and the like

Concerning the 500 kV OHTL (1) between the Project site and the existing Yukgres SS in Ulken, in the absence of existing OHTL or other linear facility corridors to the north of the Project site, the Company considered two alternative routes (**Option 1** and **Option 2** shown in the figure further below, respectively connecting the Project site from the North or South Mirny SS). No major environmental or social constraints were detected along either alternative route, while the few present are equally affecting both (potential presence of herders along both routes, as an example). Therefore **Option 1** connecting the Project site from the North substation, i.e. the shortest route, was chosen as the preferred alternative to minimise costs.

For OHTL (2), the fact that the shortest route between the two new SSs would minimise the footprint, and this would be entirely included in the Project it, made this the preferred option. Other alternatives were not considered as they would not present advantages from a physical environmental and socioeconomic perspective (the conditions are the same for kilometers from the chosen route), nor from a biodiversity one (no biodiversity constraints along the shortest connection).

As for OHTL (3), the primary criterion for the selection of the preferred route was the availability of existing OHTLs or linear facilities corridors. There is indeed an existing OHTL that runs southwards and passes southeast from the Project Site. The preferred route runs in parallel to this existing line from KP24 up to the end point at KP143. For the initial 24km the route does not follow existing linear facilities, but it minimises the footprint and impacts by following the shortest route possible, while a direct connection across the southeastern end of the Project site would not be possible as the OHTL would interfere with turbines. Alternative routes were not considered as these two criteria (existing linear facilities and shortest route possible) were considered prevailing on all others. As OHTL (3) will cross the river Shu, the Company also considered alternative crossing options with the objective of avoiding or reducing the effects on the river. The chosen option will consist in using higher pylons, which would allow crossing the river without any interactions with its bed, nor with its shores, as these will be at a significant distance from the pylons and any interactions with the river will be avoided in construction and, later, operations.

The final OHTL combining (1), (2) and (3) will have a total length of about 230 km and will connect the Yukgres SS to the Shu SS across the new Northern power substation and the new Southern power Substation. The selected OHTL routing is shown in the following figures.

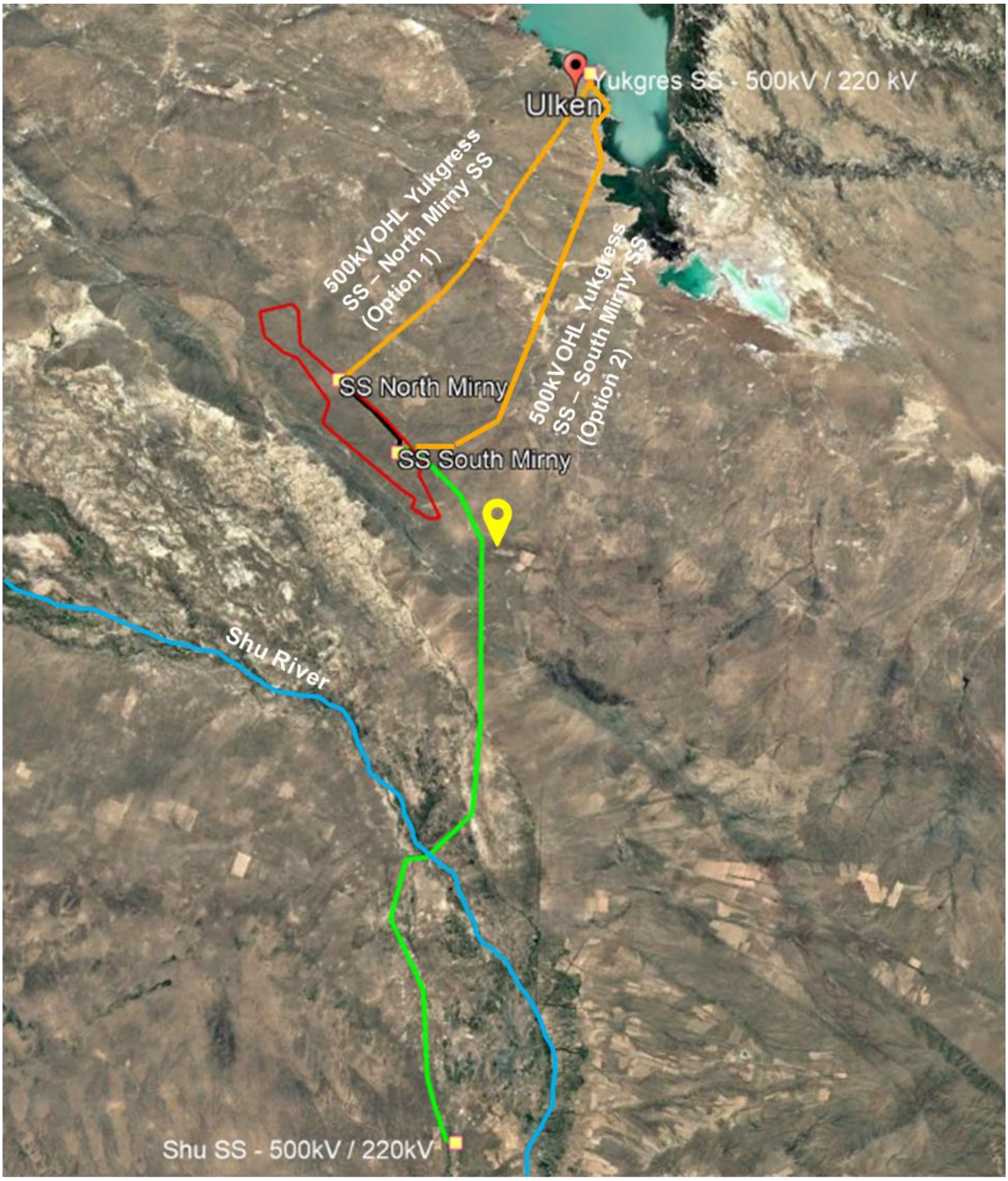

Figure 6: OHTLs (*(1): orange; (2): black; (3): green*) and routing alternatives considered for (1). The yellow marker shows the point where (3) joins the existing OHTL corridor.

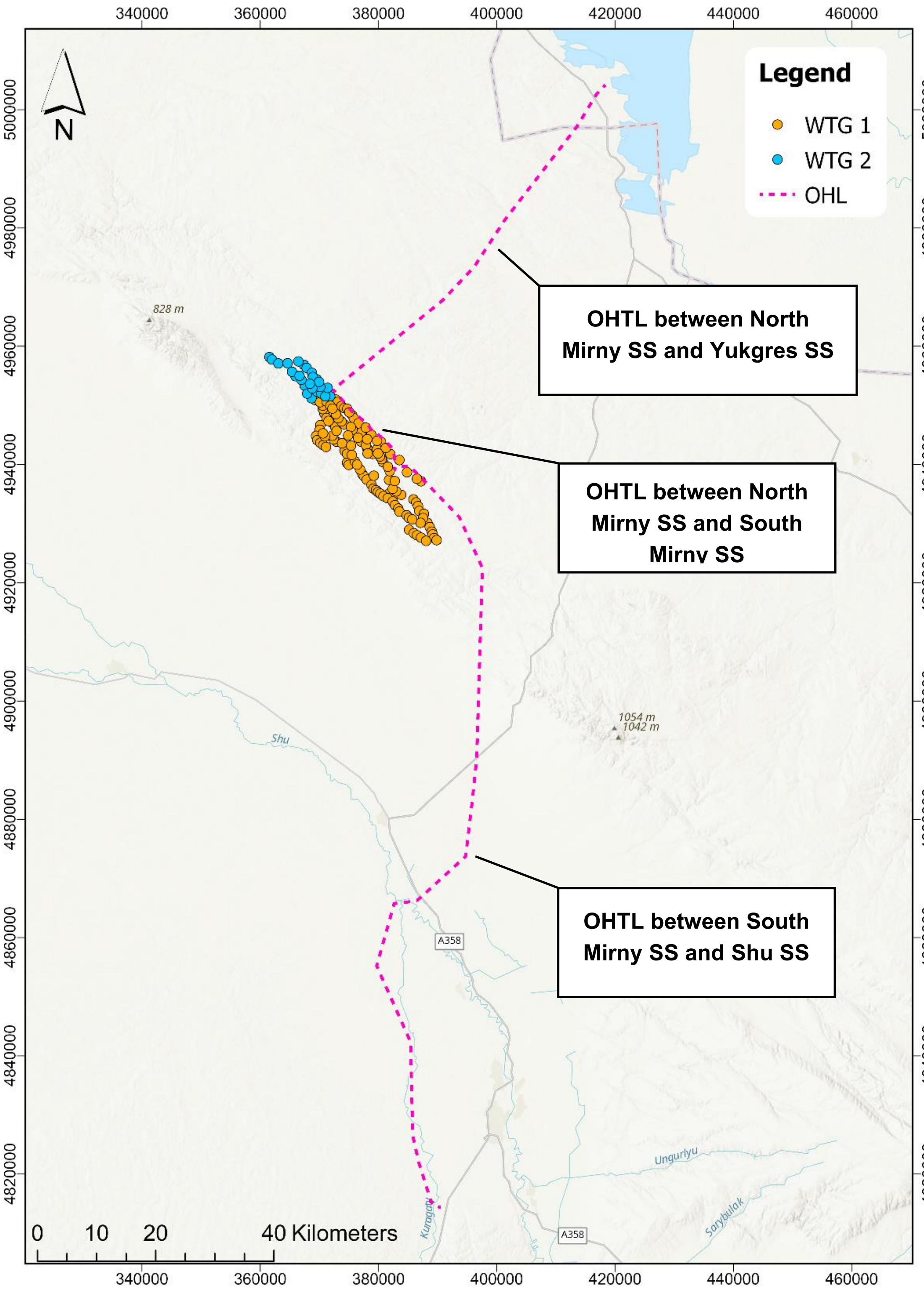

Figure 7: OHTL, final route.

2.3.4 Road Alternatives

2.3.4.1 Initial Project Access Design

A study on the Project's access roads was carried out in September 2022 to identify future improvements and roadworks that will be necessary for construction vehicles that will transport large components and bulky equipment, including the wind blades, up to 100 meters long, which will be transported via land in a single piece.

In the initial Project planning, the Company considered maximizing the use of the existing access roads to reach the Project site, in addition to building around 200 km of new roads (35 km of access roads and 160 km of internal roads) to connect turbines and make them accessible for maintenance. Below is the first proposed road design, as per the scoping report, prepared in February 2024.

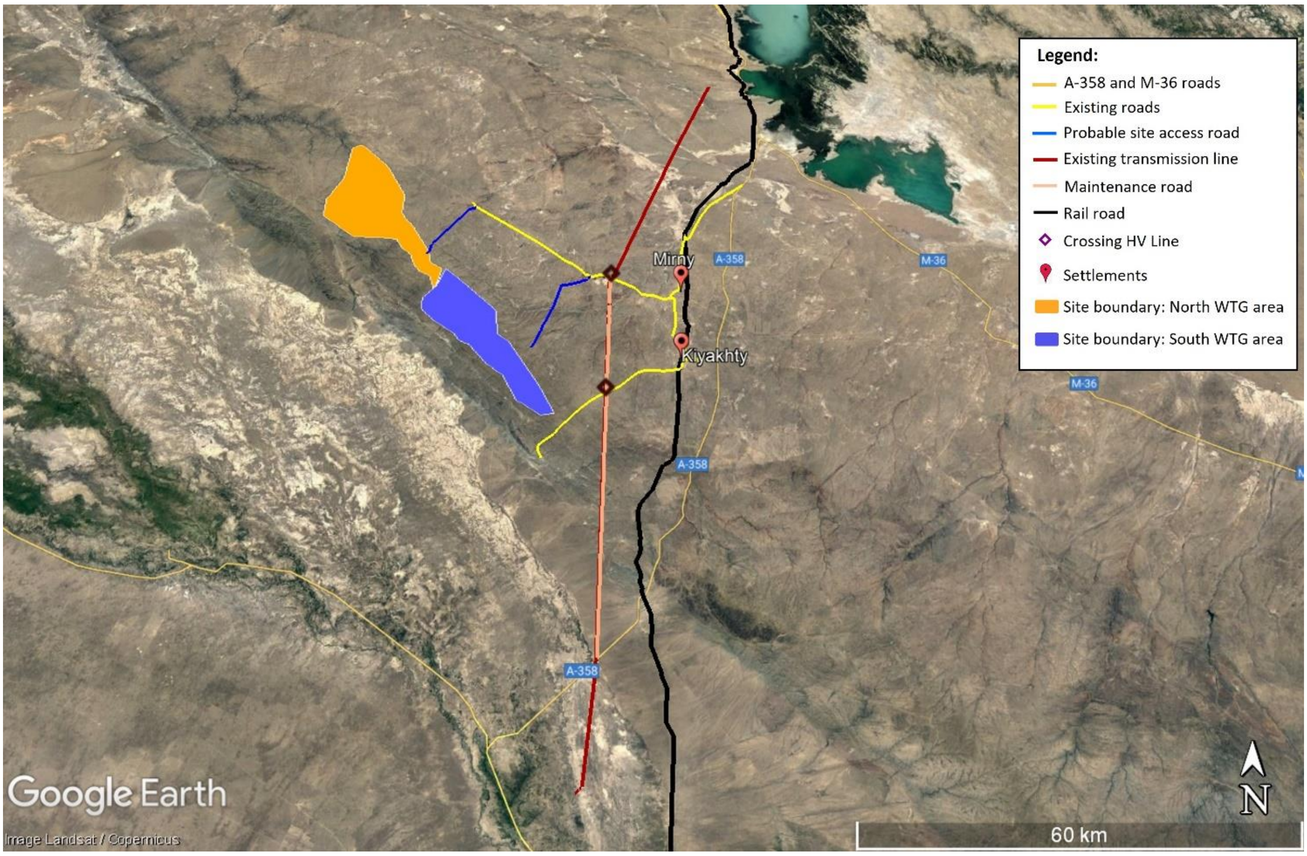

Figure 8: Initial design of access roads to the Project site. (Please note that the WPP footprint in this figure is not the final one.)

Other existing infrastructures around the Project site are:

- Railroad, existing connection from Kyrgyzstan to the north of Kazakhstan.
- Bridges, to allow the existing roads to cross the railways.
- Existing OHTL.

2.3.4.2 Final Access Road Design

Considering the final layout of the preferred Project site, a few modifications were proposed in the access road design. The new roads were selected considering various options and conducting specific studies.

A group of specialists from Build Master Group LLP visited the Project site in November 2024 to survey for alternative access roads for both construction (i.e., transportation of people, machinery and equipment) and operation-related purposes. The survey considered the following route alternatives:

- Access from Ulken village at highway road M36 (372 km) from the existing grader to km 41/69 of the Mirny-Akbakai road and further from km 27/83 of the same road to the central part of the WPP in the area of the camp site (hereinafter **Option 1**).
- Access from Shyganak station along the existing grader from highway M-36 (365 km) to the quarry, then through the forest fund territory to km 27/83 of the Mirny-Akbakai road (hereinafter **Option 2**).
- Access from Kiyakhty station along the existing grader to the southern part of the WPP through the spans of railroad overpasses (hereinafter referred to as **Option 3**).
- Access from Khantau village at highway road A-358 (82 km from Burubaytal) along the existing grader to the quarry and to the southern part of the WPP (hereinafter referred to as **Option 4**).

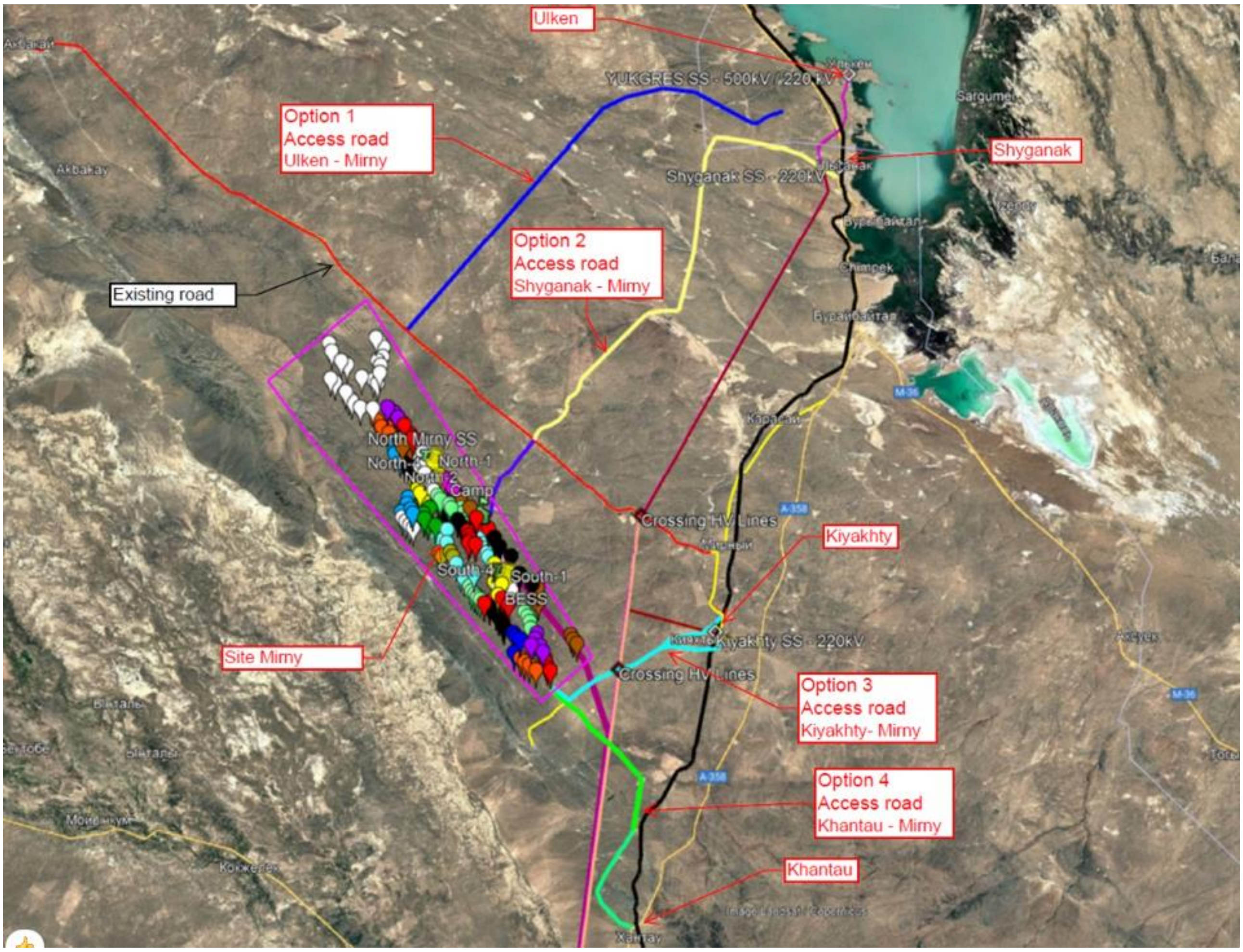

Figure 9: Roads alternatives considered *(Option (1) purple, (2) yellow, (3) blue, (4) green)*.

The criteria adopted for evaluating each alternative and compare them among each other has incorporated, in addition to technical criteria, E&S criteria as well, such as easiness of the permitting process, presence of protected areas, significance of the footprint generated on habitats, the effects on local morphology and topography. Socioeconomic criteria and considerations were considered not applicable (with considerations similar to the site selection process, see above), as all options run across land with the same conditions in terms of absence of population, land use, and the like. The following table summarizes the considerations made on the basis of these criteria and the conclusions drawn.

Table 2: Evaluation of criteria for the selection of the preferred access road alternative (in red the "no go" alterntives, in green the preferred alternatives retained for further evluations).

Major issues	Conclusions
Alternative 1	
The route is located in Zhabmyl district of Almaty region and Moyinkum district of Zhambyl region, which makes it difficult to coordinate and obtain planning and construction permits.	This alternative was removed from further consideration, for the following reasons: - likely difficult and risky permitting process; - technical constraints and higher cost due to length, need to construct new sections, challenging hydrological and geological ground conditions - likely significant impacts on protected areas and conservation species
The need for an additional turnaround area at the exit point.	
Extended sections of this road would pass through protected areas, which would increase the risks of delay in obtaining permits/approvals for design and construction and would generate significant impacts on habitats and species that would require significant management effort.	
Wide muddy areas and complex geological and hydrological conditions.	
Longest road option, including a large number of newly constructed road sections.	
Alternative 2	
Extended sections of this road would pass through protected areas, which would increase the risks of delay in obtaining permits/approvals for design and construction.	This alternative was initially proposed to be removed from further consideration; however, the routing was modified to minimise effects on protected areas, which was considered sufficient to retain the modified option for further consideration.
The need for an additional turnaround area at the exit point.	
Alternative 3	
Need for an additional turning area at the Burubaital overpass.	This alternative was removed from further consideration due to significant technical constraints which would also imply significant costs. E&S criteria were not evaluated as technical constraints were sufficient to consider it not viable.
Need for additional components for turning/crossing/going under the railway bridge, which is located in the protected zone of AO 'NK "Kazakhstan Temir Zholy".	
Need for reconstruction of bridge structures, requiring additional assessments of the condition of concrete. Moreover, it would be necessary to obtain approval/receipt of technical specifications from AO 'Nk "Kazakhstan Temir Zholy".	
Considering the hidden foundations of bridge structures in the routing, would not be possible to increase the size of the passage under the bridge. Works on the reconstruction of the railway would entail risks of significant increase of time for design and/or approval with AO 'NK "Kazakhstan Temir Zholy", not excluding the impossibility of reconstruction of this crossing.	
Alternative 4	
Need for additional turning area on the Burubaital overpass (to transfer the equipment from Almaty via Burubaital overpass).	This alternative was retained for further consideration and comparison with Option 2 for the following reaons: - the route would skip protected areas and significant habitats, avoiding significant impacts on biodiversity and making the permitting process more easy - as other alternatives, there would be the need to construct additional turning areas - limited technical constraints as there would not be interferences with the railway line, which implies an easier permitting process
the route would pass outside the forest fund territories (which facilitates obtaining land allotment documents);	
there are no railways crossings the routing (which excludes the work on coordination / obtaining permits for construction design with AO 'NK"Kazakhstan Temir Zholy");	
the route would not pass through territories with red-listed saxaul;	
it would not be necessary to construct a turning area together with an exit.	

The table presented above clearly shows that two alternatives were compared out of the initial four. Two other options were discarded due to technical, permitting and environmental constraints. Alternative 4 was finally retained as it minimises or avoids impacts on biodiversity and has less technical constraints than Alternative 2.

Summarizing, the Company will construct about 155 km of new access roads (about 57 km to the south and 68 km northwards). Moreover, the Company will upgrade about 146 km of access roads and will build about 128 km of onsite roads to connect the WTGs to each other’s. The preferred roads routing is detailed in the following figure.

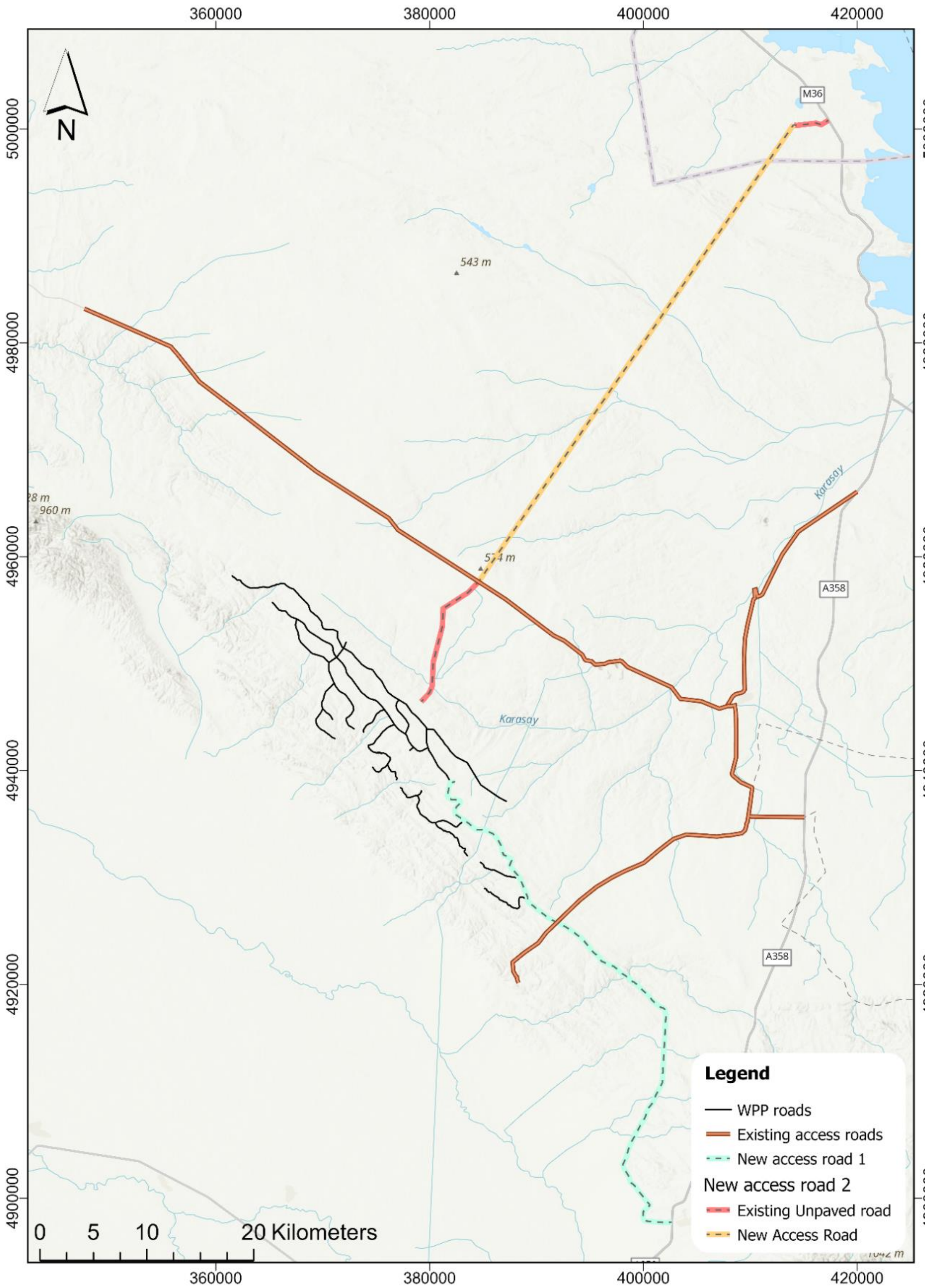

Figure 10: Onsite and offsite final road layouts.

2.3.5 Project Technologies Alternatives

The WTGs and the OHTL pylon alternatives have been mainly assessed on the basis of technical aspects and biodiversity-related constraints.

2.3.5.1 WTGs

Initially the design included 160 turbines with the same capacity that were progressively reduced to 150 during the design phase. Two final turbine sizes have been chosen:

- 26 WTGs Sany SI-19580, 7.7MW, HH120m.
- 124 WTGs Envision EN182-8.0 WTG, 6.5MW, HH110m;

The two turbine types will be installed, respectively, on 26 locations to the north-western portion of the Project site (**the modified version of the extended Site A**) and on 124 locations to the south-eastern portion of the Project site.

- From a physical environmental perspective the reduction of the number of turbines has significant advantages as it implies:
    a. The reduction of natural resources used for constructing foundations (less water, less concrete, fewer vehicles and trips required for delivering turbine components and construction material, less traffic).
    - Less ancillary facilities to be constructed (roads connection, underground cables, etc.) and a reduction of manpower and related construction risks) which implies fewer emissions, less traffic, fewer workers and related labour and occupational risks
- From a biodiversity perspective in addition to the reduction of footprint on habitats, it was discussed if the change of the turbines size would have impacted birds and bats. The type of turbines have been assessed and proposed to the Biodiversity team for consideration. The collision risk has determined that risks exist at 200 m above the ground level, so the selected WTGs, whose towers are slightly above 100 m and blades remain below 200m, are below that height which was the main and prevailing criterion for preferring these turbine design.

2.3.5.2 OHTL pylons

There are three pylon designs that will be used for the Mirny project. These have been selected to ensure Project standards and requirements are met. From an E&S perspective the three pylon designs chosen have the following advantages:

- The three designs equally avoid any risks of bird and bat electrocution, as grounded surfaces and elements are at a distance of more than 1.5 m from energized elements, such as cables. This is in line with good practice and IFC EHS guidelines on Electric transmission lines.
- As far as collision risks is concerned, the three designs show similar risk levels and perform better than other discarded; mitigations will be equally implemented for the three of them.
- The three designs are equally suitable for being installed at the Project site and do not show particular advantages with respect to other designs, as they perform the same with respect to environmental conditions and constraints such as ground conditions and impacts on soil, however their better performance with respect to other criteria make them preferable. As presented below, the structural nature of one specific pylon design make it preferable to be installed on slopes.
- From a socioeconomic perspective, any design would be suitable as impacts on communities would be the same. The three designs perform equally well in terms of minimization of footprint and land needs, while ensuring the required technical requirements are met.

The three pylon designs present the following characteristics:

- Steel lattice 4 poles will be used only in specific locations and mostly in areas with downhill sections with heavy loads, these structures can be used for one or two circuits and will only be used occasionally.

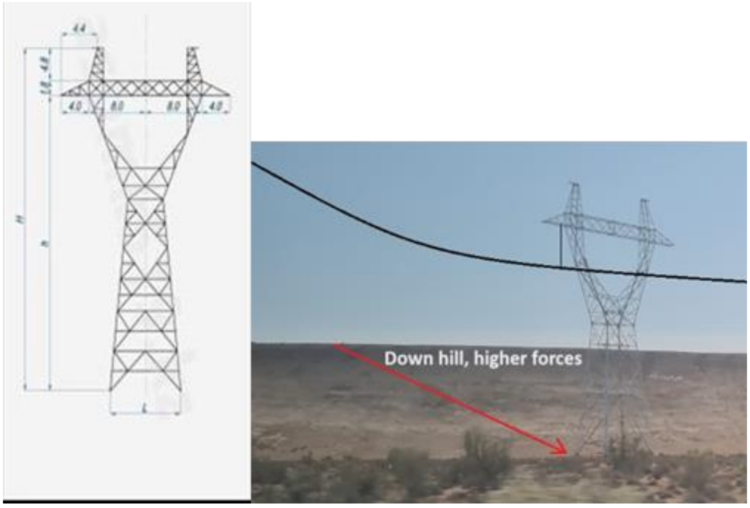

Figure 11: Structure n.1: Steel lattice 4 poles

- The most common pylons for the project will be the P2 type steel lattice, two pole free standing structure which will account for c 90% of the 500kV OHTL structures. This structure can support one circuit and is already present on the site with an existing line already in place. The new OHTL will run in parallel to this existing structure from KP24. This structure is large enough not to present an electrocution risk to birds and the cables are arranged so that the potential collision risk area is limited. Biodiversity surveys along the existing OHTL made of these poles have included carcass searches along the existing line and no evidence of collision has been found so far.

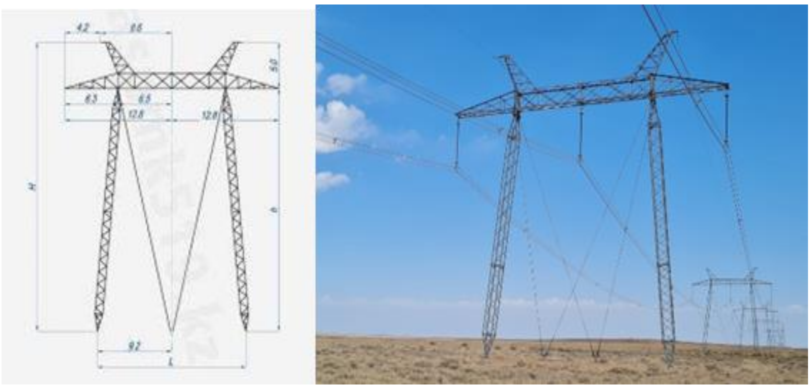

Figure 12: Structure n.2: P2 type steel lattice

- The three-post lattice free-standing poles of P2 type design may also be used and as this design has a prominent earth wire, this may require flight diverters in sections where flight activity surveys indicate higher levels of bird activity.

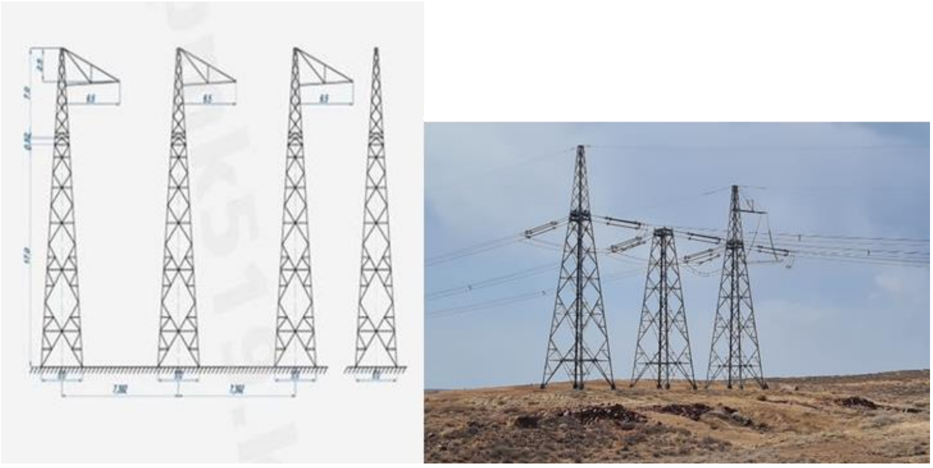

Figure 13: Structure n.3: Three-post lattice free-standing poles

2.4 Selected Project Layout

The following figure shows the selected final Project layout and its components.

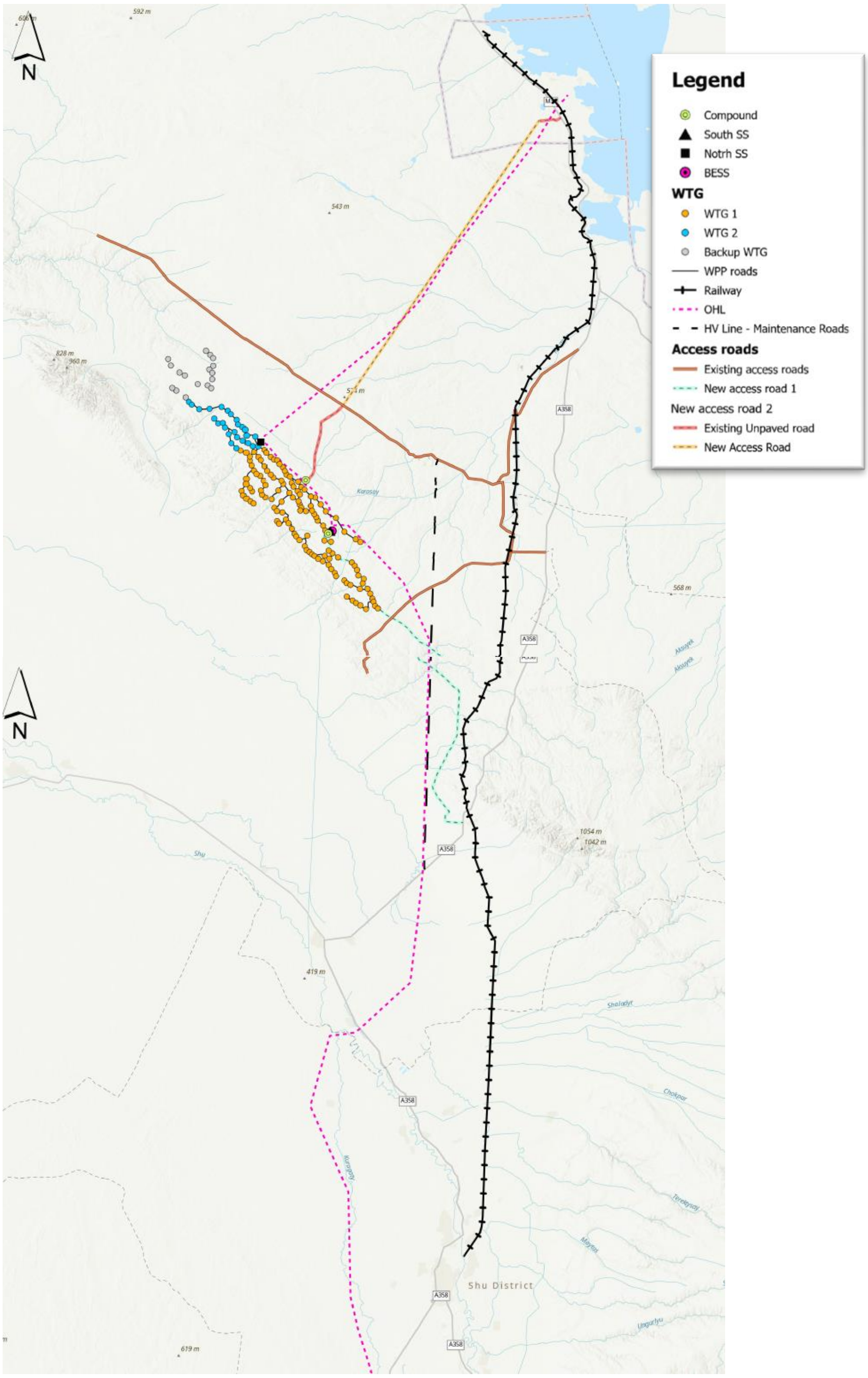

Figure 14: Project selected layout.

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